

PROJECT MANUAL
FOR
CITY OF LYNCHBURG

Renovations to Miller Center

BID NO. 13-834

February 2013



**PROCUREMENT DIVISION
3RD FLOOR CITY HALL
900 CHURCH STREET
LYNCHBURG, VA 24504
TELEPHONE (434) 455-3970
FAX (434) 845-0711**

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- Record Drawings, Miller Park School (1910)
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ADVERTISEMENT FOR BIDS

Sealed bids for the Renovations to Miller Center will be received by the City of Lynchburg, Procurement Division, City Hall, Lynchburg, VA, until 3:00 p.m., March 21, 2013, and then publicly opened and read, in the Bidder's Room, Third Floor, City Hall.

The Project includes a three-story addition of approximately 1,840 sf and renovations to the existing three-story approximately 25,400 sf historic school building, along with associated landscaping and sitework. Two additive alternates are identified.

The Contract Documents for the above project may be obtained from CRI Mutual Press, 434-845-1203; 60 9th Street, Lynchburg, Virginia 24504 for a non-refundable fee of \$148/set. No partial sets will be provided. Documents are also available to view and download on the City's website: www.lynchburgva.gov, Quick Index, Current Solicitations.

A Pre-Bid Conference will be held at 1:00 p.m., March 5, 2013, in the Auditorium at the Miller Center, 300 Grove Street, Lynchburg and will be immediately followed by a site inspection at the project site.

All requests for clarification or questions regarding this project must be submitted in writing to Stephanie Suter, email: stephanie.suter@lynchburgva.gov, fax: 4348450711 by March 14, 2013.

BID FORM

Stephanie Suter, CPPO, CPPB
Procurement Division
City of Lynchburg
Third Floor, City Hall
900 Church Street
Lynchburg, Virginia 24504

Dear Ms. Suter:

The undersigned, as bidder, hereby declares that the only persons interested in this bid as principal, or principals, is or are named herein and that no person other than herein mentioned has any interest in this bid or in the Construction Agreement to be entered into; that this bid is made without connection with any other person, company, or parties making a bid; and that it is in all respects fair and in good faith, without collusion or fraud.

The undersigned, having visited and examined the site and having carefully studied all the Contract Documents, including without limitation, all drawings and specifications pertaining to "Renovations to Miller Center" for the City of Lynchburg, Virginia, hereby proposes to furnish all labor, equipment, materials, and services to perform all operations necessary to execute and complete the Work required for the project, in strict accordance with the Contract Documents, together with Addenda numbered _____ through _____ issued during bidding period and hereby acknowledged, subject to the terms and conditions of the Construction Agreement for the sum of:

Part A: Building and all site work within property lines:

_____ DOLLARS (\$_____)

Part B: All site work beyond the property line:

_____ DOLLARS (\$_____)

Total Base Bid:

_____ DOLLARS (\$_____)

Additive Bid Items

Note: Each additive bid item shall reflect completed installations and credit values for work that will not be installed as part of the base bid work.

Additive Bid Item No. 1: Aviary Parking Lot Light Fixtures:

_____ DOLLARS (\$_____)

Additive Bid Item No. 2: Sound-Rated Auditorium Door Assemblies:

_____ DOLLARS (\$_____)

It is understood and agreed that the Owner, in protecting its best interests, reserves the right to reject any or all bids or waive any defects. Any changes, erasures, modifications, deletions in the bid form, or alternate proposals not specified in the Advertisement for Bids may make the bid irregular and subject to rejection.

We are properly equipped to execute all work of the character and extent required by the Contract Documents, and we will enter into the Construction Agreement for the execution and completion of the Work in accordance with the Contract Documents; and we further agree that, if awarded the Construction Agreement, we will commence the Work on the date stated in the "Notice to Proceed" and will maintain a work force large enough to execute the Work and all obligations no later than the completion date stated in the Contract Documents.

Bidder proposes and agrees, if its bid is accepted, to consent to the assignment by the City of Lynchburg of all or a portion of the awarded contract.

Enclosed herewith is the following Security, offered as assurance that the undersigned will enter into the Construction Agreement for the execution and completion of the Work in accordance with the Contract Documents:

Bidder's Certified Check issued by _____ (name of bank) in the amount of: \$ _____ (5% of Base Bid amount).

Bidder's Bid Bond for 5% of Base Bid Amount Issued by _____ (name of surety authorized to do business in Virginia).

The undersigned hereby agrees, if awarded the Construction Agreement, to execute and deliver to the City within ten (10) days after his receipt of the Notice of Award, a performance bond and a payment bond, in forms satisfactory to the City, from sureties authorized to do business in Virginia satisfactory to the City, in the amount of one hundred (100) percent of the Base Bid.

The undersigned further agrees that, in case of failure on his part to execute the said Construction Agreement within the ten (10) days after written notice being given on the award of the Construction Agreement or the failure to deliver the required performance and payment bonds within the ten (10) days, the monies payable by the Security accompanying this bid shall be paid to the City of Lynchburg, Virginia, as liquidated damages for such failure; otherwise the Security accompanying this Bid shall be returned to the undersigned.

Attached herewith are completed Statement of Experience and Statement of Resources forms which include the information requested.

The undersigned further certifies that this bid is not the result of, or affected by, any act of collusion with another person engaged in the same line of business, or any act punishable under the Virginia Governmental Frauds Act, or other law.

This bid remains valid and may not be withdrawn for a period of 90 days from this date.

CURRENT VIRGINIA CLASS A CONTRACTOR'S LICENSE/ REGISTRATION NO.: _____

VIRGINIA STATE CORPORATION COMMISSION NUMBER: _____

Respectfully submitted,

CONTRACTOR

DATE

ADDRESS

PHONE/FAX

BY: _____

ITS: _____
(Title)

ELECTION OF ESCROW ACCOUNT PROCEDURE FOR RETAINAGE

If determined to be the successful low bidder(s), the above signed elects to use the Escrow Account Procedure for retainage.

Write "Yes" or "No" on above line

If the successful bidder elects to use the Escrow Account Procedure for Retainage, the "Escrow Agreement" form shall be executed and submitted to the City of Lynchburg Engineering Division within fifteen (15) calendar days after notification. If the "Escrow Agreement" form is not submitted within the fifteen (15) day period, the Contractor shall forfeit his rights to the use of the Escrow Account Procedure.

Company_____

Authorized Signature_____

**STATEMENT OF EXPERIENCE: QUALIFICATION OF CONTRACTOR AND ITS SELECTED
SUBCONTRACTORS AND CRAFTSMEN**

The City of Lynchburg's Miller Center is a recognized historic building. All restoration work must conform to the Secretary of the Interior Standards for Historic Preservation.

Due to the historic significance of the building itself and the importance of the theatrical equipment and systems in the renovated Auditorium, the contractor, its subcontractors and its craftsmen will be subject to the review of qualification as listed below to assure that they have satisfactory previous experience and appropriate skills in the restoration of historic and significant building structures and the installation of similar theatrical equipment and systems.

The bidding contractor's subcontractors and its craftsmen selected to perform the following work must meet the qualification stated as called for in the heading listed as "SUBCONTRACTOR AND CRAFTSMEN QUALIFICATIONS":

Masonry Cleaning, Repair, and Restoration
Historic Wood Window Repair, and Restoration
Wood Flooring Refinishing
Theatrical Equipment and Systems

Definitions:

Similar Projects shall be defined as projects that:

1. are of at least \$500,000 in construction cost, including sub-trades.
2. include brick masonry and exterior wood components such as entablature, wood cornice and windows in historic buildings.
3. include similar construction techniques such as rotted/damaged wood repairs, re-pointing masonry, and refinishing hardwood floors.
4. included similarly complex theatrical equipment and systems.
5. required similar construction logistical complexity (time frame, means and methods, trades)

Note: Similar projects are not required to have been historic schools, but could also be churches, city halls, museums, office buildings and other municipal buildings of the historic value of this project.

Project Manager is the person that manages the construction project primarily from the office. He/she prepares contracts, communicates with Owner and Architect for project design decisions, meeting and coordination, and provides daily communication with the Project Site Superintendent.

Project Site Superintendent is the person that manages the construction project at the site and is on site full time. He/she provides day-to-day construction operations at the site and coordinates with the Owner's Representative and craftsmen.

Verifiable Experience: Project experience that can be confirmed through contact with Owners and Architects associated with previous projects listed in the submission.

Successful Experience: Project experience which resulted in completion of projects on time, on budget plus contingency, in accordance with the contract documents, and with evidence of good working relationships with owners, subcontractors and suppliers. (References will be reviewed).

Evaluation Criteria: The following criteria will be used for evaluating the qualifications of Bidders. The evaluation will be based on information provided by Bidders as well as information supplied by the Bidders' references.

1. The Bidder, acting as General Contractor, will be required to demonstrate verifiable, successful experience in project supervision and administration of *similar projects* (see definition above). This experience shall include three (3) projects involving separate buildings and similar activities and scope of work as the subject project completed within the past seven (7) years. Each project must be at least \$500,000 in construction cost, including sub-trades.
2. The Bidder's proposed *Project Manager* (see definition above) will be required to demonstrate verifiable, successful experience in project supervision and administration of similar projects. This experience shall include three (3) projects involving separate buildings and similar activities and scope of work as the subject project completed within the past seven (7) years. Each project must be at least \$500,000 in construction cost, including sub-trades.
3. The Bidder's proposed *Project Site Superintendent* (see definition above) will be required to demonstrate verifiable, successful experience in project supervision and administration of similar projects. This experience shall include two (2) projects involving separate buildings and similar activities and scope of work as the subject project completed within the past five (5) years. Each project must be at least \$500,000 dollars in construction cost, including sub-trades.
4. The Bidder must demonstrate satisfactory performance on all current projects in progress.

GENERAL CONTRACTOR

Provide evidence of successful experience to demonstrate verifiable, successful experience with similar projects. This experience shall include three (3) projects involving separate buildings and similar activities and scope of work as the subject project completed within the past seven (7) years. Each project must be at least \$500,000 in construction cost, including sub-trades.

PROJECT #1

Project Name:

Location:

Completion Date:

Cost:

Scope of Work and Nature of Project:

Approx. original construction date of historic building or site, if applicable:

Owner:

Owner's Contact Person and Phone No.:

Architect:

Architect's Contact Person and Phone No.:

PROJECT #2

Project Name:

Location:

Completion Date:

Cost:

Scope of Work and Nature of Project:

Approx. original construction date of historic building or site, if applicable:

Owner:

Owner's Contact Person and Phone No.:

Architect:

Architect's Contact Person and Phone No.:

PROJECT #3

Project Name:

Location:

Completion Date:

Cost:

Scope of Work and Nature of Project:

Approx. original construction date of historic building or site, if applicable:

Owner:

Owner's Contact Person and Phone No.:

Architect:

Architect's Contact Person and Phone No.:

GENERAL CONTRACTOR- PROJECT MANAGER

Provide evidence of successful experience to demonstrate verifiable, successful experience in project supervision and administration of similar projects. This experience shall include three (3) projects involving separate buildings and similar activities and scope of work as the subject project completed within the past seven (7) years. Each project must be at least \$500,000 in construction cost, including sub-trades.

- Name of Project Manager: _____

PROJECT #1

Project Name:

Location:

Completion Date:

Cost:

Scope of Work and Nature of Project:

Approx. original construction date of historic building or site, if applicable:

Owner:

Owner's Contact Person and Phone No.:

Architect:

Architect's Contact Person and Phone No.:

PROJECT #2

Project Name:

Location:

Completion Date:

Cost:

Scope of Work and Nature of Project:

Approx. original construction date of historic building or site, if applicable:

Owner:

Owner's Contact Person and Phone No.:

Architect:

Architect's Contact Person and Phone No.:

PROJECT #3

Project Name:

Location:

Completion Date:

Cost:

Scope of Work and Nature of Project:

Approx. original construction date of historic building or site, if applicable:

Owner:

Owner's Contact Person and Phone No.:

Architect:

Architect's Contact Person and Phone No.:

GENERAL CONTRACTOR - PROJECT SITE SUPERINTENDENT

Provide evidence of successful experience to demonstrate verifiable, successful experience in project supervision and administration of similar projects. This experience shall include two (2) projects involving separate buildings and similar activities and scope of work as the subject project completed within the past five (5) years. Each project must be at least \$500,000 in construction cost, including sub-trades.

- Name of Project Site Superintendent_____

PROJECT #1

Project Name:

Location:

Completion Date:

Cost:

Scope of Work and Nature of Project:

Approx. original construction date of historic building or site, if applicable:

Owner:

Owner's Contact Person and Phone No.:

Architect:

Architect's Contact Person and Phone No.:

PROJECT #2

Project Name:

Location:

Completion Date:

Cost:

Scope of Work and Nature of Project:

Approx. original construction date of historic building or site, if applicable:

Owner:

Owner's Contact Person and Phone No.:

Architect:

Architect's Contact Person and Phone No.:

SUBCONTRACTOR AND CRAFTSMEN QUALIFICATIONS

Masonry Cleaning, Repair, and Restoration

The contractor, subcontractor and craftsmen for this work shall have a minimum of 5 years documented experience similar to that required for this project. All the craftsmen for the work of this section shall have successfully completed a minimum of three (3) projects of comparable complexity and skill of similar historic buildings within the previous five (5) years.

- Name of Sub-Contractor (if work is contracted out): _____
- Name of Foreman/Craftsman: _____

PROJECT #1

Project Name:
 Location:
 Completion Date:
 Cost of this trade’s work:
 Scope of Work and Nature of Project (specifically exterior work):

Approx. original construction date of historic building:
 Owner:
 Owner’s Contact Person and Phone No.
 Contractor:
 Architect:

PROJECT #2

Project Name:
 Location:
 Completion Date:
 Cost of this trade’s work:
 Scope of Work and Nature of Project (specifically exterior work):

Approx. original construction date of historic building:
 Owner:
 Owner’s Contact Person and Phone No.:
 Contractor:
 Architect:

PROJECT #3

Project Name:
 Location:
 Completion Date:
 Cost of this trade’s work:
 Scope of Work and Nature of Project (specifically exterior work):

Approx. original construction date of historic building:
 Owner:
 Owner’s Contact Person and Phone No.:
 Contractor:
 Architect:

SUBCONTRACTOR AND CRAFTSMEN QUALIFICATIONS

Historic Wood Window Repair and Restoration

The subcontractor and craftsmen for this work shall have a minimum of 5 years documented experience similar to that required for this project. All the craftsmen for the work of this section shall have successfully completed a minimum of three (3) projects of comparable complexity and skill of similar historic buildings within the previous five (5) years.

- Name of Sub-Contractor: _____
- Name of Foreman/Craftsman: _____

PROJECT #1

Project Name:
Location:
Completion Date:
Cost of this trade's work:
Scope of Work and Nature of Project (specifically exterior work):

Approx. original construction date of historic building:
Owner:
Owner's Contact Person and Phone No.:
Contractor:
Architect:

PROJECT #2

Project Name:
Location:
Completion Date:
Cost of this trade's work:
Scope of Work and Nature of Project (specifically exterior work):

Approx. original construction date of historic building:
Owner:
Owner's Contact Person and Phone No.:
Contractor:
Architect:

PROJECT #3

Project Name:
Location:
Completion Date:
Cost of this trade's work:
Scope of Work and Nature of Project (specifically exterior work):

Approx. original construction date of historic building:
Owner:
Owner's Contact Person and Phone No.:
Contractor:
Architect:

SUBCONTRACTOR AND CRAFTSMEN QUALIFICATIONS

Wood Floor Refinishing

The subcontractor and craftsmen for this work shall have a minimum of 5 years documented experience similar to that required for this project. All the craftsmen for the work of this section shall have successfully completed a minimum of three (3) projects of comparable complexity and skill of similar historic buildings within the previous five (5) years.

- Name of Sub-Contractor: _____
- Name of Foreman/Craftsman: _____

PROJECT #1

Project Name:
Location:
Completion Date:
Cost of this trade's work:
Scope of Work and Nature of Project (specifically interior work):

Approx. original construction date of historic building:
Owner:
Owner's Contact Person and Phone No.:
Contractor:
Architect:

PROJECT #2

Project Name:
Location:
Completion Date:
Cost of this trade's work:
Scope of Work and Nature of Project (specifically interior work):

Approx. original construction date of historic building:
Owner:
Owner's Contact Person and Phone No.:
Contractor:
Architect:

PROJECT #3

Project Name:
Location:
Completion Date:
Cost of this trade's work:
Scope of Work and Nature of Project (specifically interior work):

Approx. original construction date of historic building:
Owner:
Owner's Contact Person and Phone No.:
Contractor:
Architect:

SUBCONTRACTOR AND CRAFTSMEN QUALIFICATIONS

Theater Equipment and Systems

The subcontractor and craftsmen for this work shall have a minimum of 5 years documented experience similar to that required for this project. All the craftsmen for the work of this section shall have successfully completed a minimum of three (3) projects of comparable complexity and skill of similar historic buildings within the previous five (5) years.

- Name of Sub-Contractor: _____
- Name of Foreman/Craftsman: _____

PROJECT #1

Project Name:
 Location:
 Completion Date:
 Cost of this trade's work:
 Scope of Work and Nature of Project (specifically theatrical work):

Owner:
 Owner's Contact Person and Phone No.:
 Contractor:
 Architect:

PROJECT #2

Project Name:
 Location:
 Completion Date:
 Cost of this trade's work:
 Scope of Work and Nature of Project (specifically theatrical work):

Owner:
 Owner's Contact Person and Phone No.:
 Contractor:
 Architect:

PROJECT #3

Project Name:
 Location:
 Completion Date:
 Cost of this trade's work:
 Scope of Work and Nature of Project (specifically theatrical work):

Owner:
 Owner's Contact Person and Phone No.:
 Contractor:
 Architect:

End of Document

STATEMENT OF AVAILABLE RESOURCES

Equipment: _____

Number of Personnel Currently Employed: _____

Number of Personnel Available for Project: _____

Other Pertinent Information: _____

CORPORATE STATUS FORM

ALL PROSPECTIVE FIRMS MUST RESPOND TO THE FOLLOWING

If a limited liability company, limited liability partnership or a limited partnership, indicate by checking one: Limited liability company

 Limited liability partnership

 Limited partnership

Have you registered with the Virginia State Corporation Commission, to conduct business in Virginia?

Yes No

Name and address of organizer: _____

List who is authorized to execute contracts:

If conducting business under an assumed (fictitious) business name, fill out the following information:

Names of persons or entities owning business using assumed business name: _____

Owners' addresses: _____

Registration date: _____ Expires: _____

If conducting business as a sole proprietorship, general partnership, or joint venture, fill out the following information:

Names of all persons liable for obligations of the business: _____

Addresses of such persons: _____

Questions to Bidders/Offerors

Bidders/Offerors are to respond to the following question: Have any of the individual(s), owner(s), and/or principal officer(s) of the firm submitting the bid/proposal ever been convicted of (1) a felony, or (2) a misdemeanor involving moral turpitude?

YES _____ NO _____

If yes, list individual or officer and title and give details.

NOTE: Answering yes to this question will not necessarily exclude your company from consideration but will be used to weigh the relationship between the offense and the contract to be performed.

Is your firm currently involved in litigation or a dispute involving arbitration?

YES _____ NO _____

If yes, for litigation list the litigation by case name, name of court, case number, and jurisdiction, and for arbitration, list the organization administering, if any, its contact information, any case number assigned, the arbitrators, and the location of the arbitration. For litigation and arbitration, briefly describe the claims and status, and give contact information for the opposing party or parties.

CONSTRUCTION AGREEMENT

This Construction Agreement (the "Contract") made and entered into on the _____ day of _____, 2013, by and between _____, party of the first part, hereinafter referred to as Contractor, and the City of Lynchburg, a municipal corporation of the Commonwealth of Virginia, party of the second part, hereinafter referred to as the Owner or City.

That the Contractor, for the consideration hereinafter fully set out, hereby agrees with the Owner as follows:

1. That the Contractor shall furnish all labor, materials, tools, and equipment and perform all Work required by the Contract Documents (as defined in the General Conditions hereto) for the Renovations to Miller Center.

2. That the Contractor shall commence Work within ten (10) days after Notice to Contractor to Proceed with the Work under Contract ("Notice to Proceed"), and shall complete the work within 365 days. Owner and Contractor recognize that time is of the essence of this Contract and that the Owner will suffer financial loss if the Work is not completed within the times specified in the Notice to Proceed, plus any extensions thereof. They also recognize the delays, expense and difficulties involved in providing the actual loss suffered by Owner if the Work is not completed on time. Accordingly, instead of requiring any such proof, Owner and Contractor agree that as liquidated damages for certain losses Owner is expected to suffer due to delay (but not as a penalty) Contractor shall pay \$500 for each day that expires after the time specified for completion. If the Contractor is subject to liquidated damages, the City has the right, but not the obligation, to withhold the liquidated damages from the Contractor's regular payments or retainage. Rights and obligations relating to these liquidated damages are set out more fully in the General Conditions.

3. The Owner hereby agrees to pay the Contractor for the faithful performance of this Contract in accordance with the Contract Documents, subject to additions and deductions as provided in the Contract Documents, in lawful money of the United States, as follows:

_____ Dollars

(\$ _____)

4. The Owner shall make partial payment on a monthly basis to the Contractor in accordance with the Contract Documents on the basis of a duly certified and approved estimate of work performed during the preceding calendar month by the Contractor, less five percent (5%) of the amount of such estimate which may be retained by the Owner until all Work has been performed strictly in accordance with the Contract Documents and until such Work has been accepted by the Owner.

5. Within ninety (90) days after submission by the Contractor of evidence satisfactory to the Owner that all payrolls, material bills and other costs incurred by the Contractor in connection with the construction of the Work have been paid in full, satisfaction of all the requirements of the Contract Documents, and acceptance of such Work by the Owner, final payment on account of this Contract shall be made.

6. It is further mutually agreed between the parties hereto that if, at any time after the execution of this Contract, the performance bond provided for its faithful performance and the payment bond, the Owner shall deem the surety or sureties upon such bonds or either of them to be unsatisfactory, or if for any reason, such bonds cease to be adequate to cover the performance of the Work, the Contractor shall,

at his own sole expense, within five (5) days after the receipt of Notice from the Owner so to do, furnish an additional bond or bonds in such form and amount, and with such surety or sureties as shall be satisfactory to the Owner. In such event, no further payment to the Contractor shall be deemed to be due under this Contract until such new or additional security for the faithful performance of the Work shall be furnished in manner and form satisfactory to the Owner.

7. Contractor agrees to fulfill all requirements of state, Federal, and municipal laws which may be applicable to this project.

8. This Contract is subject to the General Conditions accompanying it, and all the documents defined by the General Conditions to be the Contract Documents are a part of this Contract.

This Contract is executed in two counterparts, each of which shall, without proof or accounting for the other counterparts, be deemed an original contract.

IN WITNESS WHEREOF, _____ has

caused its name to be subscribed to this Contract by _____, its

_____, and its corporate seal to be hereunto affixed and attested by

_____, its _____, said officers being duly authorized therefore; and the City of Lynchburg has caused its name to be hereunto subscribed by L. Kimball Payne, City Manager, and its corporate seal to be hereunto affixed and attested by Valeria Chambers, its Clerk of Council, said officers being duly authorized therefore, all as to the day and year first above written.

CONTRACTOR

BY: _____

ITS: _____

(SEAL)

ATTEST:

CITY OF LYNCHBURG

BY: _____

City Manager

(SEAL)

ATTEST:

Clerk of Council

**CITY OF LYNCHBURG, VIRGINIA
STANDARD PERFORMANCE BOND**

KNOW ALL MEN BY THESE PRESENTS: That _____
_____, the Contractor ("Principal"), whose principal place
of business is located at _____
_____ and _____
_____ ("Surety"), are held and firmly bound unto the City of Lynchburg, Virginia,
the Owner ("Obligee"), in the amount of

_____ Dollars
(\$ _____) for the payment whereof Principal and Surety bind themselves, their heirs, executors,
administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS,

Principal has, entered into a Construction Agreement with Obligee for certain work on a construction project known as "Renovations to Miller Center", which contract (the "Contract") is by reference expressly made a part hereof;

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION is such that, if the Principal shall promptly and faithfully perform said Contract in strict conformity with the plans, specifications and conditions of the Contract and its Contract Documents, then this obligation shall be null and void; otherwise it shall remain in full force and effect.

Provided, that any alterations which may be made in the terms of the Contract, or in the Work to be done under it, or the giving by the Obligee of any extension of time for the performance of the Contract, or any other alterations, extensions or forbearance on the part of either or both of the Obligee or the Principal to the other shall not in any way release the Principal and the Surety, or either of them, their heirs, executors, administrators, successors or assigns, from their liability hereunder, notice to the Surety of any such alterations, extensions, or forbearance being hereby waived.

No action shall be brought on this bond unless brought within one year after: (a) completion of the Contract and all Work thereunder, including expiration of all warranties and guarantees, or (b) discovery of the defect or breach of warranty or guarantee if the action be for such.

The Surety represents to the Principal and to the Obligee that it is legally authorized to do business in the Commonwealth of Virginia.

Signed and sealed this _____ day of _____, 2013.

(SEAL)
Contractor/Principal

By: _____

Witness: _____

Title: _____

(SEAL)
Surety

By: _____
Attorney -in-Fact

My Power of Attorney is recorded in the Clerks Office of the Circuit Court of _____, Virginia in Deed Book _____, Page _____, and has not been revoked.

Attorney-in-Fact

AFFIDAVIT AND ACKNOWLEDGEMENT OF ATTORNEY-IN-FACT

COMMONWEALTH OF VIRGINIA
(or, alternatively, Commonwealth or State of _____)

CITY/COUNTY OF _____ to wit:

I, the undersigned notary public, do certify that _____ personally appeared before me in the jurisdiction aforesaid and made oath that he is the attorney-in-fact of _____, the Surety, that he is duly authorized to execute on its behalf the aforesaid Bond(s) as its act and deed.
Given under my hand this _____ day of _____ 2013.

(SEAL)
Notary Public

My Commission expires: _____

APPROVED:

City Attorney/Designee Date

**CITY OF LYNCHBURG
STANDARD LABOR AND MATERIAL PAYMENT BOND**

KNOW ALL MEN BY THESE PRESENTS: That _____
_____, the Contractor ("Principal") whose principal
place of business is located at _____
_____ and _____
_____ ("Surety") are held and firmly bound unto the City of Lynchburg,
Virginia, the Owner ("Obligee") in the amount of _____ Dollars
(\$ _____) for the payment whereof Principal and Surety bind themselves, their heirs,
executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS,

Principal has by written agreement dated _____ entered into a Construction Agreement
with Obligee for the Renovations to Miller Center, which contract (the "Contract") is by reference
expressly made a part hereof;

NOW THEREFORE, THE CONDITION OF THIS OBLIGATION is such that, if the Principal shall
promptly make payment to all claimants as hereinafter defined, for labor performed and material
furnished in the prosecution of the Work provided for in the Contract and its Contract Documents, then
this obligation shall be void; otherwise it shall remain in full force and effect, subject, however, to the
following conditions.

The Principal and Surety, jointly and severally, hereby agree with Obligee as follows:

1. A claimant is defined as one having a direct contract with the Principal or with a subcontractor of
the Principal for labor, material, or both for use in the performance of the Contract. A
"subcontractor" of the Principal, for the purposes of this bond only, includes not only those
subcontractors having a direct contractual relationship with the Principal but also any other
contractor who undertakes to participate in the Work which the Principal is to perform under the
aforesaid Contract, whether there are one or more intervening subcontractors contractually
positioned between it and the Principal (for example, a subcontractor). "Labor" and "material"
shall include, but not be limited to, public utility services and reasonable rentals of equipment, but
only for periods when the equipment rented is actually used at the Work site.
2. Subject to the provisions of paragraph 3, any claimant who has performed labor or furnished
material in accordance with the Contract Documents in the prosecution of the Work provided in
the Contract, who has not been paid in full therefore before the expiration of ninety (90) days after
the day on which such claimant performed the last of such labor or furnished the last of such
materials for which he claims payment, may bring an action on this bond to recover any amount
due him for such labor or material, and may prosecute such action to final judgment and have
execution on the judgment. The Obligee need not be a party to such action and shall not be liable
for the payment of any costs, fees or expenses of any such suit.

3. Any claimant who has a direct contractual relationship with any subcontractor of the Principal from whom the Principal has not required a subcontractor payment bond, but who has no contractual relationship, express or implied, with the Principal, may bring an action on this bond only if he has given written notice to the Principal within one hundred eighty (180) days from the day on which the claimant performed the last of the labor or furnished the last of the materials for which he claims payment, stating with substantial accuracy the amount claimed and the name of the person for whom the Work was performed or to whom the material was furnished. Notice to the Principal shall be served by registered or certified mail, postage prepaid, in an envelope addressed to the Principal at any place where his office is regularly maintained for the transaction of business. Claims for sums withheld as retainages with respect to labor performed or materials furnished shall not be subject to the time limitations stated in this paragraph 3.
4. No suit or action shall be commenced hereunder by any claimant.
 - a. Unless brought within one year after the day on which the person bringing such action last performed labor or last furnished or supplied materials, it being understood, however, that if any limitation embodied in this bond is prohibited by any law controlling the construction hereof, the limitation embodied within this bond shall be deemed to be amended so as to be equal to the minimum period of limitation permitted by such law.
 - b. Other than in a Virginia court of competent jurisdiction, with venue as provided by statute, or in the United States District Court for the district in which the project, or any part thereof is situated.
5. The amount of this bond shall be reduced by and to the extent of any payment or payments made in good faith hereunder.
6. This bond is intended to comply with the requirements and to afford all the benefits of a payment bond consistent with the requirements of Virginia Code § 2-2-4337 and § 2-2-4341. To the extent that those sections as they are in effect as of the date of issuance of this bond confer any requirements on Principal or Surety, or confer any additional benefits on any claimant (as the term "claimant" is used within either the meaning of those sections or this bond), those requirements and benefits shall be deemed to be incorporated into and be part of this bond.

Signed and sealed this _____ day of _____, 2013.

(SEAL)
Contractor/ Principal

By: _____

Witness: _____

Title: _____

(SEAL)
Surety

By: _____
Attorney-in-Fact

Typed Name: _____

My Power of Attorney is recorded in the Clerks Office of the Circuit Court of _____ Virginia in Deed Book _____, Page _____, and has not been revoked.

Attorney-in-Fact

AFFIDAVIT AND ACKNOWLEDGEMENT OF ATTORNEY-IN-FACT
COMMONWEALTH OF VIRGINIA

(or, alternatively, Commonwealth or State of _____)

CITY / COUNTY OF _____

I, the undersigned notary public, do certify that _____ personally appeared before me in the jurisdiction aforesaid and made oath that he is the attorney-in-fact of _____, the Surety, that he is duly authorized to execute on its behalf the foregoing bond pursuant to the Power of Attorney noted above, and on behalf of said Surety, acknowledged the aforesaid bond(s) as its act and deed.

Given under my hand this _____ day of _____, 2013

(SEAL)

Notary Public

My Commission expires: _____

APPROVED: _____
City Attorney/Designee Date

ESCROW AGREEMENT

THIS AGREEMENT ("Agreement"), made and entered into this ____ day of _____, 2013 by,
between and among the City of Lynchburg ("City"), _____ ("Contractor"), and

(Name of Bank)

(Address of Bank)

a trust company, bank, or savings and loan institution with its principal office located in the Commonwealth of Virginia (hereinafter referred to as "Bank" or "Escrow Agent"), and

("Surety") provides:

I.

The City and the Contractor have entered into the Construction Agreement ("Contract") with respect to City Project Name: Renovations to Miller Center, ("the Contract"). This Agreement is pursuant to, but in no way amends or modifies, the Contract. Payments made hereunder or the release of funds from escrow shall not be deemed approval or acceptance by the City of performance by the Contractor or Surety.

II.

In order to assure full and satisfactory performance by the Contractor of its obligations under the Contract, the City may, pursuant to the Contract Documents, retain certain amounts otherwise due the Contractor. The Contractor has, with the approval of the City, elected to have these retained amounts held in escrow by the Bank. This Agreement sets forth the terms of the escrow. The Bank shall not be deemed a party to, bound by, or required to inquire into the terms of, the Contract or any other instrument or agreement between the City and the Contractor.

III.

The City may from time to time pursuant to this Agreement pay to the Bank amounts retained by the City under the Contract. Except as to amounts actually withdrawn from escrow by the City, the Contractor shall look solely to the Bank for payment of funds retained under the Contract and paid by the City to the Bank.

The risk of loss by diminution of the principal of any funds invested under the terms of this Agreement shall be solely upon the Contractor.

Funds and securities held by the Bank pursuant to this Agreement shall not be subject to levy, garnishment, attachment, lien, or other process whatsoever. Contractor agrees not to assign, pledge, discount, sell or otherwise transfer or dispose of his interest in the escrow account or any part thereof, except to the Surety.

IV.

Upon receipt of checks or warrants drawn by the City's Director of Finance and made payable to it as escrow agent, the Bank shall promptly notify the Contractor, negotiate the same and deposit or invest and reinvest the proceeds in "Approved Securities" within the meaning of this Agreement in accordance with the written instruction of the Contractor. In no event shall the Bank invest the escrowed funds in any security that is not an "Approved Security."

V.

The following securities, and none other, are Approved Securities for all purposes of this Agreement:

- (1) United States Treasury Bonds, United States Treasury Notes, United States Treasury Certificates of Indebtedness or United States Treasury Bills,
- (2) Bonds, notes and other evidences of indebtedness unconditionally guaranteed as to the payment of principal and interest by the United States,
- (3) Bonds or notes of the City,
- (4) Bonds of any political subdivision of the City, if such bonds carried, at the time of purchase by the Bank or deposit by the Contractor, a Standard and Poor's or Moody's Investors Service rating of at least "A", and
- (5) Certificates of deposit issued by commercial Banks located within the Commonwealth, including, but not limited to, those insured by the Bank and its affiliates,
- (6) Any bonds, notes, or other evidences of indebtedness listed in Section (1) through (3) may be purchased pursuant to a repurchase agreement with a Bank, within or without the City, having a combined capital, surplus and undivided profit of not less than \$25,000,000 provided the obligation of the Bank to repurchase is within the time limitations established for investments as set forth herein. The repurchase agreement shall be considered a purchase of such securities even if title, and/or possession of such securities is not transferred to the Escrow Agent, so long as the repurchase obligation of the Bank is collateralized by the securities themselves, and the securities have on the date of the repurchase agreement a fair market value equal to at least 100 percent of the amount of the repurchase obligation of the Bank, and the securities are held by a third party, and segregated from other securities owned by the Bank.

No security is an Approved Security hereunder if it matures more than five years after the date of its purchase by the Bank or deposit by the Contractor.

VI.

The Contractor may from time to time withdraw the whole or any portion of the escrowed funds by depositing with the Bank Approved Securities in an amount equal to, or in excess of, the amount so withdrawn. Any securities so deposited or withdrawn shall be valued at such time of deposit or withdrawal at the lower of par or market value, the latter as determined by the Bank. Any securities so deposited shall thereupon become a part of the escrowed fund.

Upon receipt of a direction signed by the City's Director of Public Works or the City Engineer, the Director of Finance or the City Accountant shall authorize the Bank to pay the principal of the fund, or any specified amount thereof, to the account of the City of Lynchburg. Such payment shall be made in cash as soon as is practicable after receipt of the direction.

Upon receipt of a direction signed by the City's Director of Public Works or the City Engineer, the Director of Finance or the City Accountant shall authorize the Bank to pay and deliver the principal of the fund, or any specified amount thereof, to the Contractor, in cash or in kind, as may be specified by the Contractor. Such payment and delivery shall be made as soon as is practicable after receipt of the direction.

VII.

For its services, hereunder the Bank shall be entitled to a reasonable fee in accordance with its published schedule of fees or as may be agreed upon by the Bank and the Contractor. Such fee and any other costs of administration of this Agreement shall be paid from the income earned upon the escrowed fund, and, if such income is not sufficient to pay the same, by the Contractor.

VIII.

The net income earned and received upon the principal of the escrowed fund shall first be paid or applied to pay the Bank's fee and any other costs of administration and such income shall be deemed a part of the principal of the fund. After all of the Bank's fees and other costs of administration have been paid from such income, the net income earned thereafter may then be paid over to Contractor in installments.

IX.

The Surety undertakes no obligation hereby but joins in this Agreement for the sole purpose of acknowledging that its obligations as surety for the Contractor's performance of the Contract are not affected hereby.

WITNESS the following signatures, all as of the day and year first above written.

CITY OF LYNCHBURG

CONTRACTOR: _____

BY: _____
City Manager

BY: _____
Officer, Partner, or Owner (Seal)

SURETY:

By: _____

Its: President (Seal)

ATTEST:

Secretary

By: _____
Attorney-in-Fact

AFFIDAVIT AND ACKNOWLEDGEMENT OF ATTORNEY-IN-FACT

COMMONWEALTH OF VIRGINIA

(or, alternatively, Commonwealth or State of _____)

CITY / COUNTY OF _____

I, the undersigned notary public, do certify that _____ personally appeared before me in the jurisdiction aforesaid and made oath that he is the attorney-in-fact of _____, the Surety, that he is duly authorized to execute on its behalf the foregoing bond pursuant to the Power of Attorney noted above, and on behalf of said Surety, acknowledged the aforesaid bond(s) as its act and deed.

Given under my hand this _____ day of _____, 2013

(SEAL)
Notary Public

My Commission expires: _____

APPROVED:

City Attorney/Designee Date

INSTRUCTIONS TO BIDDERS

DESCRIPTION OF WORK:

The Work included under this Contract shall consist of all labor, materials, equipment, and the performance of all work necessary to complete the project known as the Renovations to Miller Center, as described in the Contract Documents. This Work shall be performed in accordance with the Contract Documents.

1. General: Subject to Owner's right to waive informalities, to be valid for consideration, bids must be completed and submitted in accordance with these instructions to bidders. All individual bid unit price items must be filled in, regardless of the quantity shown.
2. Plans and Specifications: The Contract Documents for the above project may be obtained from CRI Mutual Press, 60 9th Street, Lynchburg, Virginia 24504, for a non-refundable fee of \$148/set, which includes tax. No partial sets will be provided. Documents are also available on the City's website: www.lyncburgva.gov, Quick Index, Current Solicitations.

The successful bidder shall be issued, without charge, five (5) sets of sets of plans and specifications.

3. Qualification of Bidders: Each bidder must submit with their bids the completed Statement of Experience: Qualifications of Contractor and Its Selected Subcontractors and Craftsmen forms and be prepared to submit within five calendar days of the Owner's request any additional written evidence of his qualifications for the project, including, without limitation, financial data, previous experience, resources, personnel and evidence of authority to conduct business in the jurisdiction where the project is located.
 - 3.1 Projects listed by the bidder shall have been completed by the bidder under the company name in which the bidder will be bidding. If the bidder has completed projects under a different company name, the name(s) under which the projects were completed shall be noted.
 - 3.2 A contractor who has pending litigation against the company for work not completed or for failed work may be subject to disqualification.
 - 3.3 Debarment by federal, state, or local government may be cause for disqualification.
 - 3.4 By submitting a bid, the bidder certified that the company is not currently debarred from submitting bids in the state or local governing jurisdiction where the project is located.
4. Examination of Bid Documents and Site:
 - 4.1 Before submitting bids, each bidder must examine bid documents, including, without limitation, all the Contract Documents, thoroughly; familiarize himself with Federal, state and local laws, ordinances, rules, codes, and regulations affecting the Work; and correlate his observations with requirements of the bid documents.
 - 4.2 Bidders are required to visit the site of the project to alert themselves to local and special conditions which may be encountered during construction of the project such as: labor and transportation, handling and storage of materials, the availability of materials, and site access. Failure to make such investigations shall not relieve the successful bidder from performing and completing the Work in accordance with the Contract Documents.
 - a. A pre-bid conference will be held at the time and place stated in the Advertisement for Bids.

5. Clarification:

- 5.1 No oral clarification of the bid documents will be made to any bidder. To be given consideration, requests for clarification must be received in time to allow preparation of a written response at least seven (7) days prior to date fixed for opening of bids. Clarifications will be issued in the form of written addenda to the bid documents and posted to the Procurement Website within five (5) days of the bid opening. Only clarifications by formal written addenda will be binding.
- (1) All communications in regard to clarifications and any other matters related to this project shall be addressed to: Stephanie Suter, Procurement Division, 900 Church Street, Lynchburg, VA 24504, Fax: 434-845-0711, email: stephanie.suter@lynchburgva.gov.

6. Substitutions:

- 6.1 Substitutions of material or equipment or both may be offered by the Contractor with his bid, provided that, if approved:
- a. No major changes in the construction or design intent of the project would be required. Changes required to accommodate substituted items shall be made by the Contractor at no additional cost or time delay.
 - b. Features of quality, capacity, construction, performance, appearance, size, arrangement, and general utility, including economy of operation of substitutes offered, either parallel or exceed those of specified products.
 - c. The provisions of the General Conditions are met, and the provisions of the General Conditions any other guarantees, if required by the specification sections, shall apply in full force and effect to the performance of such substitute products, approved for incorporation into the Work.
- 6.2 Technical data covering the proposed substitution shall be furnished with the bid when possible, and not later than 10 days after bid submission.

7. Bid Submission:

- 7.1 Submit bids using forms furnished in the Project Manual and fill in all blank spaces on the form. Repeat notation "Contractor's Current Virginia License No. _____" on outside of inner envelope containing bid and bid security, and place this envelope within another envelope addressed to:

City of Lynchburg
Procurement Division
900 Church Street
Third Floor, City Hall
Lynchburg, VA 24504

Bidders shall include the following with their bid submission:

- Bid Form
- Statement of Experience: Contractor and Subcontractor Qualifications
- Statement of Available Resources
- Equal Opportunity Report Statement
- Corporate Status Form
- Questions to Offeror Form
- Bid Bond or Cashiers Check Equivalent

- 7.2 Both the inner and outer envelopes shall have noted thereon:
- a. "Sealed Bid 13-834 Enclosed for Renovations to Miller Center";
 - b. The bidder's name and address;

c. Repeat notation "Current Registered Virginia Contractor No. ____" on the outside envelope.

7.3 Each bid must be accompanied by a cashier's check payable to the City drawn on a bank satisfactory to the City, or a Bid Bond, in the amount of five percent (5%) of the amount of the total base bid, with the City as obligee, as assurance that the successful bidder will enter into the Contract within ten (10) days after Notice of Award.

If the successful bidder defaults by failure to enter into the Contract and to provide required performance and payment bonds, the certified check or Bid Bond accompanying the successful bid shall be collected by the City, not as a penalty but as liquidated damages for delays and such additional expenses as may be incurred by the City for reasons of such default.

7.4 Any changes, erasures, modifications, or deletions in the bid form, or alternate proposals not specified in the bid proposal may make the proposal irregular and subject to rejection.

7.5 Receipt deadline for bids will be as stated in the Advertisement for Bids.

7.6 Bids will be opened publicly in accordance with the Advertisement for Bids.

7.7 Withdrawal of bid after bid opening: To withdraw a bid after bid opening, a bidder must satisfy the substantive requirements of Va. Code §2.2-4330. In addition, the following procedures shall apply:

a. The bidder shall give notice in writing of his claim of right to withdraw his bid within two business days after the conclusion of the bid opening procedure and shall submit original work papers with such notice.

b. The mistake may be proved only from the original work papers, documents and materials used in preparation of the bid and delivered as required herein.

8. Bonds and Damages:

8.1 Bonds shall be with a surety company acceptable to the Owner- that is legally authorized to do business in Virginia and in a form acceptable to Owner.

8.2 A performance bond and a labor and material payment bond will be required in the amount of 100 percent of the bid.

8.3 Liquidated damages shall be as indicated in the Contract Documents.

9. Award of Contract:

9.1 The award of the Contract will be the responsible bidder submitting the lowest responsive base bid.

Selection of the apparently successful bidder's responsibility will include a serious evaluation of whether the bidder has conscientiously attempted to meet Minority and Disadvantaged Business Enterprise goals. A requirement of the Contract bidder will be that a genuine concerted effort will be utilized to meet the Contract goal.

9.2 Before the Contract is awarded, the bidder submitting the lowest responsive bid must satisfy the City that it has the requisite organization, capital, equipment, ability, resources, personnel, management, business integrity, and at least five years experience in the type municipal work for which it has submitted a bid. Each bidder shall, with his bid, submit the required detailed project information as outlined in the Statement of Experience. The bidder shall verify to the City that it has the sufficient and qualified personnel to provide for the Contract Work. Failure by the lowest

responsive bidder to sufficiently satisfy the City of its ability to meet any of the above requirements may serve as grounds for rejection of the bid.

9.3 The Owner reserves the right to cancel the Advertisement for Bids, reject any and all bids, waive any and all informalities, and disregard all conforming, nonconforming, conditional bids or counterproposals.

9.4 Unless canceled or rejected, a responsive bid from the lowest responsible bidder shall be accepted as submitted, except that if the responsive bid from the lowest responsible bidder exceeds available funds, pursuant to Section 18.1-9 of the Lynchburg Public Procurement Code, the Owner may negotiate with the apparent low bidder to obtain a contract price within available funds.

a. Procedures for Negotiations: If the Owner wishes to negotiate with the apparent low bidder to obtain a contract price within available funds, negotiations shall be conducted in accordance with the following procedures:

1. If the using agency wishes to conduct negotiations pursuant to this section, it shall provide the procurement administrator with a written determination that the bid from lowest responsive, responsible bidder exceeds available funds. This determination shall be confirmed in writing by the director of finance or his designee. The using agency shall also provide the procurement administrator with suggested measures to bring the proposed purchase within budget through negotiations with the lowest responsive, responsible bidder, including reductions in scope, changes in quality, value engineering, changes in terms and conditions, or changes in schedule.
2. The procurement administrator shall advise the lowest responsive, responsible bidder, in writing, that the proposed purchase exceeds available funds. He shall further invite proposed measures, such as a reduction in scope, change in quality, value engineering, changes in terms or conditions, or changes in schedule for the proposed purchase, and invite the lowest responsive, responsible bidder to amend its bid based upon the proposed measures to bring the purchase within available funds.
3. Informal discussions between the City and the lowest responsive, responsible bidder, either in person, by e-mail, by telephone, or by other means, may be used to attempt to obtain a contract within available funds.
4. Following any successful negotiations, the lowest responsive, responsible bidder shall submit a proposed addendum to its bid, which addendum shall include the specific changes in the proposed purchase, the reduction in price, and the new contract value. The addendum shall be reviewed by the purchasing agency, the City Manager, and City Attorney for acceptability.
5. If an addendum is acceptable to the City, the City may award a contract within funds available to the lowest responsive, responsible bidder based upon the amended bid proposal.
6. If the City and the lowest responsive, responsible bidder cannot negotiate a contract within available funds, all bids shall be rejected.

9.5 Protests of Award or Decisions to Award of Contract

a. The following are the exclusive procedures for a bidder or offeror to protest the City's award or decision to award a contract.

1. Any protest to award a contract shall be in writing and shall be delivered so that it is received by the City Manager not later than five (5) business days after announcement

of the award or decision to award, whichever comes first. Otherwise any such protest shall be deemed to be waived.

2. Except for a protest of an emergency or sole source procurement, a protest of a City award or decision to award a contract may only be made by a person who submitted a bid or proposal for the procurement at issue and who was reasonably likely to have its bid or proposal accepted but for the City's decision. In the case of an emergency or sole source procurement, a protest may only be made by a person who can show that he was reasonably likely to have submitted a successful bid or proposal if the procurement had been other than emergency or sole source.
 3. Protests shall only be granted if (1) the protester has complied fully with Sec. 18.1-6 of the Lynchburg Public Procurement Code and there has been a violation of law, the Lynchburg Public Procurement Code, or mandatory terms of the solicitation that clearly prejudiced the protestor in a material way, or (2) a statute requires voiding of the decision.
 4. The City Manager shall issue a written decision on a protest within ten (10) days of its receipt by the City Manager.
 5. If the protest is denied, the protestor may only appeal the denial or otherwise contest or challenge the procurement by then filing suit in the Lynchburg Circuit Court, Lynchburg, Virginia, and serving the city with such suit within ten (10) days of such denial. Otherwise, the City Manager's decision shall be final and conclusive, and the protester's right to appeal the denial or to otherwise contest or challenge the procurement shall be deemed to be waived.
 6. Strictly following these procedures shall be a mandatory prerequisite for protest of the City's award or decision to award a contract. Failure by a bidder to follow these procedures strictly shall preclude that bidder's protest and be deemed to constitute a waiver of any protest.
- b. A protest may not be based upon the alleged non-responsibility of a person to whom the City awards or makes a decision to award a contract.
10. Bidders are referred to the General Conditions for the meanings of capitalized terms.

End of Instructions to Bidders

PREBID QUESTION FORM

PROJECT: RENOVATIONS TO MILLER CENTER
Lynchburg, Virginia

DATE: _____

(Note: Bidders must make inquiries at least six working days prior to time set for the receipt of bids.)

The following question concerns: (indicate)

Drawings: Sheet (number) _____.
Specifications: Section (number _____, Page _____).

The Owner's response is:

All necessary responses to questions will be issued by addenda which will be posted to the City's Current Solicitations webpage.

Question submitted by: _____
Name Telephone

Organization e-mail address

Note: Use separate form for each question submitted.

Procurement Division Fax: 434-845-0711
Attention: Stephanie Suter e-mail: Stephanie.Suter@lynchburgva.gov

END OF PREBID QUESTION FORM

GENERAL CONDITIONS

ARTICLE 1	CONTRACT DOCUMENTS AND DEFINITIONS
ARTICLE 2	ARCHITECT/ENGINEER
ARTICLE 3	OWNER
ARTICLE 4	CONTRACTOR
ARTICLE 5	SUBCONTRACTORS
ARTICLE 6	WORK BY OWNER OR BY SEPARATE CONTRACTORS
ARTICLE 7	MISCELLANEOUS PROVISIONS
ARTICLE 8	CONTRACT TIME
ARTICLE 9	PAYMENTS AND COMPLETION
ARTICLE 10	PROTECTION OF PERSONS AND PROPERTY
ARTICLE 11	INSURANCE FOR CONTRACTS
ARTICLE 12	CHANGES AND MODIFICATIONS IN THE WORK
ARTICLE 13	CLAIMS AND DISPUTE PROCEDURE
ARTICLE 14	UNCOVERING AND CORRECTION OF WORK
ARTICLE 15	TERMINATION OF THE CONTRACT

GENERAL CONDITIONS

ARTICLE 1 CONTRACT DOCUMENTS AND DEFINITIONS

1.1 DEFINITIONS

1.1.1 CONTRACT AND CONTRACT DOCUMENTS:

The Contract Documents include: (1) the Construction Agreement (the "Contract"), its General Conditions, its Special Conditions (if any) and its attachments (if any); (2) the City's Invitation for Bid No. 13-834 dated February 2013, and any addenda; (3) the Contractor's bid; (4) the Contract plans, drawings, and specifications and any addenda; and (5) any Modifications and any Field Orders. Any soils, geotechnical or other reports, surveys and analyses which may be made available to the Contractor for review or information under this Contract, are not adopted by reference into, nor are they part of the Contract Documents.

1.1.2 MODIFICATION:

A Modification is (1) a written amendment to the Contract signed by both parties (Project Manager for City of Lynchburg and authorized agent for the Contractor), (2) a written Change Order signed by the Project Manager or Owner's authorized representative and an authorized agent for the Contractor, or (3) a written Change Directive signed by the Owner's authorized representative. Modifications may be made to the Contract and Contract Documents without notice to any surety for the performance or payment bonds for the Work. Any Modification that increases the Contract Sum by more than \$50,000 or that causes total expenditures for the Contract to exceed the amount budgeted for the Contract may only be made with the specific approval of the City Manager.

1.1.3 WORK:

"Work" means the construction and services required by the Contract Documents and includes all services, plant, labor, materials, supplies, equipment and other things necessary for Contractor to carry out and complete the requirements of the Contract Documents. "Work" includes material suitably stored and protected. "Work" also includes any portion of the Work, whether completed or not.

1.1.4 PROJECT:

The Project is the total construction of which the Work performed by Contractor under the Contract Documents may be the whole or a part.

1.1.5 FURNISH, INSTALL & PROVIDE:

The terms "Furnish" or "Install" or "Provide", unless specifically limited in context, mean furnishing and incorporating a specified item, product or material into the Work, including all necessary labor, materials, equipment to make the item and the Work ready for use.

1.1.6 EXTRA WORK:

The term "Extra Work" as used herein, refers to and includes work required by the Owner, which, in the judgment of the Owner involves changes in or additions to the Work required by the Contract Documents in their then-existing form.

1.1.7 NOTICE OF AWARD:

"Notice of Award" is the written notice of the Owner's acceptance of the Contractor's bid given by the Owner to Contractor as the successful bidder.

1.1.8 NOTICE:

"Notice" means written notice made in the manner specified in this paragraph.

decision thereon shall be final. In case of conflict or inconsistency between the drawings and the specifications, the specifications shall govern.

- 1.2.4 Should any labor, material, or equipment be required which is not denoted in the drawings and specifications, but which is, nevertheless, reasonably necessary for the proper carrying out of the intent of the Work, it is agreed that the labor, material, or equipment is implied, and the Contractor shall provide such labor and furnish such materials and equipment as fully as if they were completely delineated and prescribed, without additional cost to the Owner.
- 1.2.5 The Contractor may be furnished additional instructions and detail drawings to carry out the Work included in the Contract Documents. The additional drawings and instructions thus supplied to the Contractor will coordinate with the Contract Documents and will be so prepared that they can be reasonably interpreted as a part thereof. The Contractor shall carry out the Work in accordance with the additional detail drawings and instructions.
- 1.2.6 The drawings and specifications are divided into sections for convenience and clarity only. The Contractor shall not construe this division as a division of the Work into various subcontractor units. The Contractor may subcontract the Work in such divisions as he sees fit, but he is ultimately responsible for furnishing all Work required by the Contract Documents.
- 1.2.7 The provisions of this Contract cannot be amended, modified, varied or waived in any respect that causes a change to the Contract Sum or Contract Time except by a Modification. **The Contractor is hereby given notice that no person has authority to orally waive, or to release the Contractor from any of the Contractor's duties or obligations under or arising out of the Contract Documents.** Any waiver, approval or consent granted by Modification or Field Order to the Contractor shall be limited to those matters specifically and expressly stated thereby to be waived, approved or consented to and shall not relieve the Contractor of the obligation to obtain any future waiver, approval or consent.

1.3 OWNERSHIP AND USE OF DOCUMENTS

- 1.3.1 All plans, drawings, specifications, and documents relating to the Work are the property of the Owner and are to be used only for the Project.

ARTICLE 2 ARCHITECT/ENGINEER

2.1 DEFINITIONS

- 2.1.1 The term Architect/Engineer, hereinafter "A/E" or "Architect" or "Engineer", shall mean the consulting firm or City Department/Division, or their duly authorized representatives, lawfully licensed to practice in Virginia, that is responsible for the activities specified herein.
- 2.1.2 Although the A/E is referred to throughout the Contract Documents as if singular in number and masculine in gender, A/E includes plural in number and feminine or neuter in gender, as appropriate.

2.2 ARCHITECT/ENGINEER SERVICES

- 2.2.1 The A/E will provide services as described in these General Conditions.
- 2.2.2 The A/E will advise and consult with the Owner. The Owner's instructions to the Contractor may be forwarded through the A/E. The A/E has authority to act on behalf of the Owner only to the extent provided in the Contract Documents, and the A/E does not have authority to approve a change to the Contract Sum or the Contract Time.

- 2.2.3 The A/E may visit the site at intervals appropriate to the stage of construction to familiarize himself generally with the progress and quality of the Work and to determine in general if the Work is proceeding in accordance with the Contract Documents. Any visits or inspections by the A/E, any Owner's representative, or any consultant retained by the Owner are solely for the Owner's benefit and shall not confer any rights on Contractor or excuse Contractor from any obligation under the Contract Documents.
- 2.2.4 The A/E will immediately inform the Owner and Contractor whenever, in the reasonable opinion of the A/E, any of the Work is proceeding contrary to the requirements of the Contract Documents and will be unacceptable. Such notification by the A/E is solely for the benefit of the Owner and will not be a cause for the Contractor to claim either delay of the Work or any increase in the Contract Sum or Contract Time.
- 2.2.5 The A/E, the Owner and other governmental representatives shall at all times have access to the Project site and the Work regardless of its stage of progress. The Contractor shall provide facilities for such access so that the A/E, the Owner and other governmental representatives may perform their functions under the Contract Documents.
- 2.2.6 Where applicable, based on the A/E's observations and an evaluation of the Contractor's Applications for Payment, the A/E will recommend the amounts owing to the Contractor and will issue Certificates for Payment in such amounts, as provided in Article 9.9, Payments and Completion.
- 2.2.7 The A/E will be an interpreter of the requirements of the Contract Documents. The A/E will render interpretations necessary for the proper execution and progress of the Work, with reasonable promptness and in accordance with any time limit agreed upon. Either party to the Contract may make written request to the A/E for such interpretations. All interpretations of the A/E shall be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing and/or in the form of drawings.
- 2.2.8 The A/E will recommend to the Owner the rejection of Work that does not conform to the Contract Documents. Whenever, in his opinion, he considers it necessary or advisable for the implementation of the intent of the Contract Documents, he will have authority to require special inspection or testing of the Work in accordance with Subparagraph 7.6.2 whether or not such Work is then fabricated, installed or completed.
- 2.2.9 The A/E will review or take other appropriate action upon Contractor's submittals such as Shop Drawings, Product Data, Samples and Manuals, but only for conformance with the design concept of the Work and with the information given in the plans, drawings, and specifications. Contractor shall ensure that all submittals are complete and have had included with them all correlated items that the A/E requires for his review. In the A/E's and Owner's sole discretion, the A/E may decline to review partial submittals or submittals for which correlated items have not been included. Contractor shall clearly note, both in a cover letter with any submittal and on the submittal itself, any deviation or inconsistency of anything submitted with the requirements of the Contract Documents. The A/E's review of a specific item shall not indicate review of an assembly of which the item is a component. The A/E's review is for the sole benefit of the Owner and is not for the benefit of the Contractor. The A/E's review shall in no way excuse Contractor from fully complying with the Contract Documents.
- 2.2.10 The A/E's acceptance of materials or products on behalf of the Owner shall not bar future rejection of such items (a) if they are subsequently found to be defective or inferior in quality or uniformity to the materials or products specified by the Contract Documents, (b) if such materials or products are not as represented by the Contractor, or (c) if such materials or products do not conform to the requirements of the Contract Documents.
- 2.2.11 As required, the A/E will conduct inspections to assist the Owner in determining the dates of Substantial Completion and Final Completion, will receive and forward to the Owner for the Owner's review written

warranties and related documents required by the Contract Documents and assembled and submitted by the Contractor, and will recommend a final Certificate for Payment upon Contractor's full compliance with the requirements of Article 9, Payment and Completion.

- 2.2.12 All claims, disputes, or other matters or questions between the Contractor and Owner arising out of or relating to the A/E's interpretation of the Contract Documents or arising out of any other decisions, communications, or actions of the A/E relating to the performance of the Work shall be resolved as set forth in Article 12, Changes and Modifications in the Work, and Article 13, Claims.
- 2.2.13 In case of the termination of the employment of the A/E, the Owner shall appoint a new A/E, who shall have the same status under the Contract Documents as the former A/E.

ARTICLE 3 OWNER

3.1 DEFINITION

- 3.1.1 The Owner is the City of Lynchburg, Virginia ("City"). The term Owner means the Owner or its authorized representative. The Departmental Director, or his designee, is the authorized Owner's representative for this Contract. Notwithstanding the foregoing, the authority of the Owner's representative is subject to the limitations in the Lynchburg Public Procurement Code.
- 3.1.2 The Departmental Director, will designate a single Owner's representative, with the title of Project Manager (PM), who will have the power to act, within the scope of his delegated authority, for and on behalf of the Owner, in accordance with the terms of the Contract Documents.
- 3.1.3 For purposes of any change in the Work, the term "Owner" or "Owner's representative" specifically excludes any and all inspectors having building code or City ordinance responsibilities or jurisdiction under the requirements of the building permit for the Project.

3.2 INFORMATION POSSESSED BY OWNER

- 3.2.1 The Owner, as a courtesy, may make available for the Contractor's reasonable review, at the Owner's offices or together with the Contract Documents, certain boring logs, geotechnical, soils and other reports, surveys and analyses pertaining to the Project site. Any such information provided to the Contractor is intended to be for the Contractor's convenience only, and its accuracy and completeness are not guaranteed or warranted by the Owner or the A/E, it being the Contractor's sole responsibility to verify the accuracy and completeness of such information. Such information is not incorporated by reference into or made a part of the Contract Documents.
- 3.2.1.1 Notwithstanding any information provided by Owner or anyone acting on the behalf of Owner, the Contractor assumes full responsibility for inspection of the site and for the means and methods of construction that he employs when performing the Work. The Owner shall not be liable for any additional work or costs arising as a result of any conclusions reached or assumptions derived by the Contractor from or based upon any such information that the Owner makes available for the Contractor's convenience.

3.3 OWNER-PAID PERMITS AND FEES

- 3.3.1 The Owner will, where applicable, pay for:
- .1 Sewer availability fees;
 - .2 Water availability/meter connection fee;

- .3 Electrical, natural gas, telephone, and cable TV permanent installation charges;
- .4 Any easements required;
- .5 Railroad flagging services; and
- .6 Permits for work in Virginia Department of Transportation (VDOT) right-of-way. The Contractor is required to comply with the general requirement for work in the VDOT right-of-way as outlined in the The Manual of Specifications and Standard Details, 2005 for the City of Lynchburg, and the VDOT Manual for this work. Upon completion of all work in the VDOT right-of-way, the VDOT Personnel will conduct an inspection and issue a punch list. The Contractor shall be responsible for completion of those items on the punch list and for obtaining the written release of the permit.

3.3.2. The Contractor's attention is directed to Article 4.7, Contractor-Paid Taxes, Permits, Fees, and Notices, describing other permits to be obtained and fees to be paid by the Contractor.

3.4 OWNER'S RIGHT TO STOP WORK

3.4.1 If the Contractor fails to correct defective Work as required herein or persistently fails to carry out the Work in accordance with the Contract Documents, the Owner, by a written order, may order the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of the Owner to stop the Work shall not give rise to any duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity.

3.5 OWNER'S RIGHT TO CARRY OUT THE WORK

3.5.1 If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within seven (7) days after receipt of Notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to any other remedy he may have, rectify such deficiencies, including without limitation, by performing the Work or having the Work performed by other contractors, as outlined in Section 6.1, Owner's Right to Perform Work and to Award Separate Contracts. In such case, an appropriate Change Order or Change Directive shall be issued by Owner deducting from the payments then or thereafter due the Contractor the cost of correcting such deficiencies, including compensation for the A/E's additional services made necessary by such default, neglect or failure. If the payments then or thereafter due the Contractor are not sufficient to cover such amount, the Contractor shall pay the difference to the Owner.

3.5.2 Neither the Owner nor the A/E nor their officers, agents, assigns or employees are in any way liable or accountable to the Contractor or his surety for the method by which Work performed by the Owner or performed by other contractors pursuant to this Article 3.5, or any portion thereof, is accomplished or for the price paid therefore. Notwithstanding the Owner's exercise of its rights under this Article 3.5, the Contractor and its surety shall have sole responsibility to maintain and protect the Work, including without limitation, that portion of the Work performed by or on behalf of Owner pursuant to this Article 3.5.

3.6 SUSPENSION OF WORK

3.6.1 The Owner shall have the authority to suspend the Work, in whole or in part, for such periods and such reasons as the Owner may deem necessary or desirable, in its sole discretion, including without limitation:

- .1 Unsuitable weather;
- .2 Other conditions considered unfavorable for the suitable prosecution of the Work; and/or

.3. Other conditions considered adverse to the best interests of the Owner.

3.6.2 Any such suspension shall be made by Owner by written order to the Contractor. The Contractor shall obey immediately such order of the Owner and shall not resume the Work until so ordered in writing by the Owner. The Contractor shall be entitled to an extension of the Contract Time, subject to the provisions of Article 8, Contract Time, herein.

3.6.3 No such suspension of the Work shall be the basis of a claim by the Contractor for any increase in the Contract Sum or for any other damages, losses, costs or expenses if the suspension is for a reasonable time under the circumstances then existing and the cause thereof is beyond the control and is without the fault or negligence of the Owner or those acting on Owner's behalf.

3.6.4 In the event of suspension of Work, the Contractor will, and will cause his Subcontractors and others providing any of the Work through Contractor to, protect carefully his and their materials and Work against damage or injury from the weather and maintain completed and uncompleted portions of the Work as required by the Contract Documents. If, in the opinion of the Owner, any Work is damaged or injured by reason of failure on the part of the Contractor or any of his subcontractors to so protect same, such Work shall be removed and replaced at the expense of the Contractor.

3.7 USE AND OCCUPANCY PRIOR TO FINAL ACCEPTANCE BY OWNER

3.7.1 The Owner has the right to take possession of and use any completed or partially completed portions of the Work, notwithstanding that the time for completing the entire Work or any portions thereof may, or may not, have expired. The taking of possession and use by the Owner shall be in accordance with the provisions in Article 9.8, Substantial Completion and Guarantee Bond. If such prior use delays the Work, the Contractor may submit a request for a time extension in accordance with the requirements of Article 8, Contract Time.

3.8 RIGHT TO AUDIT AND PRESERVATION OF RECORDS

3.8.1 The Contractor shall maintain books, records and accounts that completely and accurately account for all of his costs and receipts relating to the Project in accordance with generally accepted accounting principles and practices. The Owner or its authorized representatives shall have the right to review, inspect, audit and/or copy the books, records, accounts and related documents, including without limitation, supporting documents, of the Contractor under any of the following conditions:

.1 If the Contract is terminated for any reason in accordance with the provisions of these Contract Documents, in order to arrive at equitable termination costs;

.2 If the Contractor and the Owner dispute the amount due the Contractor under the terms of this Contract;

.3 To check or substantiate any amounts invoiced or paid that are required to reflect the costs of the Contractor, or the Contractor's efficiency or effectiveness under this Contract or in connection with any extras, changes, claims, additions, backcharges, or other, as may be provided for in this Contract; and/or

.4 If it becomes necessary to determine the Owner's rights and the Contractor's obligations under the Contract or to ascertain facts relative to any Claim.

3.8.2 These provisions for review, inspection, audit and copying shall give the Owner unlimited access during normal working hours to the Contractor's books, records, accounts and supporting documents under the conditions stated above.

- 3.8.3 The Contractor shall make all his books, records, accounts, and all other documents relating to his costs and receipts under this Contract, including without limitation any supporting documents, available to the Owner and its representatives for review, audit, inspection and copying at any time during the period from entry into this Contract through three years after Final Payment or termination of this Contract, whichever occurs later.
- 3.8.4 Any payments made under this Contract shall not constitute a waiver of the Owner's rights to review, inspect, copy and audit. Payments shall not constitute a waiver or agreement by the Owner that it accepts as correct the billings, invoices or other charges upon which the payments are based. If the Owner's review and audit produces a claim against the Contractor, the Owner may pursue all its legal remedies, even though Owner has made all or part of the payments required by this Contract.
- 3.8.5 If any review or audit by the Owner or the Owner's representatives discloses an underpayment by the Owner, the Owner shall pay any amounts found by the audit to be owed to the Contractor. If such audit discloses an overpayment, the Contractor reimburses the Owner for the amount of the overpayment.
- 3.8.6 The Owner's right to review, inspect, audit and copy, and the Contractor's duty as to preservation of records shall terminate at the end of three (3) years after Final Payment or termination of this Contract, whichever occurs later. The Contractor shall include this "Right to Audit and Preservation of Records" clause in all his subcontracts, and he shall require the same to be inserted by all Subcontractors and lower-tier subcontractors in their subcontracts, for any portion of the Work. Should Contractor fail to cause this clause to be included in any such subcontract or lower tier subcontract or otherwise fail to ensure the Owner's rights under this Article 3.8, Contractor shall be liable to Owner for all costs, expenses and attorney's fees that Owner may incur in order to obtain the information that would have otherwise been available to Owner under this Article 3.8, and the absence of such information shall create a presumption in the Owner's favor, which Contractor must overcome with clear and convincing evidence, that the missing information does not support the payment to Contractor or Contractor claim at issue.
- 3.8.7 Review, inspection, audit and copying pursuant to this Article 3.8 may be conducted by the Owner or its authorized representatives.
- 3.8.8 Documents subject to this Article 3.8 shall be made available to Owner and its representatives in whatever formats Owner requests, including without limitation, any electronic formats and/or in paper formats.

3.9 RIGHT TO REVIEW OTHER DOCUMENTS AND MATERIALS

- 3.9.1 In addition to the rights granted to the Owner under Article 3.8, Right to Audit and Preservation of Records or Documents, the Owner shall have the right to inspect, review and copy any and all of the Contractor's records or documents pertaining to or relating in any way to the Work, including, but not limited to, correspondence, memoranda, minutes, reports, intra- and inter-office communications, work papers, estimating sheets, progress reports, forecasts, audio or video recordings, computer disks, e-mails, films, or any other materials, regardless of physical form or characteristics, which were prepared by or in the possession of, or obtainable by, the Contractor. The Contractor shall make all such documents and records available to the Owner upon ten (10) days Notice to the Contractor of the Owner's intent to inspect and review such documents. The Contractor shall include this "Right to Review Documents and Other Materials" clause in all its subcontracts, and Contractor shall cause the same to be inserted by all Subcontractors and lower-tier subcontractors in their subcontracts for any portion of the Work. The Contractor hereby waives any right he may have to additional compensation or time extensions in the event he fails or refuses to preserve and produce records pertaining to any such claim as requested by the Owner pursuant to this paragraph. In addition, the Owner may withhold all or any portion of any progress payments, which may be otherwise due, in the event Contractor refuses to comply with its obligations under this Article 3.9. The review, inspection and copying of documents and other records under this Article 3.9 may be conducted by the Owner or its authorized representatives.

3.9.2 Records and documents subject to this Article 3.9 shall be made available to Owner and its representatives in whatever formats Owner requests, including without limitation, any electronic formats and/or in paper formats.

ARTICLE 4 CONTRACTOR

4.1 DEFINITION

4.1.1 The Contractor is the person or entity identified in the Contract as such, and is generally referred to throughout the Contract Documents as if singular in number and masculine in gender but includes the feminine and neuter in gender, as appropriate. The term Contractor means the Contractor or his authorized representative.

4.1.2 This entire Contract is not one of agency by the Contractor for Owner but one in which the Contractor is engaged independently in the business of providing the services and performing the Work herein described as an independent contractor.

4.2 REVIEW OF CONTRACT DOCUMENTS

4.2.1 The Contractor shall not perform any portion of the Work at any time without having obtained and carefully reviewed the Contract Documents or, where required, approved Shop Drawings, Product. Data, Samples or Manuals for such portion of the Work.

4.2.2 The Contractor shall keep at the Project site at least two (2) copies of the drawings and specifications and shall at all times give the A/E, inspectors, and representatives of the Owner access thereto. Further, said drawings and specifications shall be the approved sets issued to the Contractor by the appropriate City permit agencies

4.3 CONTRACTOR'S REPRESENTATIONS

By entering into this Contract with the Owner, the Contractor represents and warrants the following, together with all other representations and warranties in the Contract Documents

4.3.1 That he is experienced in and competent to perform the type of work required and to furnish the plant, materials, supplies or equipment to be so performed or furnished by him;

4.3.2 That he is financially solvent, able to pay his debts as they mature, and possessed of sufficient working capital to initiate and complete the Work required by the Contract Documents;

4.3.3 That he is familiar with all federal, state, and local government laws, ordinances, permits, regulations and resolutions that may in any way affect the Work or those employed therein;

4.3.4 That such temporary and permanent Work required by the Contract Documents which is to be done by him will be satisfactorily constructed and fit for use for its intended purpose and that such construction will not injure any person, or damage any property;

4.3.5 That he has carefully examined the Contract Documents and the site of the Project and the Work and that from his own investigations, he has satisfied himself and made himself familiar with: (1) the nature and location of the Work, (2) the character, quality and quantity of materials likely to be encountered, including, but not limited to, all structures and obstructions on or at the project site, both natural and man-made; (3) the character of equipment and other facilities needed for the performance of the Work, (4) the general and local conditions, including without limitation its climatic conditions, the availability and cost of labor and the availability and cost of materials, tools and equipment; (5) the quality and quantity of all materials, supplies, tools, equipment, labor and professional services necessary to complete

the Work in the manner required by the Contract Documents; and (6) all other matters or things which could in any manner affect the performance of the Work;

- 4.3.6 That he will fully comply with all requirements of the Contract Documents;
- 4.3.7 That he will perform the Work consistent with good workmanship, sound business practice, and in the most expeditious and economical manner consistent with the best interests of the Owner;
- 4.3.8 That he will furnish efficient business administration, an experienced superintendent, and an adequate supply of workmen, equipment, tools and materials at all times;
- 4.3.9 That he will complete the Work within the Contract Time;
- 4.3.10 That his Contract Sum is based upon the labor, materials, systems and equipment required by the Contract Documents, without exception; and
- 4.3.11 That he has satisfied himself as to the feasibility and correctness of the Contract Documents for the construction of the Work.

4.4 SUPERVISION AND CONSTRUCTION PROCEDURES

- 4.4.1 The Contractor shall supervise and direct the Work, using his best skill and attention. He shall be solely responsible for all construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract; subject, however, to the Owner's right to reject means and methods proposed by the Contractor which are unsafe or otherwise not in compliance with the Contract Documents.
- 4.4.2 The Contractor shall be responsible to the Owner for the acts and omissions of Contractor's employees, Subcontractors and sub-subcontractors, suppliers, their agents and their employees, and of any other persons providing any of the Work through Contractor, and for their compliance with each and every requirement of the Contract Documents, in the same manner as if they were directly employed by the Contractor.
- 4.4.3 The Contractor understands and agrees that he shall not be relieved of his obligations to perform the Work in accordance with the Contract Documents either by the activities or duties of the Owner or the A/E in their administration of the Contract or by inspections, tests, or approvals required or performed under Article 7 by persons other than the Contractor.
- 4.4.4 Before starting a section of the Work, the Contractor shall carefully examine all preparatory work that has been executed by others to receive his Work to see that it has been completed. He shall check carefully, by whatever means are required, to ensure that his Work and adjacent, related work will finish to proper quality, contours, planes, and levels.
- 4.4.5 The Contractor understands and agrees that the Owner and A/E will not have any liability for or any responsibility to exercise any control over construction means, methods, techniques, sequences or procedures, or for safety precautions and programs in connection with the Work, and they will not be responsible for the Contractor's failure to carry out the Work in accordance with the Contract Documents. The Owner and the A/E will not have any liability for or any responsibility to exercise any control over the acts or omissions of the Contractor, Subcontractors, sub-subcontractors or any of their agents or employees, or any other persons performing any of the Work.
- 4.4.6 The Contractor shall use no plant, equipment, materials, or persons for this Work to which the Owner objects.

4.4.7 The Contractor shall not remove any portion of the Work or stored materials from the site of the Project without the Owner's prior, written approval.

4.5 LABOR, MATERIALS AND EQUIPMENT

4.5.1 The Contractor shall furnish all plant, labor, materials, supplies, equipment and other facilities and things necessary or proper for, or incidental to, the Work, and will perform all other obligations imposed on him by the Contract Documents. Final payment will not be made until the Work is so completed.

4.5.2 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for all labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for the proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

4.5.3 Work, materials, and equipment which are necessary in the construction but which are not specifically referred to in the specifications or shown in the drawings but implied by the Contract Documents shall be furnished by the Contractor at his own cost and expense. Such work and materials shall correspond with the general character of the Work as may be determined by the A/E subject to review as provided in Article 2.2.11.

4.5.4 The Contractor shall perform at least that percentage of the Work specified in the Contract to be Contractor self performed with forces that are in the direct employment of the Contractor. The Contractor shall submit to the Owner within thirty (30) days after award of the Contract a designation of the Work to be performed by the Contractor with his own forces. The percentage of the Work to be performed under subcontract shall be calculated by adding the amounts of all subcontracts and dividing this sum by the total Contract Sum.

4.5.5 The Contractor shall at all times enforce strict discipline, safety and good order among all persons providing any of the Work through him and shall not cause or allow to be used for the Work any unfit person or anyone not skilled in the task assigned to him. If any person providing any of the Work through the Contractor shall appear to the Owner to be incompetent or to act in a disorderly or improper manner, such person shall be removed immediately, at the request of the Owner, and shall not provide any of the Work except on written consent of the Owner.

4.5.6 No materials or supplies for the Work shall be purchased by the Contractor or by any Subcontractor subject to any chattel mortgage, or under a conditional sale or other agreement by which an interest is retained by the seller. The Contractor warrants that he has good title to all materials and supplies used by him in the Work.

4.5.7 The Contractor shall provide approved and adequate sanitary accommodations. All wastes shall be covered, disinfected, incinerated or otherwise disposed of legally.

4.5.8 All equipment, apparatus and/or devices of any kind to be incorporated into the Work that are shown or indicated on the drawings or called for in the specifications or required for the completion of the Work shall be entirely satisfactory to the Owner as regards operation, capacity and/or performance. No approval, either written or verbal, of any drawings, descriptive data or samples of such equipment, apparatus, and/or device shall relieve the Contractor of his responsibility to turn over the same in good working order for its intended purpose at the completion of the Work in complete accordance with the Contract Documents. Any equipment, apparatus and/or device not fulfilling these requirements shall be removed and replaced by Contractor with proper and acceptable equipment, apparatus, and/or device, or put in good working order satisfactory to the Owner by Contractor without additional cost to the Owner.

4.6 WARRANTY

- 4.6.1 The Contractor warrants to the Owner that all materials and equipment furnished under this Contract will be new unless otherwise specified, and that all workmanship will be of first class quality, free from faults and defects and in conformance with the Contract Documents and all other warranties and guaranties specified therein. Where no standard is specified for such workmanship or materials, they shall be the best of their respective kinds. All Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. If required by the Owner, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment. This warranty is not limited by the provisions of Article 13, Uncovering and Correction of Work.
- 4.6.2 The Work included in this Contract is specified in the Contract Documents. The Contractor shall be required to complete the Work specified and to provide all items needed for construction of the Work, complete and in good order.

4.7 CONTRACTOR-PAID TAXES, PERMITS, FEES AND NOTICES

- 4.7.1 The Contractor shall pay all sales, consumer, use and other similar taxes for the Work or portions thereof provided by the Contractor which are legally enacted at the time bids are received, whether or not yet effective. Taxes to be paid by the Contractor shall include, but shall not be limited to, the Lynchburg City Business, Professional and Occupational License Tax (a gross receipts tax).
- 4.7.2 Except as provided in Article 3.3, Owner-Paid Permits and Fees, the Contractor will be responsible for obtaining and paying for all other fees, permits and licenses necessary for the proper execution of the Work, including but not limited to:
- .1 Building Permit and inspections (City fees waived);
 - .2 Plumbing, Electrical, Mechanical Permits and inspections (City fees waived);
 - .3 Temporary water meter, temporary electrical and telephone installations and temporary utility usage;
 - .4 Temporary security lighting;
 - .5 All other permits necessary in order to perform the Work shall also be secured by the Contractor, and fees necessary in order to perform the Work shall be paid by him as part of this Contract at no additional cost to the Owner.
- 4.7.3 The Contractor shall give all notices and comply with all laws, ordinances, rules, regulations, codes, permits, resolutions and lawful orders of any public authority bearing on the performance of the Work; including but not limited to OSHA, Title 40.1 Labor and Employment Chapter 3 of the Code of Virginia, and Title VII of the Civil Rights Act of 1964, as amended. All safety violations shall be corrected immediately upon receipt of notice of violation.

4.8 COMPLIANCE

- 4.8.1 All demolition and excavation shall comply with all laws, ordinances, rules and regulations, and lawful orders of public authority, including without limitation, those for the prevention of accidents as issued by the Department of Labor and Industry of the Commonwealth of Virginia.
- 4.8.2 To the extent of the Work indicated in the Contract Documents, the Contractor shall comply and the construction shall conform to all applicable and current editions or revisions of the following codes, specifications and standards. In case of conflict, the order of precedence shall be as hereinafter listed:

- .1 Lynchburg Public Procurement Code;
- .2 Contract Documents;
- .3 The Virginia Uniform Statewide Building Code ("USBC"), as amended including, without limitation, The International Building Code ("IBC") and other codes incorporated by the USBC and IBC); and
- .4 The Virginia Department of Transportation Road and Bridge Specifications and the Road Designs and Standards.

4.8.3 If the Contractor (or any person in a contract with the Contractor relating to the Work) finds an error, inconsistency, omission, ambiguity, discrepancy, conflict or variance in the Contract Documents, or between the Contract Documents and any provisions of law, ordinance, rule, or regulations or any of the codes, specifications and standards set forth in 4.8.2 herein, the Contractor has the obligation to promptly seek in writing a clarification thereof from the A/E, with a copy to the Owner, prior to the time of beginning any of the Work that is affected by such error, inconsistency, omission, ambiguity, discrepancy, conflict or variance. The Owner will welcome such a clarification request, and, if deemed necessary by the Owner, the Owner will issue a written instruction clarifying the matter in question. If the Contractor feels that the written clarification requires additional work, the Contractor shall follow the change process in Article 12, Changes and Modifications in the Work.

Should the Contractor fail to seek such a clarification thereof immediately upon the discovery of the need therefor, prior to the time the said Work is performed, the Contractor thereby assumes all risk of loss related to such error, inconsistency, ambiguity, discrepancy, conflict or variance which the Contractor (and any person in contract with Contractor relating to the Work) knew or should have known, using a normal, professional standard of care, existed prior to the time the Work was performed.

4.8.4 Any material or operation specified by reference to publications, or published specifications of a manufacturer, a society, an association, a code, or other published standard, shall comply with the requirements of the referenced document which is current on the date of receipt of bids. If the Contractor observes that any of the Contract Documents are at variance with any such referenced publications, codes, published specifications, or published standards in any respect, he shall promptly notify the A/E in writing, with a copy to the Owner. The A/E will make such judgments as are necessary and notify the Contractor prior to the performance of the Work.

4.8.5 If the Contractor performs any Work contrary to any law, code, ordinance, regulation, publication, standard, permit, rule, regulation or resolution, he shall assume full responsibility therefore and shall bear all costs attributable thereto.

4.8.6 The Contractor is responsible for locating all underground structures such as water, oil and gas mains, water and gas services, storm and sanitary sewers and telephone and electric conduits that may be encountered during construction. The Contractor shall have Miss Utility locate all utilities on the site within the area of the Work and shall dig test holes, to determine the position of the underground structures. The Contractor shall pay the cost of digging test holes and likewise he shall pay the cost of the services of the representatives of the owners of such utilities for locating the said utilities. The cost of determining the location of any and all utilities is to be included in the bid price. The Owner shall pay the owners of such utilities for fees or charges for relocation of gas, electric, telephone, cable or other lines and/or services indicated to be relocated by others.

4.8.7 If utilities are marked which are not shown on the plans, the Contractor shall immediately give Notice to the Owner and the A/E of such finding. The Owner and A/E shall provide a direction to the Contractor within a reasonable period of time if additional work is required as a result of the finding. If the

Contractor believes that it requires additional work, the Contractor shall follow the change process in Article 12, Changes and Modifications in the Work.

4.9 ALLOWANCES

4.9.1 The Special Conditions, if any, will contain provisions for allowances, if applicable to this Contract.

4.10 SUPERINTENDENT

4.10.1 The Contractor shall employ and have present at the Project site a competent Superintendent and any necessary assistants to ensure adequate supervision of the Work. The Superintendent shall have full authority to represent the Contractor, and all communications given to the Superintendent shall be as binding as if given to the Contractor.

4.10.2 Such Superintendent shall be acceptable to the Owner and shall be one who will be continued in that capacity for duration of this Project, unless he ceases to be on the Contractor's payroll. The Superintendent shall not be employed on any other project during the performance of this Contract.

4.11 CONSTRUCTION SCHEDULE

4.11.1 The Contractor shall, within twenty (20) days after issuance of the Notice of Award, prepare and submit to the A/E and Owner for review, a reasonably practicable and feasible Construction Schedule, showing the method by which the Contractor will comply with Completion Date requirements as set forth in the Contract. Unless otherwise agreed in writing by Owner or indicated in the specifications, the Construction Schedule shall use the Critical Path Method ("CPM") and an industry-standard computer software program, such as Primavera, acceptable to Owner and A/E, and shall be provided in electronic and paper format. The Construction Schedule shall show in detail how the Contractor plans to execute and coordinate the Work. The Contractor shall use this schedule in the planning, scheduling, direction, coordination and execution of the Work. The Construction Schedule shall encompass all of the work of all trades necessary for construction of the Project and shall be sufficiently complete and comprehensive to enable progress to be monitored on a day-to-day basis. The Owner and A/E shall each be provided with a copy of all schedules, updates, reports and other documentation required herein, which shall be suitable for reproduction by the Owner, and, unless otherwise agreed by Owner, shall be in electronic and paper format. When required to assist the Owner or testing agency with Project staffing requirements for the following week, the Contractor shall provide the Owner, on each Friday, with a detailed work schedule for the following week. The Contractor shall provide the Owner with at least a seventy-two (72) hour notice for the following items: (1) All traffic lane changes, (2) Work ready for inspection or testing. The Contractor may be charged for additional costs of inspection when material and workmanship are found to not be ready for inspection or testing at the time the Contractor calls for inspection or testing.

4.11.2 It is the sole responsibility of the Contractor to prepare, maintain, update, revise and utilize the Construction Schedule as outlined in this Article 4.11, Construction Schedule. The Construction Schedule shall be the sole overall schedule utilized by the Contractor in managing this Project; provided, however, that Contractor may, at its option, employ and utilize other schedules based upon and consistent with the Construction Schedule. In general, it is the intent of this paragraph 4.11.2 to allow the Contractor to choose its own means, methods and construction procedures consistent with good practice and the Contract Documents.

4.11.3 If the Contractor should express an intention to complete the Work earlier than any required Milestone or Completion Date, including without limitation, in any schedule, the Owner shall not be liable to the Contractor for any delay or associated extra costs based upon the Contractor being unable to complete the Work before such earlier date. The duties, obligations and warranties of the Owner to the Contractor apply only to the completion of the Work on the Milestone and Completion Dates required by the Contract Documents and do not apply to early completion.

- 4.11.4 Submission to the Owner of the Construction Schedule is advisory only, does not satisfy any requirement for any notice required by the Contract Documents or the Lynchburg Public Procurement Code, and such submission shall not relieve the Contractor of the responsibility for accomplishing the Work within each and every required Milestone and Completion Date. Omissions and errors in the approved Construction Schedule shall not excuse performance that is not in compliance with the Contract Documents. Submission to the Owner and/or A/E in no way makes the Owner and/or A/E an insurer of the Construction Schedule's success or makes Owner and/or the A/E liable for time or cost overruns flowing from the Construction Schedule's shortcomings. The Owner hereby disclaims any obligation or liability by reason of Owner and/or A/E approval or failure to object to the Construction Schedule, and any such approval or failure to object shall not be considered an admission by the Owner that the Construction Schedule was reasonably practicable or feasible.
- 4.11.5 Contractor shall consult with and obtain information from principal Subcontractors necessary in preparation of the Construction Schedule, and for updates and revisions required therein. Contractor shall provide each principal Subcontractor with copies of the Construction Schedule and any revisions or updates affecting that Subcontractor's work. Contractor shall hold appropriate progress meetings with Subcontractors and shall direct and coordinate the work of Subcontractors consistent with and as required herein. Owner shall have the right to attend Subcontractor progress meetings but shall not be required to participate in such meetings or provide information to Subcontractors, except through the Contractor. Contractor shall keep up-to-date minutes of subcontractor progress meetings and shall provide same to Owner. The Contractor shall ensure that each Subcontractor, sub-subcontractor or supplier acknowledges and accepts the requirements of the Construction Schedule relating to their part of the Work.
- 4.11.6 If Contractor's Construction Schedule indicates that Owner, the A/E, or a separate contractor is to perform an activity by a specific date, or within a certain duration, Owner, the A/E, or any separate contractor shall not be bound to said date or duration unless Owner expressly and specifically agrees in writing to the same. The Owner's and/or A/E's overall review and acceptance or approval of the schedule does not constitute an agreement to specific dates or durations for activities of the Owner, A/E, or any separate contractor.
- 4.11.7 The Contractor's Superintendent shall maintain at the Project site a current, updated Construction Schedule, indicating actual monthly progress for those portions of the Project on which Work has been or is being performed.
- 4.11.8 If an extension or contraction of any Milestone or Completion Date is authorized by any Change Order, the Contractor shall revise his Construction Schedule, Milestone and Completion Dates accordingly.
- 4.11.9 If, in the opinion of the Owner, the Construction Schedule does not accurately reflect the actual progress and sequence of the Contractor's performance of the Work, the Contractor shall revise the Construction Schedule, upon the Owner's request, and submit a revised Construction Schedule that accurately represents the progress and sequence of the Contractor's performance of the Work.
- 4.11.10 Contractor shall submit to the Owner the name of any scheduling consultant that Contractor may select or retain, prior to using such consultant. Contractor shall not utilize any particular scheduling consultant over the reasonable objection of the Owner to that consultant.
- 4.11.11 Contractor covenants, warrants, and guarantees that Contractor will not:
- .1 Misrepresent to Owner its planning and scheduling of the Work;
 - .2 Utilize schedules materially different from those made available to the Owner or any subcontractors for the direction, execution and coordination of the Work, or which are not feasible or realistic;

- .3 Prepare schedules, updates, revisions or reports that do not accurately reflect Contractor's actual intent or Contractor's reasonable and actual expectations as to:
- (a) The sequences of activities,
 - (b) The duration of activities,
 - (c) The responsibility for activities,
 - (d) Resource availability,
 - (e) Labor availability or efficiency,
 - (f) Expected weather conditions,
 - (g) The value associated with the activity,
 - (h) The percentage complete of any activity,
 - (i) Completion of any item of work or activity,
 - (j) Project completion,
 - (k) Delays, slippages, or problems encountered or expected,
 - (l) Subcontractor requests for time extension, or delay claims of subcontractors, and
 - (m) If applicable, the float time available.

4.11.12 Contractor's failure to substantially comply with the foregoing covenants, warranties and guarantees of paragraph 4.11.11 shall be a substantial and material breach of contract which will permit Owner to terminate Contractor for default, or withhold payments under the Contract Documents, and shall entitle Owner to the damages afforded by these Contract Documents or applicable law.

4.11.13 Should Contractor fail to substantially comply with the provisions of the Contract Documents relating to scheduling and execution of the Work by the overall Construction Schedule, Owner shall have the right, at its option, to retain the services of scheduling consultants or experts (including attorneys if necessary in the opinion of the Owner) to prepare schedules, reports, updates and revisions of the schedule in accordance with the Contract Documents and to review and analyze same, in order to allow Owner and the A/E to evaluate the progress of the Work by Contractor, to determine whether Contractor is substantially complying with the Contract Documents, and to direct such action by the Contractor, as permitted by the Contract Documents, as required to ensure, under the Owner's schedule prepared hereunder, that Contractor will complete the Work within the Contract Time. All costs and expenses and fees incurred by Owner in exercising its rights hereunder shall be charged to Contractor's account. If Contractor fails to substantially comply with the scheduling and execution of the Work requirements of the Contract Documents, Contractor hereby agrees, in such instance, to comply with such Owner-prepared schedules, if any, or directions, activity sequences and durations as Owner may reasonably require, without additional cost to the Owner (subject only to cost adjustments for such changes in the Work as Owner may direct), to ensure completion within the Contract Time.

4.11.14 The Construction Schedule shall be utilized by Owner, A/E and Contractor for submission, review and approval of monthly Payment Requests. The schedule must be updated by Contractor monthly with each progress payment application and submitted to the Owner and A/E for review with the progress

payment application. Owner shall not be required to process and review Contractor's Application for Payment if Contractor has failed or refused to provide the scheduling update information required herein.

- 4.11.15 The type of schedule to be utilized on this Project, along with its particular elements, shall be as specified in the Contract Documents.

4.12 RESPONSIBILITY FOR COMPLETION

4.12.1 The Contractor shall furnish such manpower, materials, facilities and equipment and shall work such hours, including night shifts, overtime operations and Sundays and holidays, as may be necessary to ensure the performance of the Work within the Milestone and Completion dates specified in the Contract. If the Owner notifies the Contractor that it has become apparent that the Work will not be completed within required Milestone or Completion Dates and such is not due solely to circumstances for which Contractor has established entitlement to an extension to the Contract Time, the Contractor agrees that it will assume full responsibility to take some or all of the following actions, at no additional cost to the Owner (except for circumstances beyond the Contractors' control), in order to ensure, in the opinion of the Owner, that the Contractor will comply with all Milestone and Completion Date requirements:

- .1 Increase manpower, materials, crafts, equipment and facilities;
- .2 Increase the number of working hours per shift, shifts per working day, working days per week, or any combination of the foregoing; and
- .3 Reschedule activities to achieve maximum practical concurrency of accomplishment of activities.

Failure of the Owner to notify the Contractor of the apparent delay shall not relieve Contractor of the obligation to finish the Work within the required Milestone or Completion date.

4.12.2 If the actions taken by the Contractor to remedy delays not due solely to circumstances for which Contractor has established entitlement to a time extension are not satisfactory, the Owner may direct the Contractor to take any and all actions necessary to ensure completion within the required Milestone and Completion Dates, without additional cost to the Owner. In such event, the Contractor shall continue to assume responsibility for his performance and for completion within the required dates.

4.12.3 If, in the opinion of the Owner, the actions taken by the Contractor pursuant to this Article or the progress or sequence of Work are not accurately reflected on the Construction Schedule, the Contractor shall revise such schedule to accurately reflect the actual progress and sequence of Work.

4.12.4 Failure of the Contractor to substantially comply with the requirements of this Article is grounds for a determination by the Owner, pursuant to Article 15, Termination Of The Contract, that the Contractor is failing to prosecute the Work with such diligence as will ensure its completion within the time specified.

4.12.5 The Owner may, at its sole discretion and for any reason, including when it is apparent to the A/E or Owner that the Work will not be completed within the required Milestone or Completion Dates, require the Contractor to accelerate the Construction Schedule by providing overtime, Saturday, Sunday and/or holiday work and/or by having all or any subcontractors designated by the Owner provide overtime, Saturday, Sunday, and/or holiday work. If the Owner requires overtime, Saturday, Sunday or holiday work by the Contractor's or his Subcontractor's own forces, and such requirement is not related in any way to the Contractor's apparent inability to comply with Milestone and Completion Date requirements, the Owner shall reimburse the Contractor for the direct cost to the Contractor of the premium time for all labor utilized by the Contractor in such overtime, Saturday, Sunday or holiday work (but not for the straight time costs of such labor), together with any Social Security and State or Federal unemployment

insurance taxes in connection with such premium time. However, no overhead supervision costs, commissions, profit or other costs and expenses shall be payable in connection therewith.

- 4.12.6 This provision does not eliminate the Contractor's responsibility to comply with the City's noise ordinances, all VDOT permit requirements, and all other applicable laws, regulations, rules, ordinances, resolutions, and permit requirements.

4.13 DOCUMENTS AND SAMPLES AT THE SITE

- 4.13.1 The Contractor shall, at the Owner's direction, maintain at the site for the Owner one record copy of all drawings, specifications, addenda, Change Orders and other Modifications, and Field Orders in good order and marked currently to record all changes made during construction, and approved Shop Drawings, Product Data, Samples and Manuals. These shall be available to the A/E. These shall be delivered to the Owner upon completion of the Work.

4.14 SHOP DRAWINGS, PRODUCT DATA, SAMPLES AND MANUALS

- 4.14.1 SHOP DRAWINGS are drawings, diagrams, schedules and other data specially prepared for the Work by the Contractor or any Subcontractor, manufacturer, supplier or distributor to illustrate some portion of the Work.
- 4.14.2 PRODUCT DATA are illustrations, standard schedules, performance charts, instructions, brochures, diagrams and other information furnished by the Contractor to illustrate a material, product or system for some portion of the Work.
- 4.14.3 SAMPLES are physical examples that illustrate materials, equipment or workmanship and establish standards by which the Work will be judged.
- 4.14.4 MANUALS are manufacturer's installation, start-up, operating, maintenance and repair instructions, together with parts lists, pictures, sketches and diagrams that set forth the manufacturer's requirements, for the benefit of the Contractor and the Owner.
- 4.14.5 The Contractor shall review, approve and submit, with reasonable promptness and in such sequence as to cause no delay in the Work or in the work of the Owner or any separate contractor, all Shop Drawings, Product Data, Samples and Manuals required by the Contract Documents.
- 4.14.6 By approving and submitting Shop Drawings, Product Data, Samples and Manuals, the Contractor represents that he has determined and verified all materials, field measurements, and field construction criteria related thereto, and that he has checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

Parts and details not fully indicated on the contract drawings shall be detailed by the Contractor in accordance with standard engineering practice. Dimensions on the drawings, as well as detailed drawings themselves, are subject in every case to measurements of existing, adjacent, incorporated and completed Work, which shall be taken by the Contractor before undertaking any Work dependent on such data.

- 4.14.7 The Contractor shall not be relieved of responsibility for any deviation from the requirements of the Contract Documents by the Owner or A/E's review of Shop Drawings, Product Data, Samples or Manuals under Article 2, Architect/Engineer unless the Contractor has specifically informed the Owner and A/E in writing of such deviation at the time of submission and the Owner has given specific written approval to the specific deviation. The Contractor shall not be relieved from responsibility for errors or omissions in the Shop Drawings, Product Data, Samples or Manuals by the A/E's review thereof.

4.14.8 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data or Samples, to revisions other than those requested by the Owner or A/E on previous submittals.

No portion of the Work requiring submission of Shop Drawings, Product Data, or Samples shall commence until the submittal has been reviewed by the Owner and A/E as provided in Article 2, Architect/Engineer. All such portions of the Work shall be in accordance with reviewed submittals.

4.14.9 For substances that are proposed for use in the Project that may be hazardous to human health, the Contractor shall submit to the A/E, for information only, information on precautions for safely using these substances, including Material Safety Data Sheets and certification of registration by the Contractor with authorities under the respective Virginia and Federal Toxic Substances Control Acts.

4.14.10 Unless otherwise modified by the Owner in writing, the Contractor shall label or stamp and number all Shop Drawings, Product Data, Samples or Manuals as prescribed by the Project Manager.

4.14.11 The Contractor shall submit a copy of each submittal, including the transmittal sheet (for shop drawings, product data, samples or manuals) to the Owner simultaneously with the Contractor's submission of said drawings, data, samples or manual packages to the A/E.

4.15 EQUAL PRODUCTS:

4.15.1 The term "Product" as used in the Contract Documents refers to materials, equipment, supplies, articles, fixtures, devices, types of construction, or products, as appropriate.

4.15.2 All products furnished shall, whenever specified and otherwise wherever practicable, be the standard products of recognized, reputable manufacturers. If the manufacturer cannot make scheduled delivery of an approved item, the Contractor may request review by of the A/E to use another brand, make, manufacturer, article, device, product, material, fixture, form or type of construction which the Contractor judges to be equal to that specified. An item need not be considered by the A/E for evaluation as equal to the item so named or described unless it (1) it is at least equal in quality, durability, appearance, strength, and design; (2) it will perform at least equally the specific function imposed by the general design for the work being contracted for or the material being purchased; and (3) it conforms substantially, even with deviations, to the detailed requirements for the item in the specifications. Acceptance shall be at the sole discretion of the A/E and will be based upon considerations of quality, workmanship, economy of operation, suitability for the purpose intended, and acceptability for use on the project. Any such acceptance must be in writing to be effective, and the decision of the A/E shall be final.

4.15.4 To obtain such acceptance of equal products other than those specified in Contract Documents, and not previously accepted during the bidding, the Contractor's request for consideration of any equal product shall include the following:

- .1 Complete data substantiating compliance of the proposed equal product with the Contract Documents;
- .2 Accurate cost data on proposed equal product in comparison with product or method specified;
- .3 Product identification including manufacturer's name, address, and phone number;
- .4 Manufacturer's literature showing complete product description, performance and test data, and all reference standards;
- .5 Samples and colors in the case of articles or products;
- .6 Name and address of similar projects on which the product was used and date of installation;

- .7 All directions, specifications, and recommendations by manufacturers for installation, handling, storing, adjustment, and operation.

4.15.5 The Contractor shall also submit with his request for consideration a statement which shall include all of the following representations by the Contractor, namely that:

- .1 He has investigated the proposed equal product and determined that it is equal or better in all respects to that specified and that it fully complies with all requirements of the Contract Documents;
- .2 He will meet all contract obligations with regard to this substitution;
- .3 He will coordinate installation of accepted equal products into the work, making all such changes and any required schedule adjustments, at no additional cost to the Owner, as may be required for the Work to be complete in all respects;
- .4 He waives all claims for additional costs and additional time related to equal products. He also agrees to hold the Owner harmless from claims for extra costs and time incurred by subcontractors and suppliers, or additional services which may have to be performed by the A/E, for changes or extra work that may, at some later date, be determined to be necessary in order for the Work to function in the manner intended in the Contract Documents;
- .5 He will provide the same warranty and guarantee, and perform any work required in accordance therewith, for the equal product that is applicable to the specified item for which the equal product is requested;
- .6 Material will be installed, handled, stored, adjusted, tested, and operated in accordance with the manufacturers' recommendation and as specified in the Contract Documents;
- .7 In all cases, new materials will be used unless this provision is waived in writing by, the Owner or unless otherwise specified in the Contract Documents;
- .8 All material and workmanship will be in every respect, in accordance with that which in the opinion of the Owner, is in conformity with approved modern practice; and
- .9 He has provided accurate cost data on the proposed equal product in comparison with the product or method specified, if applicable.

4.15.6 The Owner may require tests of all products proposed as equal products so submitted to establish quality standards, at the Contractor's expense. After acceptance of an equal product, if it is determined that the Contractor submitted defective information or data regarding the equal product upon which Owner's acceptance was based, and that unexpected or unanticipated redesign or rework of the Project will be required in order to accommodate the equal product, or that the item will not perform or function as well as the specified item for which equal product was requested, the Contractor will be required to furnish the original specified item or request consideration to use another equal product. The Contractor shall pay all costs, expenses or damages associated with or related to the unacceptability of such an equal product and the resultant utilization of another item, and no time extension shall be granted for any delays associated with or related to such an equal product.

4.15.7 Equal products will not be considered for consideration by the Owner if:

- .1 The proposed equal product is indicated or implied on the Contractor's shop drawing or product data submittals and has not been formally submitted for acceptance by the Contractor in accordance with the above-stated requirements; or
- .2 Acceptance of the proposed equal product will require substantial design revisions to the Contract Documents or is otherwise not acceptable to the Owner.

4.15.8 Except as otherwise provided for by the provisions of any applicable laws, the Contractor shall not have any right of appeal from the decision of the Owner rejecting any products submitted if the Contractor fails to obtain the acceptance of an equal product under this Article.

4.15.9 If the Contractor proposes a product which the Owner determines is not equal to the product named in Contract Documents but which the Owner nevertheless is willing to accept, Contractor shall provide, upon request by the Owner, an itemized comparison of the proposed substitution with the product specified and the cost differential which shall be credited to the Owner in a Change Order issued in accordance with Article 12, Changes and Modifications in the Work.

4.16 USE OF SITE

4.16.1 The Contractor shall confine his operations at the site to areas permitted by law, ordinances, permits, easements, right-of-way agreements and the Contract Documents. The Contractor shall not unreasonably encumber the site, in the opinion of the Owner, with any materials, equipment or trailers, nor shall Contractor block the entrances or otherwise prevent reasonable access to the site, other working and parking areas, completed portions of the Work and/or properties, storage areas, areas of other facilities that are adjacent to the worksite. If the Contractor fails or refuses to move said material, equipment or trailers within 48 hours of Notice by the Owner to so do, the Owner shall have the right, without further Notice, to remove, at the Contractor's expense, any material, equipment and/or trailers which the Owner deems are in violation of this paragraph.

4.17 CUTTING AND PATCHING OF WORK

4.17.1 The Contractor shall be responsible for all cutting, fitting or patching that may be required to complete the Work and to make its several parts fit properly and in accordance with the Contract Documents.

4.17.2 The Contractor shall not damage or endanger any portion of the Work or the work of the Owner or any separate contractors by cutting, patching or otherwise altering any work, or by excavation. The Contractor shall not cut or otherwise alter the work of the Owner or any separate contractor except with the written consent of the Owner and of such separate contractor. The Contractor shall not unreasonably withhold from the Owner or any separate contractor Contractor's consent to cutting or otherwise altering the Work. The Owner shall not be required to accept Work with a cut, splice, or patch when such cut, splice or patch is not generally accepted practice for the particular work involved or is otherwise unworkmanlike in the opinion of the Owner.

4.18 SITE CLEAN UP

4.18.1 The Contractor at all times shall keep the Project site and adjacent areas free from accumulation of waste materials or rubbish caused by his operations. Before final payment is made, the Contractor shall remove all of his waste materials, rubbish, scrap materials, debris, tools, construction equipment, machinery, surplus materials, falsework, temporary structures, including foundations thereof and plant of any description, from the Project site and put the site in a neat, orderly condition.

4.18.2 If the Contractor fails to clean up as required herein at any time during the performance of the Work or at the completion of the Work, the Owner may, upon 48 hours notification, clean up the site at the Contractor's expense.

4.19 PATENTS, ROYALTIES, ETC.

4.19.1 The Contractor guarantees to save harmless the Owner, its officers, agents, servants and employees from liability of any kind or nature, including without limitation, cost, expense and attorney's fees, on account of suits and claims of any kind for violation or infringement of any patents or patent rights by the Contractor, or by anyone directly or indirectly employed by him, or by reason of the use of any art, process, method, machine, manufacture, or composition of matter patented or unpatented in the performance of this Contract in violation or infringement of any letter or rights. The Contractor agrees to pay all royalties, fees, licenses, etc. required in respect of the Work or any part thereof as part of his obligations hereunder without any additional compensation.

4.20 INDEMNIFICATION

4.20.1 It is hereby mutually covenanted and agreed that the relation of the Contractor to the Work to be performed by him under this Contract shall be that of an independent contractor and that as such he will be responsible for all damages, loss or injury, including death, to persons or property that may arise or be incurred in or during the conduct and progress of said work as the result of any action, omission or operation under the Contract or in connection with the Work, whether such action, omission or operation is attributable to the Contractor, subcontractor, any material supplier, or anyone directly or indirectly employed by any of them. The Contractor shall make good any damages that may occur in consequence of the Work or any part of it. The Contractor shall assume all liability, loss and responsibility of whatsoever nature by reason of his neglect or violation of any federal, state, county or local laws, regulations, codes or ordinances.

4.20.2 The Contractor shall indemnify, hold harmless and defend the Owner, its employees, agents, servants and representatives from and against any and all claims, suits, demands, actions (regardless of the merits thereof) and damages of whatever nature arising out of or resulting from the performance of the Work or the failure to perform the Work, including without limitation, jurisdictional labor disputes or other labor troubles that may occur during the performance of the Work.

4.20.3 The indemnification obligations under this Article shall not be affected in any way by any limitation on the amount or type of damages, compensation or benefits payable by or for the Contractor or any Subcontractor under worker's or workman's compensation acts, disability benefit acts or other employee benefit acts.

4.20.4 The obligations of the Contractor under this Article 4.20 shall not extend to the actions or omissions of the A/E, his agents or employees, arising out of the preparation or approval of maps, drawings, opinions, reports, surveys, change orders, designs or specifications.

4.20.5 The obligations of the Contractor under this Article 4.20 shall not extend to the proportion of damages, loss or injury, including death, to persons or property that may arise or be incurred as the result of any action, omission or operation of the Owner, or Owner's separate contractor(s), and their employees, agents, servants, and/or representatives.

4.21 NON-DISCRIMINATION IN EMPLOYMENT

4.21.1 During the performance of this Contract, the Contractor agrees as follows:

- .1 The Contractor will not discriminate against any employee or applicant for employment because of race, religion, color, sex, national origin, age, disability, or any other basis prohibited by state

law relating to discrimination in employment, except where there is bona fide occupational qualification reasonably necessary to the normal operation of the Contractor. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the provisions of this nondiscrimination clause.

- .2 The Contractor, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, will state that such Contractor is an equal opportunity employer.
- .3 Notices, advertisements and solicitations placed in accordance with federal law, rule or regulation shall be deemed sufficient for the purpose of meeting the requirements of this section.
- .4 The Contractor will include the provisions of the foregoing paragraphs 1, 2, and 3 in every subcontract or purchase order of over \$10,000, so that the provisions will be binding upon each subcontractor or vendor.

4.21.2 DRUG-FREE WORKPLACE REQUIRED:

As required by section 2.2-4312 of the Code of Virginia during the performance of the Contract, Contractor agrees to (i) provide a drug-free workplace for the contractor's employees; (ii) post in conspicuous places, available to employees and applicants for employment, a statement notifying employees that the unlawful manufacture, sale, distribution, dispensation, possession, or use of a controlled substance or marijuana is prohibited in the Contractor's workplace and specifying the actions that will be taken against employees for violations of such prohibition; (iii) state in all solicitations or advertisements for employees placed by or on behalf of the Contractor that the Contractor maintains a drug-free workplace; and (iv) include the provisions of the foregoing clauses in every subcontract or purchase order of over \$10,000, so that the provisions will be binding upon each subcontractor or vendor.

For the purposes of this Article 4.21, "drug-free workplace" means a site for the performance of Work done in connection with this Contract where Contractor's employees are prohibited from engaging in the unlawful manufacture, sale, distribution, dispensation, possession or use of any controlled substance or marijuana during the performance of the Contract.

4.22 CONTRACT SECURITY

- 4.22.1 The Contractor shall deliver to the Owner, within ten (10) working days from Notice of Award, two (2) originals of a Performance Bond and a separate Labor and Material Payment Bond, in a form acceptable to the Owner, and each in an amount required by the Contract Documents and the Virginia Public Procurement Act, as security for the faithful performance of the Contract, and the payment of all persons performing labor and furnishing materials in connection with this Contract. The City will not issue Notice to Proceed until the bonds are received. The amount of the Performance and Payment Bonds shall be increased to the same extent the Contract Sum is increased due to Modifications. The form of bonds shall be acceptable to the Owner, and the surety shall be such surety company or companies as are acceptable to the Owner and as are authorized to transact business in the Commonwealth of Virginia. The cost of such bonds shall be included in the Contractor's bid amount.
- 4.22.2 The bonds shall irrevocably obligate the Contractor and surety to the full amount of the bonds unless and until all of Contractor's obligations under the Contract Documents have fully been fulfilled.
- 4.22.3 If, at any time, any surety or sureties for any bond relating to the Work becomes insolvent or is determined by the Owner to be unable to adequately secure the interest of the Owner, the Contractor shall, within (30) days after Notice from the Owner to do so, substitute an acceptable bond(s) in such form and sum and with such other sureties as obligors as may be satisfactory to the Owner. The premiums on such bond(s) shall be paid by the Contractor.

ARTICLE 5 SUBCONTRACTORS

5.1 DEFINITIONS

- 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform or supply any of the Work at the site. Subcontractor means a Subcontractor or his authorized representative. The term Subcontractor does not include any separate contractor performing work pursuant to Article 6 or his subcontractors.
- 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform or supply any of the Work at the site. The term Sub-subcontractor includes a Sub-subcontractor or an authorized representative thereof.
- 5.1.3 The A/E will not deal directly with any Subcontractor or Sub-subcontractor or materials supplier. Subcontractor, Sub-subcontractors or material suppliers shall route requests for information or clarification through the Contractor to the A/E, with a copy to the Owner.

5.2 AWARD OF SUBCONTRACT AND OTHER CONTRACTS FOR PORTIONS OF THE WORK

- 5.2.1 The Contractor shall submit to the Owner with a copy to the A/E prior to the award of any subcontract for Work under this Contract and thirty (30) calendar days after the award of this Contract, the names of the suppliers of principal items, systems, materials, and equipment proposed for the Work; the names and addresses, business and emergency phones of the Subcontractors which he proposes to employ under this Contract, as well as such other information as may be requested by the Owner. The Owner will review each Subcontractor and supplier based upon his apparent financial soundness and responsibility, his known or reported performance on previous similar work, and his available plant, equipment and personnel to perform the Work. The Contractor shall not employ a Subcontractor or supplier to whom the Owner reasonably objects. The Owner's objection to a proposed Subcontractor or supplier shall not affect the Contract Sum.
- 5.2.2 The Contractor shall make no substitutions for any Subcontractor, person or entity previously selected unless first submitted to the Owner for review and approval.

5.3 SUBCONTRACTUAL RELATIONS

- 5.3.1 By an appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by the terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities which the Contractor, by these Contract Documents, assumes toward the Owner and the A/E. Said agreement shall preserve and protect the rights of the Owner and the A/E under the Contract Documents with respect to the Work to be performed by the Subcontractor so that the subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the Contractor-Subcontractor agreement, the benefit of all rights, remedies and redress against the Contractor that the Contractor, by these Contracts Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with his Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract, copies of all of the Contract Documents, and identify to the Subcontractor any terms and conditions of the proposed subcontract which may be at variance with the Contract Documents. Each Subcontractor shall similarly make copies of such Contract Documents available to his Sub-subcontractor's. Each subcontract agreement shall insure that all appropriate provisions of the Contract Documents are complied with by the Subcontractor.

5.3.2 The provisions herein regarding the City's reasonable objection to any Subcontractor shall in no way affect the liability of the Contractor to Owner regarding performance of all obligations by or payment of Subcontractors. The City's failure to object to any given Subcontractor shall not relieve the Contractor of his obligation to perform or have performed to the full satisfaction of the Owner all of the work required by this Contract.

5.3.3 Neither this article nor any other provision of the Contract Documents shall be deemed to make the Owner or the Architect a joint venture or partner with the Contractor or to place the Subcontractor and materialmen in privity of contract with the Owner or the Architect.

5.4 QUALIFICATION SUBMITTALS

5.4.1 Specific qualification submittals may be required of the Contractor, Subcontractors, installers and suppliers for certain critical items of the Work. Required qualification submittals are set forth in detail in the Instruction to Bidders and shall be provided, collected and submitted by the Contractor to the A/E with copies to the Owner. All information required of a single Subcontractor, installer or supplier shall be contained in a single, complete submittal. The Contractor shall submit the required qualification information within ten (10) days after receipt of the Owner's request.

5.4.2 The Owner may reject any proposed Subcontractor, installer or supplier, or any qualification submittals related thereto, for the following reasons:

- .1 The Contractor's failure to submit requested information within the specified time; or
- .2 The Contractor's failure to provide all of the requested information; or
- .3 The Contractor's submission of a Subcontractor, installer or supplier, or qualifications thereof, which are unacceptable in the judgment of the Owner.

5.4.3 Should the Owner have reasonable objection to any proposed Subcontractor, installer or supplier, the Contractor shall submit another firm for approval by the Owner at no additional cost to the Owner.

ARTICLE 6 WORK BY OWNER OR BY SEPARATE CONTRACTORS

6.1 OWNER'S RIGHT TO PERFORM WORK AND TO AWARD SEPARATE CONTRACTS

6.1.1 The Owner reserves the right to perform work related to the Project with his own forces, and to award separate contracts in connection with other portions of the Project or other work on the site.

6.1.2 When separate contracts are awarded for different portions of the Project or other work on the site, the term "contractor" in the contract documents in each case shall mean the contractor who executes each separate construction agreement.

6.2 MUTUAL RESPONSIBILITY

6.2.1 The Contractor shall afford other contractors and the Owner reasonable opportunity for the introduction and storage of their materials and equipment and the execution of their work and shall properly connect and coordinate the Work with such other work. The Contractor shall coordinate his Work with the Owner and other contractors and store his apparatus, materials, supplies and equipment in such orderly fashion at the site of the Work as will not unduly interfere with the progress of the Work or the work of any other contractors.

6.2.1.1 If the execution or result of any part of the Work depends upon any work of the Owner or of any separate contractor, the Contractor shall, prior to proceeding with the Work, inspect and promptly report to the

Owner in writing any apparent discrepancies or defects in such work of the Owner or of any separate contractor that render it unsuitable for the proper execution or result of any part of the Work.

6.2.1.2 Failure of the Contractor to so inspect and report shall constitute an acceptance of the Owner's or separate contractor's work as fit and proper to receive the Work, except as to defects which may develop in the Owner's or separate contractor's work after completion of the Work and which the Contractor could not have discovered by its inspection prior to completion of the Work.

6.2.2 Should the Contractor cause damage to the work or property of the Owner or of any separate contractor on the Project, or to other work on the site, or delay or interfere with the Owner's work on ongoing operations or facilities or adjacent facilities or said separate contractor's work, the Contractor shall be liable for the same; and, in the case of another contractor, the Contractor shall attempt to settle said claim with such other contractor prior to such other contractor's institution of litigation or other proceedings against the Contractor.

If such separate contractor sues the Owner on account of any damage, delay or interference caused or alleged to have been so caused by the Contractor, the Owner shall notify the Contractor, who shall defend the Owner in such proceedings at the Contractor's expense. If any judgment or award is entered against the Owner, the Contractor shall satisfy the same and shall reimburse the Owner for all damages, expenses, and other costs that the Owner incurs as a result thereof.

6.2.3 Should Contractor have a dispute with a separate contractor with whom the Owner has contracted regarding damage to the Work or the property of Contractor or to the Work or property of said separate contractor or with regard to any delays or interferences which either Contractor or said separate contractor has caused to the performance of the other's Work, Contractor agrees to attempt to settle such dispute directly with said separate contractor. Contractor agrees that it will not seek to recover from the Owner any damages, costs, expenses (including, but not limited to, attorney's fees) or losses of profit incurred by the Contractor as a result of any damage to the Work or property of the Contractor or for any delay or interference caused or allegedly caused by any separate contractor.

6.3 OWNER'S RIGHT TO CLEAN UP

6.3.1 If a dispute arises between the Contractor and separate contractors as to their responsibility for cleaning up as required by Article 4, Contractor, the Owner may clean up and charge the cost thereof to the contractor responsible as the Owner shall determine to be just.

ARTICLE 7 MISCELLANEOUS PROVISIONS

7.1 GOVERNING LAW

The provisions of this Contract shall be interpreted in accordance with the laws of the Commonwealth of Virginia.

7.2 PROVISIONS REQUIRED BY LAW DEEMED INSERTED

Each and every provision of law and clause required by law to be inserted in this Contract shall be deemed to be inserted herein, and the Contract shall be read and enforced as though it were included herein and if through mistake or otherwise, any such provision is not inserted or is not correctly inserted, then upon the application of either party, the Contract shall forthwith be physically amended to make such insertion.

7.3 SUCCESSORS AND ASSIGNS

The Owner and the Contractor each binds himself, his partners, successors, assigns and legal representatives to the other party hereto and to the partners, successors, assigns and legal representatives of such other party in respect to all covenants, agreements and obligations contained in the Contract Documents. Neither party to the Contract shall assign the Contract or sublet it without the written consent of the other, nor shall the Contractor assign any monies due or to become due to him hereunder, without the previous written consent of the Owner and the Contractor's surety.

In the event the Contractor desires to make an assignment of all or part of the Contract or any monies due or to become due hereunder, the Contractor shall file a copy of consent of surety, together with a copy of the assignment to the Owner and A/E. In the event the Contractor assigns all or any part of the monies due or to become due under this Contract, the instrument of assignment shall state that the right of assignees in and to any monies due to or to become due to Contractor shall be subject to prior liens and claims of all persons, firms and corporations that provided labor services or furnished material and equipment during the performance of the Work. The rights of assignees shall further be subject to the payment of any liens, claims, or amounts due to Federal, state, or local governments.

7.4 RIGHTS AND REMEDIES

- 7.4.1 The duties and obligations imposed by the Contract Documents and the rights and remedies available thereunder shall be in addition to, and not a limitation of, any duties, obligations, rights and remedies otherwise imposed or available by law, not inconsistent with the Contract Documents. No time limitations described in this Contract shall be construed to alter the applicable statutory period of limitations with regard to the enforcement of the obligations of the parties.
- 7.4.2 No action or failure to act by the Owner, A/E or Contractor shall constitute a waiver of any right or duty afforded any of them under the Contract, nor shall any such action or failure to act constitute an approval of or acquiescence in any breach thereunder, except as may be specifically agreed in writing.
- 7.4.3 Contractor agrees that he can be adequately compensated by money damages for any breach of this Contract which may be committed by the Owner and hereby agrees that, no default, act, or omission of the Owner or the A/E, except for failure to make payments as required by the Contract Documents, shall constitute a material breach of the Contract entitling Contractor to cancel or rescind the provisions of this Contract or (unless the Owner shall so consent or direct in writing) to suspend or abandon performance of all or any part of the Work. Contractor hereby waives any and all rights and remedies to which he might otherwise be or become entitled, saving only its right to money damages.

7.5 SEVERABILITY

In the event that any provision of this Contract shall be adjudged or decreed to be invalid, such ruling shall not invalidate the entire agreement but shall pertain only to the provision in question and the remaining provisions shall continue to be valid, binding, and in full force and effect.

7.6 TESTS

- 7.6.1 If the Contract Documents, laws, ordinances, rules, regulations, codes, permits, resolutions or orders of any public authority having jurisdiction require any portion of the Work to be inspected, tested or approved, the Contractor shall give the Owner at least 24 hours notice of its readiness so that the Owner or the A/E or other representatives of the Owner may observe such inspection, testing or approval. The Contractor shall bear all costs of such inspections, tests or approvals conducted by public authorities. Site inspections, tests conducted on site or tests of materials gathered on site, which the Contract requires to be performed by independent testing entities, shall be contracted and paid for by the Contractor. Examples include, but are not limited to, the testing of cast-in-place concrete, foundation materials, soil compaction, pile installations, caisson bearings, and steel framing connections.

- 7.6.2 All materials and workmanship (if not otherwise designated by the specifications) shall be subject to inspection, examination or test by the Owner, A/E, and other representatives of the Owner, at any and all times during the manufacture and/or construction and at any and all places where such manufacture and/or construction are carried on. Special, full-sized and performance tests shall be as described in the specifications. Without additional charge, the Contractor shall furnish promptly all reasonable facilities, labor and materials necessary to make tests safe and convenient.
- 7.6.3 The selection of bureaus, laboratories and/or agencies for the inspection and tests of supplies, materials or equipment shall be subject to the approval of the Owner. Satisfactory documentary evidence, including but not limited to certificates of inspection and certified test reports that the material has passed the required inspection and tests must be furnished to the Owner, with a copy to the A/E, by the Contractor prior to the incorporation of the supplies, materials or equipment into the Work or at such times as to allow for appropriate action by the Owner.
- 7.6.4 Inspection or testing performed exclusively for the Contractor's convenience shall be the sole responsibility of the Contractor. Tests required by Contractor's or Subcontractor's error, omission or non-compliance with the Contract Documents, shall be paid for by the Contractor.
- 7.6.5 It is specifically understood and agreed that an inspection and approval of the materials by the Owner shall not in any way subject the Owner to pay for the said materials or any portion thereof, even though incorporated in the Work, if said materials shall in fact turn out to be unfit to be used in the Work, nor shall such inspection be considered as any waiver of objection to the Work on account of the unsoundness or imperfection of the material used.

ARTICLE 8 CONTRACT TIME

8.1 DEFINITION

- 8.1.1 Unless otherwise provided, the Contract Time is the period of time specified in the Contract Documents for Substantial Completion of the Work as defined herein, including authorized adjustments thereto. The Contractor shall complete his Work within the Contract Time.
- 8.1.2 The date of commencement of the Work is the date established in the Notice to Proceed
- The Contractor shall not commence Work or store materials or equipment on site until written Notice to Proceed is issued or until the Contractor otherwise receives the Owner's written consent. The Contractor shall commence work no later than ten (10) days after the date established in the Notice to Proceed.
- 8.1.3 The date of Substantial Completion of the Work or designated portion thereof is the date determined by Owner when: (1) construction is sufficiently complete, in accordance with the Contract Documents, so the Owner can occupy or utilize the Work or designated portion thereof for the use for which it is intended; and (2) the Contractor has satisfied all other requirements for Substantial Completion which may be set forth in the Contract Documents.
- 8.1.4 The date of Final Completion of the Work is the date determined by the Owner when the Work is totally complete, to include punch list work, in accordance with the Contract Documents and the Owner may fully occupy and utilize the Work for the use for which it is intended.
- 8.1.5 The term "day" as used in the Contract Documents shall mean calendar days unless otherwise specifically designated.

8.2 PROGRESS AND COMPLETION

- 8.2.1 All time limits stated in the Contract Documents, including without limitation the date of Substantial Completion of the Work, are of the essence of the Contract.
- 8.2.2 The Contractor shall begin the Work on the date of commencement as defined herein. He shall carry the Work forward expeditiously with adequate forces and shall achieve Substantial and Final Completion as required by the Contract Documents.
- 8.3 CLAIMS FOR TIME EXTENSIONS**
- 8.3.1 The time during which the Contractor is delayed in the performance of the Work by the acts or omissions of the Owner, the A/E or their employees or agents, acts of God, unusually severe and abnormal climatic conditions, fires, floods, epidemics, quarantine restrictions, strikes, riots, civil commotion or freight embargoes, or other conditions beyond the Contractor's control and which the Contractor could not reasonably have foreseen and provided against, shall be added to the time for completion of the Work (i.e., the Contract Time) stated in the Agreement; however, no claim by the Contractor for an extension of time for delays will be considered unless made in compliance with the requirements of this Article and other provisions of the Contract Documents.
- 8.3.2 The Owner shall not be obligated or liable to the Contractor for, and the Contractor hereby expressly waives any claims against the Owner on account of, any indirect or direct damages, costs or expenses of any nature which the Contractor, its Subcontractors, or Sub-subcontractor's or any other person may incur as a result of (1) any delays, reasonable or unreasonable, foreseeable or unforeseeable, which are either not caused by the acts or omissions of the Owner, its agents or employees or which arise from or out of (or due to) causes not within the control of the Owner, its agents or employees, or (2) any reasonable delay regardless of its cause, it being understood and agreed that the Contractor's sole and exclusive remedy in any such events shall be an extension of the Contract Time, but only as determined in accordance with the provisions of the Contract Documents.
- 8.3.3 The burden of proof to substantiate a claim for an extension of the Contract Time shall rest with the Contractor, including evidence that the cause was beyond his control. It shall be deemed that the Contractor has control over the supply of labor, materials, equipment, methods and techniques of construction and over the Subcontractors, Sub-contractors, and suppliers, unless otherwise specified in the Contract Documents.
- 8.3.4 In the event of changes in the Work, the Contractor must identify any additional time required in the Proposed Change Order. The Owner need not consider any time extensions for changes in the Work not included in the Proposed Change Order.
- 8.3.5 No time extensions will be granted as a result of the Contractor's improper or unreasonable scheduling or for the Contractor's failure to have Shop Drawings, Product Data, Samples or Manuals submitted in ample time for review under a reasonable and agreed upon schedule.
- 8.3.6 Delays by Subcontractors, Sub-subcontractors or suppliers will not be considered justification for a time extension, except for the same valid reasons and conditions enumerated herein.
- 8.3.7 The Contractor acknowledges and agrees that actual delays due to changes, suspension of work or excusable delays, in activities which, according to the Construction Schedule, do not affect the Contract Time will not be considered to have any effect upon the Contract Time and therefore will not be the basis for a time extension.
- 8.3.8 The Contractor acknowledges and agrees that time extensions will be granted only to the extent that: (1) excusable delays exceed the available flexibility in the Contractor's schedule; and (2) Contractor can demonstrate that such excusable delay actually caused, or will cause, delay to the Contractor's schedule that will extend the Contract Time.

- 8.3.9 With respect to Suspensions of Work under Paragraph 3.6, Suspension of Work, herein, the Contractor shall be entitled to an extension of the Contract Time not to exceed the length of time that the Work was suspended (unless as determined under this Article and the other requirements of the Contract Documents that a further extension is justified and warranted) if the claim is submitted in accordance with the requirements of this Article, and if the suspension is not due to any act or omission of the Contractor, any Subcontractor or Sub-subcontractor or any other person or organization for whose acts or omission the Contractor may be liable. The Contractor's claim will be evaluated in accordance with the terms of this Article.
- 8.3.10 The Contractor shall not be entitled to any extension of time for delays resulting from any conditions or other causes unless it shall have given written Notice to the Owner, within seven (7) calendar days following the commencement of each such condition or cause, describing the occurrence, the activities impacted and the probable duration of the delay. The Contractor's complete claim submittal for a time extension shall be submitted no later than twenty (20) calendar days after cessation of the delay or within such other longer period as the Owner may agree in writing to allow.
- 8.3.11 No such extension of time shall be deemed a waiver by the Owner of his right to terminate the Contract for abandonment or delay by the Contractor as herein provided or to relieve the Contractor from full responsibility for performance of his obligations hereunder.

8.4 CHANGE ORDER WORK

- 8.4.1 The Contractor shall make every reasonable effort to perform Change Order work within the Contract Time and in such manner as to have minimum delaying effects on all remaining Work to be performed under the Contract. If, however, the Change Order work results in an unavoidable increase in the time required to complete the Work, an extension of the Contract Time may be granted to the Contractor for the Change Order work. The Contractor's request shall be determined in accordance with the provisions of Article 8.3, Claims for Time Extensions, herein and as follows:
- .1 If the time required for performance of the Change Order work has an unavoidable, direct, delaying effect on the primary sequence of Work activities remaining after rescheduling (e.g., the critical path in CPM type scheduling), the overall Contract Time may be extended by the minimum number of days required for the Change Order work as mutually agreed upon by the Owner and the Contractor;
 - .2 If the time required for performance of the Change Order work does not have an unavoidable direct delaying effect on the primary sequence of Work activities but is ordered by the Owner at a time such that insufficient Contract Time remains for completion of the Change Order work (and any limited number of contingent work activities), the Contract Time may be extended by the minimum number of days required for the Change Order work as mutually agreed upon by the Owner and the Contractor but only for the Change Order work and contingent activities, All other unaffected Work shall be performed within the Contract Time;
 - .3 Failure of the Owner and the Contractor to agree on a Contract Time extension as specified in .1 and .2 above shall not relieve the Contractor from proceeding with and performing the Change Order work promptly, as well as in such manner as to have minimal delaying effects on all remaining Work to be performed under the Contract. Such disagreement shall be resolved as soon as practical by negotiation.

8.5 LIQUIDATED DAMAGES FOR DELAY

- 8.5.1 The damages incurred by the Owner due to the Contractor's failure to complete the Work within required Milestone Dates and the Contract Time, including any extensions thereof, shall be in the amount set forth

in the Construction Agreement, for each consecutive day beyond the Milestone Dates or the Contract Time (Sundays and all holidays included) for which the Contractor shall fail to complete the Work.

8.5.2 The parties hereby agree that the amount of liquidated damages provided in this Contract is neither a penalty nor a forfeiture and is intended to compensate the Owner solely for the Owner's inability to use the Work for its fully intended purpose, and is not intended to, nor does said amount include: (1) any damages, additional or extended costs, incurred by the Owner for extended administration of this Contract, or by the Owner's agents, consultants or independent contractors for extended administration of this Contract, or (2) any additional services, relating to or arising as a result of the delay in the completion of the Work. Owner shall be entitled to claim against Contractor for its actual damages for any damages not specifically included within the liquidated damages as set forth herein. Such damages shall be computed separately, and, together with liquidated damages, either deducted from the Contract Sum or billed to the Contractor, at the option of the Owner.

Contractor agrees that it will not challenge the per diem amounts of liquidated damages imposed pursuant to this Article 8.5 except as to whether Contractor is responsible for the delays, themselves, that have resulted in the assessment of liquidated damages. The Contractor waives any challenge as to the validity of any liquidated damages specified on the grounds that such liquidated damages allegedly are void as penalties or allegedly are not reasonably related to Owner's actual damages.

Owner may, in its sole discretion, deduct from any payments otherwise due Contractor amounts of liquidated damages assessable under this Article 8.5. Owner's failure to deduct liquidated damages assessable under this Article 8.5 from payments to Contractor shall not be deemed a waiver by Owner of any entitlement to such liquidated damages.

8.6 TIME EXTENSIONS FOR WEATHER

8.6.1 The Contract Time will not be extended due to inclement weather conditions that are normal to the general locality of Work site. The time for performance of this Contract includes an allowance for workdays (based on a 5-day workweek) which, according to historical data, may not be suitable for construction work.

.1 The following is the schedule of monthly anticipated normal inclement weather workdays for the Project location and will constitute the base line for monthly weather time extension evaluations.

ANTICIPATED NORMAL INCLEMENT WEATHER WORK-DAYS INCLUDED IN THE CONTRACT TIME OF PERFORMANCE											
JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
7	7	7	7	9	7	7	7	6	6	6	7

8.6.2 The Contractor, in his planning and scheduling of the Work as required by the Contract Documents, shall allow for the normal inclement weather for the locality of the Work site. If the Contractor believes that the progress of the Work has been adversely affected and that it will directly result in a failure to meet Substantial Completion within the Contract Time, by weather conditions above and beyond the amount normally expected, he shall submit a written request to the Owner, with a copy to the A/E, for an extension of time, pursuant to Paragraph 8.3, Claims for Time Extensions.

8.6.3 Such request shall be evaluated by the Owner in accordance with the provisions of the Contract Documents and shall include a comparison of actual weather statistics compiled by City of Lynchburg's Department of Public Works, for the time of year, locality of the particular Work site with the days claimed by the Contractor and the anticipated normal inclement weather as stated in subparagraph 8.6.1.

The normal inclement weather expected has been included in the designated Contract Time for completion. The decision of the Owner shall be final.

- 8.6.4 The Contractor shall not be entitled to any money damages whatsoever for any delays resulting from inclement weather, whether normal or abnormal, foreseeable or unforeseeable. The Contractor and Owner stipulate and agree that, for delays due to weather as determined in 8.6.3, the Contractor's sole relief is a time extension granted in accordance with this Article 8.6, Time Extensions for Weather.

ARTICLE 9 PAYMENTS AND COMPLETION

9.1 *CONTRACT SUM*

- 9.1.1 The Contract Sum is stated in the Construction Agreement and, including authorized adjustments thereto, is the total amount payable by the Owner to the Contractor for the performance of the Work under the Contract Documents. The Contract Sum includes, but is not limited to, the Contractor's profit and general overhead and all costs and expenses of any nature whatsoever (including without limitation taxes, labor, equipment and materials), foreseen or unforeseen, and any increases in said costs and expenses, foreseen or unforeseen, incurred by the Contractor in connection with the performance of the Work, all of which costs and expenses shall be borne solely by the Contractor. The Contractor agrees to assume all increases in costs of any nature whatsoever that may develop during the performance of the Work.

9.2 *SCHEDULE OF VALUES*

- 9.2.1 For Lump Sum Price contracts, before the pre-construction meeting, the Contractor shall submit to the Owner and A/E a schedule of values allocated to the various portions of the Work, prepared on payment forms provided by the Owner and supported by such data to substantiate its accuracy as the Owner may require. This schedule of values, unless rejected by the Owner, shall be used as a basis for the Contractor's Applications for Payment.
- 9.2.2 For Unit Price contracts, the Contractor shall utilize the payment request form provided by the Owner, wherein the schedule of values shall correspond with the individual unit price bid items. When so requested by the Owner, the Contractor shall provide a more detailed cost breakdown of the unit price items.
- 9.2.3 Contractor may include in his schedule of values a line item for "mobilization" which shall include a reasonable amount for mobilization for the Contractor and his Subcontractors. The Contractor shall not front-end load his schedule of values.

9.3 *APPLICATION FOR PAYMENT*

- 9.3.1 The Contractor shall submit to the A/E three (3) originally executed, itemized Applications for Payment (and one (1) copy to the Owner) by the tenth of each month, along with any authorized change orders for that billing cycle. The Applications for Payment shall be notarized, indicate in complete detail all labor and material incorporated in the Work during the month prior to submission, and supported by such data substantiating the Contractor's payment request as the Owner may require. The Applications for Payment shall also contain Contractor's certification that due and payable amounts and bills have been paid by the Contractor for Work for which previous Certificates of Payment were issued and payments received from the Owner.
- 9.3.2 Payment may be made for the value of materials, which are to be incorporated into the finished Work, and which are delivered to and suitably stored and protected on the Work site. The Contractor shall provide releases or paid invoices from the seller of such materials to establish, to the Owner's satisfaction, that the Owner has title to said material. Stored materials shall be in addition to the Work completed and shall be subject to the same retainage provisions as the completed Work. Material once paid for by the Owner

becomes the property of the Owner and may not be removed from the Work site without the Owner's written permission.

- 9.3.3 The requirements for payment for materials stored off-site shall include, but are not limited to, those specified in Paragraph 9.3.2 and the additional requirements hereinafter specified. Material stored off-site under this provision shall be included in the definition of Work, Article 1, Contract Documents.
- 9.3.3.1 The requirements of Paragraph 10.2, Safety of Persons and Property, are fully applicable to materials stored off-site.
- 9.3.3.2 For purposes of administering this provision, the following definitions are provided.
 - a. Material stored NEAR the Work site: A storage location shall be considered near the Work site if it is not more than fifty (50) miles (approximately an one-hours drive) from the Work site.
 - b. Material stored DISTANT from the Work site: Locations beyond the limit of fifty (50) miles shall be considered distant.
- 9.3.3.3 All proposed off-site locations, regardless of whether they are near or distant, shall be approved by the Owner prior to any payment under this Article. The approval process will include an inspection of the proposed storage site, which may or may not coincide with any inspection of materials stored.
- 9.3.3.4 Prior to payment for any material stored off-site, said material shall be inspected to verify that it is properly stored; i.e., segregated, inventoried, identified as the property of the Owner and Contractor, and duly protected as required in Article 10.2, Safety of Persons and Property. This material shall be clearly identified and physically segregated from any other material or stock, in such a manner that it is clear, from casual observation that said material is not a part of any other stock or stored material.
- 9.3.3.5 For materials stored distant to the Work site, the Contractor shall reimburse the Owner for all reasonable costs incurred by the Owner, to include but not limited to salary, transportation, lodging and per diem, for the Owner's or the A/E's employees to travel to and from the storage locations for the purpose of verifying that the material is properly stored. It is anticipated that such trips would occur whenever additional material is claimed for payment and/or at least every six (6) months until the material is delivered to the Work site.
- 9.3.3.6 Except for unusual circumstances, the Contractor will not be required to reimburse the Owner's costs for visits to storage locations near the Work site.
- 9.3.3.7 The Contractor shall hold the Owner harmless from any and all losses, additional costs, direct or indirect damages and/or delays, whatsoever, which may occur as a result of a failure of the Contractor to deliver (or have delivered), in a timely manner, materials (for which payment has been made) to the Work site for installation and incorporation into the Work.
- 9.3.3.8 The Contractor shall provide to the Owner a release of lien or other suitable certification by the seller of the materials, in addition to paid invoices, verifying that the Contractor has valid title to all materials for which payment is requested. The seller, however, shall not be required to waive his rights for recovery against Contractor or any surety if his contract is breached.
- 9.3.4 The Contractor warrants that title to all Work, materials and equipment covered by an Application for Payment will pass to the Owner, either by incorporation in the construction or upon the receipt of payment by the Contractor, whichever occurs first, free and clear of all liens, claims, security interests or encumbrances, hereinafter referred to as "liens". The Contractor further warrants that no Work, materials or equipment covered by an Application for Payment will have been acquired by the Contractor or by any other person performing Work at the site or furnishing materials and equipment for the Work that is

subject to an agreement under which an interest therein or an encumbrance thereon is retained by the seller or otherwise imposed by the Contractor or such other person.

- 9.3.5 The Contractor's Application for Payment shall provide that the payment request attests that all Work for which the request is made has been completed in full according to all the requirements of the Contract Documents. By submitting his Application for Payment, the Contractor also represents that he has no knowledge that any Subcontractors or suppliers have not been fully and timely paid and that, insofar as he knows, the only outstanding items for payment with respect to the Contract are those to be paid from the funds for which application is being made.

9.4 CERTIFICATES FOR PAYMENT

- 9.4.1 The A/E will, within seven (7) calendar days after the receipt of the Contractor's Application for Payment, recommend a Certificate for Payment to the Owner, for such amount as the A/E determines is properly due, with his reasons for any withholding or adjusting a Certificate as provided in Paragraph 9.6, Payments Withheld.

- 9.4.2 After the Certificate for Payment is recommended by the A/E, the Owner will review it and make any changes deemed necessary by the Owner's representative. The recommendation of the Certificate for Payment by the A/E does not waive or limit the Owner's right to reduce the amount of the payment due to the Contractor as determined to be appropriate by the Owner.

- 9.4.3 The recommendation of a Certificate for Payment will constitute a representation by the A/E to the Owner, based on his observations at the site as provided in Article 2, Architect/Engineer, and the data comprising the Application for Payment, that the Work has progressed to the point indicated; that, to the best of his knowledge, information and belief: (1) the quality of the Work is in accordance with the Contract Documents (subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial or Final Completion, to the results of any subsequent tests required by or performed under the Contract Documents, to minor deviations from the Contract Documents correctable prior to completion, and to any specific qualifications stated in his Certificate); and that (2) the Contractor is entitled to payment in the amount certified. However, by recommending a Certificate for Payment, the A/E shall not thereby be deemed to represent that he has made exhaustive or continuous on-site inspections to check the quality or quantity of the Work or that he has reviewed the construction means, methods, techniques, sequences or procedures, or that he has made any examination to ascertain how or for what purpose the Contractor has used the monies previously paid on account of the Contract Sum.

- 9.4.3.1.1 The Application for Payment shall be on a form approved by the City. Payment for stored material delivered but not incorporated in the work will be the invoiced amount only. Stored materials drawdown shall be approved by the Owner. Submit applicable invoices with Application for Payment. Monthly partial payment request shall be submitted in **TRIPLICATE** to Owner's representative for approval by the 25th of the month so that the Owner can approve payment request by the first working day of the next month. Partial payments shall be made on a monthly basis on or before the end of the next month for which the Work was performed, in accordance with the Contract Documents.

- 9.4.3.1.2 The Owner shall pay to the Contractor 95 percent of the total amount due and the Owner shall retain five (5) percent of the amount due until all work has been performed strictly in accordance with the Contract Documents and until such work has been accepted by the Owner.

- 9.5.1 The Owner shall make payment in the manner and within thirty (30) calendar days after receipt of the Certificate of Payment from the A/E based upon the Owner's approval or adjustment of said Certificate. The Contractor shall be paid the amount approved or adjusted by the Owner, less 5% retainage which is

being held to assure faithful performance; provided however, that said retainage is not applicable to Time and Material Change Orders.

- 9.5.1.1 In relation to punch list or other uncompleted Work and in lieu of a portion of the above-specified five-percent 5% retainage, the Owner may, at its sole discretion, elect to retain fixed amounts directly relating to the various items of uncompleted Work. All amounts withheld shall be included in the Final Payment.
- 9.5.2 The Contractor shall, within seven (7) days after receiving payment from the Owner, do one of the following:
 - 9.5.2.1 Pay all Subcontractors for the proportionate share of the total payment received from the Owner for Work performed by each Subcontractor under the Contract; or
 - 9.5.2.2 Notify the Owner and Subcontractor(s), in writing, of his intention to withhold all or part of the Subcontractor's payment with the reason for nonpayment.
- 9.5.3 The Contractor shall make payment to Subcontractors as heretofore specified. Each payment shall reflect the percentage actually retained, if any, from payments to the Contractor on account of such Subcontractor's Work.
- 9.5.4 The Contractor shall provide the Owner with his social security number, if an individual, or his federal identification number, if a corporation, partnership, or other entity.
- 9.5.5 The Contractor shall pay unpaid Subcontractors interest on payments that are not made in accordance with this Article 9.5, Progress Payments. The rate of interest shall be in compliance with the Prompt Payment section of the Virginia Public Procurement Act of the Code of Virginia. The Contractor shall, by an appropriate agreement with each Subcontractor, require each Subcontractor to make payments to his Sub-subcontractors according to all the same requirements as provided in this Article 9.5 Progress Payments.
- 9.5.6 The Owner may, upon written request, furnish to any Subcontractor, if practicable, information regarding the percentages of completion or the amounts applied for by the Contractor and the action taken thereon by the Owner on account of Work done by such Subcontractor.
- 9.5.7 Neither the Owner nor the A/E shall have any obligation to pay or to see to the payment of any monies to any Subcontractor except as may otherwise be required by law.
- 9.5.8 No Certificate for Payment, nor any payment, nor any partial or entire use or occupancy of the Project by the Owner, shall constitute an acceptance of any Work not in accordance with the Contract Documents, nor shall it waive any right or claim by Owner based upon the Work, or any portion of the Work, including Work for which payment has been made, not conforming to the requirements of the Contract Documents.

9.6 PAYMENTS WITHHELD

- 9.6.1 The Owner may withhold the payment in whole or in part, if necessary to reasonably protect the Owner. If the A/E is unable to make representations as provided in subparagraph 9.4.3 and to recommend payment in the amount of the application, he will notify the Owner as provided in subparagraph 9.4.1. If the Contractor and the Owner cannot agree on a revised amount, the Owner will promptly issue a Certificate for Payment for the amount for which he is able to make representations with respect to payment, due for Work performed. The Owner may also decline to certify or make payment because of subsequently discovered evidence or subsequent observations, and the Owner may nullify the whole or any part of any Certificate for Payment previously issued.

- 9.6.2 The Owner may withhold from the Contractor so much of any payment certified by the A/E, as may in the judgment of the Owner be necessary:
- .1 To protect the Owner from loss due to defective work not remedied;
 - .2 To protect the Owner upon receipt of notice of the filing in court or in an arbitration proceeding as may be required in any third party contract, of verified claims of any persons supplying labor or materials for the Work, or other verified third party claims;
 - .3 To protect the Owner upon reasonable evidence that the Work will not be completed for the unpaid balance of the Contract Sum;
 - .4 To protect the Owner upon reasonable evidence that the Work will not be completed within the Contract Time established by this Contract; or
 - .5 To protect the Owner upon the Contractor's failure to properly schedule and coordinate the Work in accordance with or as required by the Contract Documents, or failure to provide progress charts, revisions, updates or other scheduling data as required by the Contract Documents, or upon the Contractor's failure to provide as-built drawings as required herein, or upon Contractor's failure to otherwise substantially or materially comply with the Contract Documents.
- 9.6.3 If required by the Contract Documents, the Contractor shall, concurrent with his submission of the Construction Schedule, submit a practicable and realistic payment schedule showing the dates on which the Contractor will submit each and every Application for Payment and the amount he expects to receive for each and every monthly progress payment. If during the performance of the Work, the Contractor expects to receive an amount for a monthly progress payment larger than that indicated on the payment schedule, the Contractor shall notify the Owner at least thirty (30) days in advance of that payment so that the necessary allocation of funds can be processed. If Contractor fails to submit a practicable and realistic payment schedule, the Contractor's Application for Payment shall be honored only to the extent that the Work is actually performed and that the proportion of payments made to the Contract Sum does not exceed the proportion of the Contract Time expired as of the time of the request.

9.7 FAILURE OF PAYMENT

If the Owner does not make payment to the Contractor within the thirty (30) calendar days after receipt of the Contractor's Application for Payment by the A/E through no fault of Contractor, and the Owner otherwise not being entitled under the Contract Documents or applicable law to withhold payment, then the Contractor may, upon fifteen (15) additional days' written Notice to the Owner and the A/E, stop the Work until payment of the amount owing has been received. In such event, the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, which shall be effected by appropriate Change Order as provided herein.

9.8 SUBSTANTIAL COMPLETION AND GUARANTEE BOND

- 9.8.1 Unless otherwise specified in Article 9.9, Final Completion and Final Payment, when the Contractor considers that the Work, or a designated portion thereof which is acceptable to the Owner, is substantially complete as defined in Article 8, Contract Time, the Contractor shall request in writing that the A/E and the Owner perform a Substantial Completion inspection. Prior to such inspection the Contractor shall:
- .1 If applicable, secure a Certificate of Occupancy for the Project or a designated portion thereof; and
 - .2 Submit five (5) copies each of the Operations and Maintenance Manuals to the A/E as specified and one (1) copy to the Owner.

- 9.8.2 The Owner shall determine whether the Work is substantially complete and shall compile a punch list of items to be completed or corrected. The failure to include any items on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.
- 9.8.3 When the Owner on the basis of his inspection determines that the Work or a designated portion thereof is substantially complete, the A/E will then prepare a Certificate of Substantial Completion which shall establish the Date of Substantial Completion and shall state the responsibilities of the Owner and the Contractor for security, maintenance, heat, utilities, damage to the Work and insurance. The Certificate of Substantial Completion shall be submitted to the Owner and the Contractor for their written acceptance of the responsibilities assigned to them in such Certificate.
- 9.8.4 The Contractor shall have thirty (30) days from the Date of Substantial Completion to complete all items on the punch list to the satisfaction of the Owner. If the Contractor fails to complete all punch list items within the designated time, the Owner shall have the option to correct or conclude any remaining items by utilizing its own forces or by hiring others. The cost of such correction of remaining punch list items by the Owner or others shall be deducted from the final payment to the Contractor, and if the Owner has not retained sufficient funds to cover the cost, Contractor or its surety shall pay the difference within 30 days of a written demand by the Owner to do so.
- 9.8.5 Guarantees and warranties required by the Contract Documents shall commence on the Date of Final Completion of the Work, unless otherwise provided in the Certificate of Substantial or Final Completion, or the Contract Documents. Provided, however, that if Contractor does not complete certain punch list items within the time period, specified in 9.8.4, all warranties and guarantees for such incomplete Punch List items shall become effective upon issuance of final payment for the Work.
- 9.8.5.1 The Contractor shall guarantee for a term of one (1) year from the date of Final Completion or Final Payment, whichever comes later, (unless otherwise provided for in the Certificate(s) of Substantial or Final Completion or the Contract Documents): (1) the quality and stability of all materials equipment and Work; (2) all the Work against defects in materials, equipment or workmanship; and (3) all shrinkage, settlement or other faults of any kind which are attributable to defective materials or workmanship. The Contractor shall remedy at his own expense, when so notified in writing to do so by the Owner, and to the satisfaction of the Owner, the Work or any part thereof that does not conform to any of the warranties and guaranties described in the Contract Documents, or that otherwise does not conform to the requirements of the Contract Documents
- 9.8.5.2 In order to make good the guarantee as herein required, the Contractor shall deposit with the Owner, after Substantial Completion but before Final Payment, a Guarantee Bond(s) issued by a surety licensed to do business in Virginia and otherwise acceptable to the Owner, for the faithful performance of the guarantee. Said Bond(s) shall be for a period of one (1) year from the date the guaranties and warranties commence and in the amount of five percent (5%) of the final gross value of the Contract.
- 9.8.5.3 The Contractor shall complete repairs during the guarantee period, within five (5) working days after the receipt of Notice from the Owner, and if the Contractor shall fail to complete such repairs within the said five (5) working days, the Owner may employ such other person or persons as it may deem proper to make such repairs and pay the expenses thereof out of any sum retained by it, provided nothing herein contained shall limit the liability of the Contractor or his surety to the Owner for non-performance of the Contractor's obligations at any time.

- 9.8.6 The issuance of the Certificate of Substantial Completion does not indicate final acceptance of the Work by the Owner, and the Contractor is not relieved of any responsibility for the Work except as specifically stated in the Certificate of Substantial Completion.
- 9.8.7 Upon Substantial Completion of the Work, or designated portion thereof, and upon application by the Contractor and certification by the A/E, the Owner shall make payment, adjusted for retainage and payments withheld, if any, for such Work or portion thereof, as provided in the Contract Documents.
- 9.8.8 Should the Owner determine that the Work or a designated portion thereof is not substantially complete, he shall provide the Contractor a written Notice stating why the Work or designated portion is not substantially complete. The Contractor shall expeditiously complete the Work and shall re-request in writing that the Owner perform a Substantial Completion inspection.

9.9 FINAL COMPLETION AND FINAL PAYMENT

- 9.9.1 A Certificate of Final Completion shall be issued by the A/E prior to final payment. At the Owner's sole option, this Final Completion Certificate may be issued without a Certificate of Substantial Completion. The Contractor, prior to application for Final Payment and within the time specified for completion of the Work, shall complete all Work, to include punch list items and provide operation and maintenance manuals and as-built data, for the Work, as completed and in place. Said Certificate of Final Completion shall be issued, even if a Certificate of Substantial Completion has been issued previously and temporary authority to operate the Work has been granted.
- 9.9.1.1 The Certificate of Final Completion shall certify that all Work has been completed in accordance with Contract Documents and is ready for use by the Owner.
- 9.9.2 For all projects where Substantial Completion Certificates have been issued for various portions of the Work, at differing times, the Contractor shall request and the Owner shall, prior to final payment, issue a Certificate of Final Completion which certifies that all required Work, including punch list items, has been completed in accordance with the Contract Documents.
- 9.9.3 Neither the final payment nor any remaining retainage shall become due until the Contractor submits to the A/E the following:
- .1 An Application for Payment for all remaining monies due under the -Contract.
 - .2 Consent of surety to final payment;
 - .3 If required by the Owner, other data establishing payment or satisfaction of all such obligations, such as receipts, releases and waivers of claims arising out of the Contract, to the extent and in such form as may be designated by the Owner. If any Subcontractor refuses to furnish waiver of claims satisfactory to the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify Owner against any such claim. If any such claim remains unsatisfied after all payments are made, the Contractor shall refund to the Owner all monies that the latter may be compelled to pay in discharging such claim, including all costs and reasonable attorneys' fees;
 - .4 As-built drawings, operation and maintenance manuals and other project closeout submittals, as required by the Contract Documents;
 - .5 Construction releases as required by the Contract Documents from each property owner on whose property an easement for construction of the Work has been obtained by the Owner, such release to be in the forms to be provided by the Owner. This release is for the purpose of releasing the Owner and the Contractor from liability, claims, and damages arising from construction operations on or adjacent to the easement and includes proper restoration of the property after

construction. It shall be the Contractor's sole responsibility to obtain all such releases and furnish them to the Owner; and

.6 A written certification that:

.1 The Contractor has reviewed the requirements of the Contract Documents,

.2 The Work has been inspected by the Contractor for compliance with all requirements of the Contract Documents,

.3 Pursuant to this inspection, the Contractor certifies and represents that the Work complies in all respects with the requirements of the Contract Documents,

.4 The Contractor further certifies and represents that all equipment and systems have been installed in accordance with the Contract Documents and have been tested in accordance with specification requirements and are operational, and

.5 The Contractor hereby certifies and represents that the Work is complete in all respects and ready for final inspection.

9.9.4 Upon receipt of the documents required in subparagraph 9.9.3 and upon receipt of a final Application for Payment, the A/E and Owner will promptly make a final inspection. When the A/E finds the Work acceptable under the Contract Documents and the Contract fully performed, he will issue within seven (7) days a final Certificate for Payment and a Final Certificate of Completion.

The Certificate of Completion will state that to the best of his knowledge, information and belief, and on the basis of his observations and inspections, the Work has been completed in accordance with the terms and conditions of the Contract Documents and that the entire balance designated in the final Certificate for Payment is due and payable. The final Certificate for Payment will constitute a further representation that the conditions precedent to the Contractor's being entitled to final payment as set forth in Subparagraph 9.9.3 have been fulfilled. The Owner shall review the Certificate of Payment and shall accept it and issue final acceptance, or reject it and notify the Contractor, within ten (10) days. Final payment to the Contractor shall be made within thirty (30) days after final acceptance. All prior estimates and payments, including those relating to Change Order work, shall be subject to correction by this final payment.

9.9.5 The making of Final Payment shall constitute a waiver of all claims by the Owner, except those arising from:

.1 Unsettled claims;

.2 Faulty, defective, or non-conforming Work discovered or appearing after Substantial or Final Completion;

.3 Failure of the Work to comply with the requirements of the Contract Documents;

.4 Terms of any warranties or guarantees required by the Contract Documents; or

.5 Fraud or bad faith committed by the Contractor or any subcontractor or supplier during performance of Work but discovered by Owner after Final Payment.

9.9.6 The acceptance of Final Payment shall constitute a waiver of all claims by the Contractor, except those previously made in writing and so identified by the Contractor, as unsettled at the time of the final Application for Payment. No payment, however, final or otherwise, shall operate to release the

Contractor or his sureties from any obligations under this Contract or the Performance, Payment, or Guarantee Bonds.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

10.1 SAFETY PRECAUTIONS AND PROGRAMS

10.1.1 The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. The requirement applies continuously throughout the Contract performance, until Final Payment is made, and is not limited to regular working hours.

10.2 SAFETY OF PERSONS AND PROPERTY

10.2.1 The Contractor shall take all reasonable precautions for the safety of, and shall provide all reasonable protection to prevent damage, injury or loss to:

- .1 All persons performing any of the Work and all other persons who may be affected thereby;
- .2 All the Work and all materials and equipment to be incorporated therein, whether in storage on or off the site, under the care, custody or control of the Contractor or any of his Subcontractors or Sub-subcontractor's. Machinery, equipment and all hazards shall be guarded or eliminated in accordance with the safety provisions of the Manual of Accident Prevention in Construction published by the Associated General Contractors of America, to the extent that such provisions are not in contravention of applicable law; and
- .3 Other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

10.2.2 The Contractor shall give all notices and comply with all applicable laws, ordinances, codes, rules, regulations, permits, resolutions and lawful orders of any public authority bearing on the safety of persons or property or their protection from damage, injury or loss.

The Contractor shall at all times safely guard the Owner's property from injury or losses in connection with the Contract. Contractor shall at all times safely guard and protect his Work and adjacent property as provided by law and the Contract Documents, from damage. All passageways, guard fences, lights and other facilities required for protection by local authorities or local conditions must be provided and maintained without additional cost to the Owner.

10.2.3 The Contractor shall erect and maintain, as required by existing conditions and progress of the Work, all reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent utilities.

10.2.4 When the use or storage of explosives or other hazardous materials or equipment is necessary for the execution of the Work, the Contractor shall exercise the utmost care and shall carry on such activities under the supervision of properly qualified personnel.

10.2.5 The Contractor is responsible for the proper packing, shipping, handling and storage (including but not limited to shipment or storage at the proper temperature and humidity) of materials and equipment to be incorporated in the Work, so as to insure the preservation of the quality and fitness of the materials and equipment for proper installation and incorporation in the Work, as required by the Contract Documents.

For example, but not by way of limitation, Contractor shall, when necessary, place material and equipment on wooden platforms or other hard and clean surfaces and not on the ground and/or place

such material and equipment under cover or in any appropriate shelter or facility. Stored materials or equipment shall be located so as to facilitate proper inspection. Material and equipment that is delivered crated shall remain crated until ready for installation. Lawns, grass plots or other private property shall not be used for storage purposes without the written permission of the owner or lessee unless otherwise within the terms of the easements obtained by the Owner.

- 10.2.6 In the event of any indirect or direct damage to public or private property referred to in Paragraphs 10.2.1.2 and 10.2.1.3, caused in whole or in part by an act, omission or negligence on the part of the Contractor, any Subcontractor, any Sub-subcontractor, or anyone directly or indirectly employed by any of them or by anyone for whose acts any of them may be liable, the Contractor shall at his own expense and cost promptly remedy and restore such property to a condition equal to or better than existing before such damage was done. The Contractor shall perform such restoration by underpinning, replacing, repairing, rebuilding, replanting, or otherwise restoring as may be required or directed by the Owner, or shall make good such damage in a satisfactory and acceptable manner. In case of failure on the part of the Contractor to promptly restore such property or make good such damage, the Owner may, upon two (2) calendar days written Notice, proceed to repair, replace, rebuild or otherwise restore such property as may be necessary and the cost thereof, or a sum sufficient in the judgment of the Owner to reimburse the owners of property so damaged, will be deducted from any monies due or to become due the Contractor under the Contract. If insufficient monies remain due or will become due to pay such sum, Contractor or its surety shall, within 30 days of receipt of a written demand from Owner to do so, pay Owner such sum.
- 10.2.7 The Contractor shall designate a responsible member of his organization at the site whose duty shall be the prevention of accidents and the protection of material, equipment and other property. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner.
- 10.2.8 The Contractor shall not load or permit any part of the Work to be loaded so as to endanger the safety of any portion of the Work.
- 10.2.9 The Contractor shall give notice in writing at least forty-eight (48) hours before breaking ground, to all persons, Public Utility Companies, owners of property having structures or improvements in proximity to site of the Work, superintendents, inspectors, or those otherwise in charge of property, streets, water pipes, gas pipes, sewer pipes, telephone cables, electric cables, railroads or otherwise, who may be affected by the Contractor's operation, in order that they may remove any obstruction for which they are responsible and have representative(s) on site to see that their property is properly protected. Such notice does not relieve the Contractor of responsibility for any damages and claims. Nor does such notice relieve the Contractor from his responsibility to defend and indemnify the Owner from actions resulting from the Contractor's performance of such work in connection with or arising out of the Contract.
- 10.2.10 The Contractor shall protect all utilities encountered while performing its work, whether indicated on the Contract Drawings or not. The Contractor shall maintain utilities in service until moved or abandoned. The Contractor shall exercise due care when excavating around utilities and shall restore any damaged utilities to the same condition or better as existed prior to starting the Work, at no cost to the Owner. The Contractor shall maintain operating utilities or other services, even if they are shown to be abandoned on the drawings, in service until new facilities are provided, tested and ready for use.
- 10.2.11 The Contractor shall return all improvements on or about the site and adjacent property which are not shown to be altered, removed or otherwise changed to conditions which existed prior to starting the Work.
- 10.2.12 The Contractor shall protect the Work, including but not limited to, the site, stored materials and equipment, excavations, and excavated or stockpiled soil or other material, intended for use in the Work, and shall take all necessary precautions to prevent or minimize damage to same and to prevent

detrimental effect upon his performance or that of his Subcontractors, caused by or due to rain, snow, ice, run-off, floods, temperature, wind, dust, sand and flying debris. For example, but not by way of limitation, Contractor shall, when necessary, utilize temporary dikes, channels or pumping to carry-off, divert or drain water, and shall as necessary tie-down or otherwise secure the Work and employ appropriate covers and screens.

10.3 OBLIGATION OF CONTRACTOR TO ACT IN AN EMERGENCY

10.3.1 In case of an emergency that threatens immediate loss or damage to property and/or safety of life, the Contractor shall act to prevent threatened loss, damage, injury or death. The Contractor shall notify the Owner of the situation and all actions taken immediately thereafter. If the Contractor fails to act and any loss, damage, injury or death occurs that could have been prevented by the Contractor's prompt and immediate action, the Contractor shall be fully liable to the Owner or any other party for all costs, damages, claims, actions, suits, costs of defense, and all other expenses arising therefrom or relating thereto.

10.3.2 Prior to commencing the Work and at all times during the performance of the Work, the Contractor shall provide the Owner two, twenty-four hour (24) emergency phone numbers where his representatives can be contacted at any time.

ARTICLE 11 INSURANCE FOR CONTRACTS

11.1 CONTRACTOR'S INSURANCE

11.1.1 During the term of this Contract, the Contractor shall procure and maintain insurance coverages with insurance companies rated by A. M. Best Company as A – VIII or better. The company(ies) shall be authorized to do business under the laws of the Commonwealth of Virginia and be acceptable to the City of Lynchburg and shall provide the following minimum types of insurance:

- a. **Commercial General Liability Insurance** – This will cover claims for Bodily Injury, Property Damage, Personal and Advertising Injury, Products and Completed Operations, which may arise from operations under the Contract, whether such operations be performed by the Contractor or by any Subcontractor or Independent Contractor, or by anyone directly or indirectly employed by any of them. Such insurance shall include coverages "X", "C" and "U" for explosion, collapse of other structures and underground utilities, as well as Contractual Liability Insurance covering the requirements outlined in the General Conditions. This insurance shall name the City, the City Council and its employees as additional insureds **by endorsement** to the Commercial General Liability policy. Such policy shall not have a restriction on the limits of coverage provided to the City of Lynchburg as an additional insured. The City of Lynchburg shall be entitled to protection up to the full limits of the Contractor's policy regardless of the minimum requirements specified in this Contract. If endorsements to the Commercial General Liability insurance policies cannot be made, then separate policies providing such protection shall be purchased by the Contractor.

1. The Policy shall have the following **minimum** limits:

- \$1,000,000 Each Occurrence Limit
- \$1,000,000 General Aggregate Limit
- \$1,000,000 Personal and Advertising Injury Limit
- \$1,000,000 Products and Completed Operations Aggregate Limit
- \$5,000 Medical Expense Limit

This insurance shall include the following provisions and /or endorsements:

- 1) The General Aggregate limit shall apply on a "per project" and on a "per location" basis;

- 2) Coverage shall apply to all liability arising from all premises and operations conducted by the Contractor, Subcontractors and independent contractors;
- 3) The Contractor agrees that liability arising from Products and Completed Operations will be covered. Such liability coverage will be maintained for two years after completion of the Work.
- 4) The Contractor shall require each of his Subcontractors to procure and maintain Commercial General Liability Insurance of the type specified in these Contract Documents in the minimum amounts required by the Owner and the Contractor (which shall be the amounts required by this paragraph 11.1.1. of Contractor unless otherwise agreed in writing by Owner), during the term of their subcontracts.

b. **Worker's Compensation and Employer's Liability Insurance** for the Contractor's employees engaged in the Work under this Contract, in accordance with statutory requirements of the Commonwealth of Virginia. The Contractor shall require each of his Subcontractors to provide Worker's Compensation and Employer's Liability Insurance for all of the Subcontractor's employees engaged on such subcontracts. If any class of employees engaged on Work under the Contract is not protected under the Worker's Compensation statute, the Contractor shall provide similar protection for these employees in amounts not less than the legal requirements. The amount of Employer's Liability Insurance for the Contractor and each of his Subcontractors shall be not less than:

\$100,000 per employee for Bodily Injury.
\$100,000 per employee for disease
\$500,000 per policy for disease

The Worker's Compensation and Employer's Liability Insurance policy shall include an "all states" or "other states" endorsement.

c. **Commercial Automobile Liability Insurance**, including coverage for owned, hired, non owned and borrowed vehicles used in the work with *minimum* limits of \$1,000,000 Combined Single Limit per occurrence. This insurance shall name the City, the City Council and its employees as additional insureds *by endorsement* to the Commercial Automobile Liability policy. Such policy shall not have a restriction on the limits of coverage provided to the City of Lynchburg as an additional insured. The City of Lynchburg shall be entitled to protection up to the full limits of the Contractor's policy regardless of the minimum requirements specified in this Contract.

d. **Umbrella Liability or Excess Liability** Insurance with the following minimum limits of:

\$5,000,000 Each Occurrence
\$5,000,000 Annual Aggregate

The following policies shall be scheduled as underlying policies:

Commercial General Liability
Commercial Automobile Liability
Employers Liability

This insurance shall name the City, the City Council and its employees as additional insureds *by endorsement* to the Umbrella or Excess Liability policy. Such policy shall not have a restriction on the limits of coverage provided to the City of Lynchburg as an additional insured. The City of Lynchburg shall be entitled to protection up to the full limits of the Contractor's policy regardless of the minimum requirements specified in this Contract.

- 11.1.2 Proof of insurance for each type of coverage listed herein shall be provided within 10 days after issuance of the award letter for the Contract, and no Work shall proceed unless all such insurance is in effect. The Contractor shall not allow any Subcontractor to commence work on his subcontract until all such insurance of the Subcontractor has been so obtained and approved by the Contractor and found to be in accordance with the requirements set forth herein. The Contractor certifies by commencement of the Work that his insurance and that of Subcontractors is in effect and meets the requirements set forth herein.
- 11.1.3 The Contractor shall purchase and maintain required liability and all other insurance as is appropriate for the Work being performed and furnished. The insurance shall provide protection from claims which may arise out of or result from Contractor's performance and furnishing of the Work and Contractor's other obligations under the Contract Documents, whether it is to be performed or furnished by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform or furnish any of the Work, or by anyone for whose acts any of them may be liable:
- a. claims under Worker's Compensation, Employers Liability, disability benefits, and other similar employee benefit acts;
 - b. claims for damages because of bodily injury, occupational sickness or disease, or death of Contractor's employees;
 - c. claims for damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees;
 - d. claims for damages insured by personal injury liability coverage which are sustained: (1) by any person as a result of an offense directly or indirectly related to the employment of such person by Contractor; or (2) by any other person for any other reason;
 - e. claims for damages, other than to the Work itself, because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom; and
 - f. claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance, or use of any motor vehicle.
- 11.1.4 The insurance required to be purchased and maintained by the Contractor shall:
- a. include completed operations insurance;
 - b. with respect to any other insurance coverage written on a claims-made basis, remain in effect for at least 2 years after final payment (and Contractor shall furnish the City and A/E evidence satisfactory to the City of continuation of such insurance at final payment and 1 year thereafter);
 - c. contain a cross liability or severability of interest clause or endorsement. Insurance covering the specified additional insureds shall be primary insurance, and all other insurance carried by the additional insureds shall be excess insurance.
- 11.1.5 All of the aforesaid insurance policies must be endorsed to provide that the insurance company ***shall give 30 days written notice to the City*** if the policies are to be terminated or if any changes are made during the Contract period which will affect in any way the insurance provided pursuant to such policy. Before starting the Work, the Contractor shall provide the City with a copy of each policy that he and each of his Subcontractors is required to carry in accordance with this Article 11, together with receipted bills evidencing proof of premium payment. These policies shall contain endorsements to the policies naming the City of Lynchburg as an additional insured as required.

- 11.1.6 Nothing contained herein shall effect, or shall be deemed to affect, a waiver of the City's sovereign immunity under law.

ARTICLE 12 CHANGES AND MODIFICATIONS IN THE WORK

12.1 CHANGES IN THE WORK

- 12.1.1 The Owner, without invalidating the Contract and without notice to the surety, may order a change to the Work consisting of additions, deletions or other revisions to the general scope of the Contract, or changes in the sequence of the performance of the Work. The Contract Sum and the Contract Time shall be adjusted accordingly. All such changes in the Work shall be authorized by Change Order, Modification, or Change Directive, and all Work involved in a change shall be performed in accordance with the terms and conditions of the Contract Documents. If the Contractor should proceed with a change in the Work upon an oral order, by whomsoever given, it shall constitute a waiver by the Contractor of any claim for an increase in the Contract Sum and/or Contract Time, on account thereof.

12.2 FIELD ORDER

- 12.2.1 A Field Order is a written order to the Contractor signed by the Owner's designated representative, interpreting or clarifying the Contract Documents or directing the Contractor to perform minor changes in the Work. Any work relating to the issuance of a Field Order shall be performed promptly and expeditiously and without additional cost to the Owner and within the Contract Time, unless the Contractor submits a Proposed Change Order, defined below, which is approved by the Owner. Field Orders shall be numbered consecutively by date of issuance by the Owner.

12.3 OWNER CHANGE REQUEST

- 12.3.1 An Owner Change Request is a written request from the Owner to the Contractor that describes a proposed change in the Work. The Contractor is required to submit a complete proposal for the total cost and additional time, if any, necessary to perform the proposed change in the Work. Owner Change Requests shall be numbered consecutively by date of issuance by the Owner.

12.4 CONTRACTOR'S PROPOSED CHANGE ORDER

- 12.4.1 A Contractor's Proposed Change Order is a written request from the Contractor to the Owner requesting a change in the Contract Sum and/or Contract Time. A Contractor's Proposed Change Order is submitted as a proposal in response to an Owner Change Request or as a claim for an increase in the Contract Sum or Contract Time pursuant to the issuance of a Field Order, or as a result of unforeseen circumstances, such as an unknown site conditions.

Change Orders for unforeseen site conditions will only be entertained if the Contractor has not accepted responsibility for the unforeseen site conditions pursuant to other provisions in the Contract Documents. A Contractor's Proposed Change Order must be submitted within twenty (20) calendar days of the issuance of an Owner Change Request or a Field Order or the discovery of an unforeseen circumstance. The Contractor shall not be entitled to any adjustment to the Contract Time or Contract Sum if Contractor fails to comply strictly with the requirements of the preceding sentence. Contractor's Proposed Change Orders shall be numbered consecutively by date of issuance by the Contractor. The Contractor shall also indicate on the Proposed Change Order the number of the Owner Change Request or the Field Order to which it responds. The Contractor understands and agrees to the City's provisions and policy regarding Change Orders as outlined in Article 1, section 1.1.2 of these General Conditions.

- 12.4.2 In the case of unit price items, it is understood and agreed by the Contractor that the estimates of the quantities in unit price items are approximate only and are presented solely for the purpose of comparing bids and may not represent the actual amount of work to be performed. The Contractor, therefore, understands and agrees that the Owner reserves the right to increase, decrease or eliminate entirely the quantity of work to be done under any item. If called upon to do more work under any unit price item named in the Bid Documents, he will perform all such additional work and accept as payment the unit price named in the proposal, subject to the 20% deviation limitations specified in subparagraph 12.4.2.2.
- 12.4.2.1 The Contractor's Proposed Change Order shall be determined by applicable unit prices, if any, as set forth in the Contract.
- 12.4.2.2 However, if changes in quantities are of an item increase the actual work to more than twenty percent (20%) of the original bid quantity for that item, or decrease quantities of that item more than 20% of the original bid quantity for that item, then the Owner or the Contractor shall have the right to request a decrease or an increase in the unit price for the item for quantities greater than 120% or less than 80% of the original bid quantity for that item.
- 12.4.2.3 It shall be understood that such unit prices shall constitute full payment for the extra work performed, including, but not limited to, "general conditions" costs, plant, materials, labor, equipment, overhead, profit, and safety requirements.
- 12.4.3 If no such unit prices are set forth, the Contractor's proposal shall be on a lump sum basis and shall be itemized and segregated by labor, equipment, and materials for the various components of the change in the Work (no aggregate labor total will be acceptable) and shall be accompanied by signed proposals of any Subcontractors who will perform any portion of the change in the Work and of any persons who will furnish materials or equipment for incorporation therein.
- 12.4.3.1 The portion of the proposal relating to labor, whether by the Contractor's forces or the forces of any of its Subcontractors, may include reasonably anticipated gross wages of job site labor, including foremen, who will be directly involved in the change in the Work (for such time as they will be so involved), plus separately identified payroll costs (including premium costs of overtime labor, if overtime is authorized, Social Security, Federal or State unemployment insurance taxes and fringe benefits required by collective bargaining agreements entered into by the Contractor or any such Subcontractor in connection with such labor).
- 12.4.3.2 The portion of the proposal relating to materials may include the reasonably anticipated direct costs to the Contractor or to any of its Subcontractors of materials to be purchased for incorporation in the change in the Work, plus transportation and applicable sales or use taxes.
- 12.4.3.3 The proposal may further include the Contractor's and any of his Subcontractor's reasonably anticipated equipment rental costs, except small hand tools, in connection with the change in the Work.
- 12.4.4 Base Cost is defined as the total of labor, material and equipment rentals as described in subparagraphs 12.4.3.1, 12.4.3.2 and 12.4.3.3. The actual net cost in money to the Owner for the change in the Work shall be computed as follows:
- .1 If the Contractor performs the change in the Work without use of Subcontractors or sub-subcontractors, his compensation will be the Base Costs as described above, plus a maximum mark-up of 12% for overhead and profit.
 - .2 If the work is performed by a bona fide Subcontractor, the Subcontractor's compensation will be the Base Costs as described above plus a maximum mark-up of 12% for overhead and profit. The

Contractor's compensation will be a maximum mark-up of 6% of the Subcontractors Base Costs for his overhead and profit.

.3 If the Work is performed by a bona fide Sub-subcontractor, the Subcontractor's compensation will be the Base Costs as herein described, plus a maximum mark-up of 12% for overhead profits. The mark-up of any Sub-subcontractor's work by the Contractor and all intervening tiers of Subcontractors shall not exceed a total of 6%.

12.4.5 The mark-up on the cost of labor, materials, and equipment described in Paragraphs 12.4.4.1, 12.4.4.2, and 12.4.4.3 shall be all the compensation to which the Contractor, Subcontractors and Sub-subcontractor are entitled for all indirect costs associated with or relating to the change in the Work including, but not limited to, labor and/or equipment inefficiency, changes in sequence, delays, interferences, impact on unchanged work, gross receipts tax, superintendent, small tools, reproduction, administration, insurance, unrelated safety requirements, temporary structures and offices, all other general and administrative, home office and field office expenses.

12.4.6 The Proposed Change Order may also include the cost of increases in premiums for the Payment Bond and the Performance Bond, provided coverage for the cost of the change in Work results in such increased costs. At the Owner's request, the Contractor shall provide proof of his notification to the surety of the change in the Work and of the surety's agreement to include such change in its coverage. The cost of the increase in premiums shall not be marked up.

12.4.7 In the event that it is necessary to increase the Contract Time in order to perform the change in the Work, the Contractor shall provide an estimate of the increase in the Contract Time as part of the Proposed Change Order. The Contractor's request for a time extension shall be evaluated in accordance with the criteria described in Article 8.3, Claims for Time Extensions.

12.4.8 If the Contractor's Proposed Change Order is rejected by the Owner as being within the scope of the Work required by the Contract Documents, the Owner may, at its sole option and discretion, direct the Contractor to perform the Work which is the subject of the said Proposed Change Order, with claimed compensation to be accounted for pursuant to 12.6 and to be subject to the procedures of Article 13. The Contractor shall then promptly proceed with said Work. Nothing herein shall excuse the timely performance by the Contractor of the Work because any Proposed Change Order is pending.

12.5 CHANGE ORDER

12.5.1 A Change Order is a written order to the Contractor signed by the Owner, issued after execution of the Contract, authorizing a change in the Work or an adjustment in the Contract Sum and/or the Contract Time. The Contract Sum and the Contract Time may be changed only by Change Order. A Change Order signed by the Contractor indicates his agreement therewith, including the adjustment in the Contract Sum and/or the Contract Time. Change Orders shall be numbered consecutively by date of issuance by the Owner and shall, if applicable, indicate the number of the Field Order(s), Request for Proposal(s) and/or Proposed Change Order(s) to which they relate.

12.5.1.1 If the Owner determines that the Contractor's Proposed Change Order, submitted pursuant to Article 12.4 for a change in the Contract Sum or Contract Time, is acceptable, the Owner shall prepare and issue a Change Order which will authorize the Contractor to proceed with the change in the Work with the adjustment to Contract Sum and Contract Time stated in the Proposed Change Order, or as otherwise may be agreed upon by the parties. The amounts stated in the Change Order for the adjustment to Contract Sum and Contract Time for the change in the Work shall be binding on the parties.

- 12.5.2 After issuance of the Change Order, the Contractor shall ensure that the amount of the Performance and Payment Bond coverage has been revised to reflect the increase in the Contract Sum due to the Change Order. Notwithstanding the foregoing, Contractor's failure to do so shall not release any surety from its obligations under any bonds.

12.6 CHANGE DIRECTIVE

- 12.6.1 If Owner and Contractor cannot agree as to whether something constitutes a change to the Work originally contemplated by the Contract Documents, or if they cannot agree as to the adjustment to the Contract Sum or Contract Time required for what Owner acknowledges to be a change to the Work constituting Extra Work, Owner may, in his sole discretion, issue a written Change Directive directing Contractor to perform such work. Contractor shall then promptly proceed with the work at issue. Owner may elect, in its sole discretion, to have the compensation or claimed compensation for such work accounted for on either a time and material basis or lump sum basis as described in 12.6.2 and 12.6.3.
- 12.6.2 If Owner elects to have the compensation and/or claimed compensation accounted for on a time and materials basis, the following procedures apply:
- 12.6.2.1 Change Directive work, the compensation or claimed compensation for which is being accounted for on a time and material basis shall be performed, whether by the Contractor's forces or the forces of any of its Subcontractors' or Sub-subcontractors', at actual cost to the entity performing the Work (without any charge for administration, clerical expense, supervision or superintendent of any nature whatsoever). The percent mark-ups for the Contractor, Subcontractors and Sub-subcontractor's shall be as described in subparagraphs 12.4.4 and 12.4.5.
 - 12.6.2.2 Prior to starting the Change Directive work on a time and material basis, the Contractor shall notify the Owner in writing as to what labor, materials, equipment or rentals are to be used for the change or claimed change in the Work. During performance, the Contractor shall submit to the Owner daily time and material tickets, which shall list the categories and amounts of labor and equipment for which Change Directive compensation is to be charged for the previous work day. Such tickets shall specifically include the following information: location and description of the change in the Work, the classification of labor employed, including names and social security numbers of laborers, labor trades used, man hours, wage rates, insurance, taxes and fringe benefits, equipment and materials suppliers' quotations with detailed break-out and pricing, rental equipment hours and rates, and materials quantities and unit prices and such other evidence of cost as the Owner may require.
 - 12.6.2.3 The Contractor shall commence submission of daily time and material tickets immediately upon commencement of the Change Directive work and continue to submit them until completion of the Change Directive work. The Owner may require authentication of all time and material tickets and invoices by persons designated by the Owner for such purpose.
 - 12.6.2.4 No payment will be made to the Contractor for any portion of the Change Directive work that Owner acknowledges to be Extra Work unless and until such daily time and material tickets and invoices are submitted. The submission of any such ticket or invoice shall not constitute an acknowledgment by the Owner that the items thereon were reasonably required for the Change Directive work.
 - 12.6.2.5 For any work performed on a time and material basis, the Contractor shall submit its complete submission of the reasonable actual cost and time to perform the change in

the Work within twenty (20) days after such Work has been completed. If Change Directive work includes both Work that Owner acknowledges to be Extra Work and work that Owner disputes to be Extra Work, Contractor shall clearly segregate its accounting for the two. The Owner shall review the costs and time submitted by the Contractor on the basis of reasonable expenditures and savings of those performing the Change Directive work. If such costs and time are acceptable to the Owner, or if the parties otherwise agree to the actual reasonable cost to perform the Change Directive work, a Change Order will be issued for the cost and time agreed upon. The amounts stated in the Change Order for the cost and time to perform the Change Directive work shall be binding upon the parties.

- 12.6.3 If Owner elects to have the compensation or claimed compensation accounted for on a lump sum basis, Owner may make a unilateral determination of a reasonable adjustment in Contract Sum and Contract Time due to the Change Directive. Any unresolved dispute about the reasonableness of Owner's unilateral determination shall be subject to Article 13, Claims and Dispute Procedure.

12.7 DECREASES AND WORK NOT PERFORMED (Deductive Change Orders)

- 12.7.1 Should it be deemed expedient by the Owner to decrease the dimensions, quantity of material or Work, or vary in any other way the Work required by the Contract Documents, the Owner may direct by written Change Order, such decreases to be made or performed without in any way affecting the validity of the Contract. The Contractor shall comply with the Change Order from the Owner. The difference in expense occasioned by such decrease shall be deducted from the amount payable under this Contract.

- 12.7.2 When Work is deleted from the Contract by Owner, the amounts to be credited to the Owner shall reflect the same current pricing as if the Work were being added to the Contract at the time the deletion is ordered, and Contractor shall provide documentation for a credit as specified in Article 12.5.4. If such deleted materials and equipment shall have already been purchased and stored on site and cannot be used in other projects, cannot be returned for credit or cannot be returned for credit at the price paid by the Contractor at the time of purchase, the Contractor shall be entitled, upon proper documentation and certification, to an adjustment in the pricing of the credit to avoid hardship to the Contractor. If necessary in order to establish such reasonable value, the Contractor may be required to submit a detailed breakdown of his original bid and all documents upon which Contractor's bid was based for the items or Work involved.

- 12.7.3 If Work is not performed, and such deletion of Work was not directed or approved by the Owner, the Owner shall ascertain the amount of the credit due.

12.8 CHANGES IN LINE AND GRADE

- 12.8.1 The Owner reserves the right to make such alterations in the line and grade of various structures or pipe lines shown on the drawings, as may be necessitated by conditions found during construction or that in the judgment of the Owner appears advisable. Such alterations shall in no way affect the validity of the Contract

12.8.1.1 In case of a unit price contract, if such changes increase the amount of the Work or materials, the Contractor will be paid according to the quantity of Work actually done at the prices established for such Work under the Contract.

12.8.1.2 In case of a lump sum contract, the price for the Work shall be determined as specified in Article 12.4, Proposed Change Order.

12.9 SUBSURFACE CONDITIONS FOUND DIFFERENT

12.9.1 Should the Contractor encounter subsurface and/or latent conditions at the site materially differing from those shown on the drawings or indicated in the specifications, he shall immediately give Notice to the Owner of such conditions before they are disturbed. The Owner shall thereupon promptly investigate the conditions and if he finds that they materially differ from those shown on the drawings or indicated in the specifications, he shall at once make such changes in the drawings and/or specifications as he may find necessary. Any increase or decrease of cost resulting from such changes shall be adjusted in the manner provided herein for adjustments as to extra and/or additional work and changes. Notwithstanding the foregoing, if the Contract Documents indicate elsewhere that excavation is to be on an unclassified basis, Contractor shall not be entitled to any adjustment to the Contract Sum or Contract Time based upon this 12.9.

12.10 OTHER CLAIMS

If the Contractor claims that additional cost or time is involved because of, but not limited to, (1) any written interpretation pursuant to Article 2, Architect/Engineer, (2) any order by the Owner to stop the Work pursuant to Article 3, Owner, where the Contractor was not at fault, (3) failure of payment by the Owner pursuant to Article 9 Payments and Completion, or (4) any written order for a minor change in the Work issued pursuant to Article 12.8, Changes in Line and Grades, the Contractor shall make such claim as provided in Section 12, Changes and Modification in the Work, and Article 13, Claims and Dispute Procedure.

ARTICLE 13 CLAIMS AND DISPUTE PROCEDURE

Any Claims by the Contractor arising under or relating to the Contract or the Contract Documents shall only be resolved as follows:

13.1. INITIAL NOTICE, SUBMISSION OF CLAIM, AND CONSIDERATION.

- a. The Contractor shall give the Owner and the A/E written notice of any Claim within ten (10) days of the beginning of the occurrence of the event leading to the Claim. The written notice shall be a document from the Contractor addressed to the Owner's and A/E's officials or employees designated by the Contract Documents to receive such notice, or if no one is so designated, to the Owner's City Manager and to the A/E. The written notice shall clearly state the Contractor's intention to make a claim, shall describe the occurrence involved, and shall be transmitted in a manner to ensure receipt by the Owner and A/E within the ten (10) days. The Contractor shall submit the Claim and any supporting data to the Owner and A/E within thirty (30) days after the occurrence giving rise to the Claim ends. The burden shall be on the Contractor to substantiate that it has given written notice and submitted its Claim in accordance with this provision.
- b. The Claim must (i) be certified under oath as true and correct by a principal of Contractor; (ii) must be for specific relief; (iii) if any money is sought, must specify the dollar amount sought; and (iv) must contain sufficient supporting documentation to reasonably allow its consideration, including without limitation, any documentation required by the Contract Documents. The burden shall be on the Contractor to substantiate the Claim.
- c. The Contractor shall comply with all other terms and conditions of the Contract Documents, including without limitation, those in Articles 8 and 12, as applicable. No decision by the A/E on a claim shall be binding on the Owner, but such decision shall have whatever effect on the Contractor that the Contract Documents provide.
- d. Following consideration by the A/E, and following initial, informal consideration by the Owner's City Manager or his designee, the parties shall endeavor to resolve any Claim through direct

negotiations, and if such direct negotiations fail, and if the Owner requests, by non-binding mediation conducted pursuant to the Rules of the American Arbitration Association, with the site of the mediation being Lynchburg, Virginia.

- e. Should the Claim remain unresolved for more than 60 days after it is submitted, then the City Manager or his designee shall, within no later than 90 days after the Claim's submission, render a written decision on the Claim on behalf of the Owner . The Contractor may not institute any legal action with respect to the Claim until after the City Manager or his designee renders his written decision or 90 days from its receipt by the City Manager has passed, whichever comes first. The only effect of the failure by the City Manager or his designee to render a decision within this 90-day period is to allow the Contractor to institute a legal action pursuant to this provision without having to wait for a decision on the Claim concerned.

13.2 APPEAL OF DENIAL OF CLAIM.

- a. If the Owner denies in whole or part a Claim by Contractor or more than 90 days have passed since the Claim was received by the City Manager but no written decision has been issued, the Contractor may appeal denial of the claim by instituting an action in the Lynchburg Circuit Court, Lynchburg, Virginia, or if the subject or amount in controversy is within its jurisdiction, the Lynchburg General District Court, Lynchburg, Virginia, and may thereafter pursue all available appeals in Virginia state courts, to the extent they have jurisdiction.
- b. The Contractor must initiate its appeal of the Claim within 180 days of the date it first has the right to do so or the Claim will be barred and the Owner's decision will be binding and conclusive.
- c. The Contractor may not amend its Claim on appeal to increase the amount of money sought.
- d. In the event of any Claim arising, Contractor shall continue its performance diligently during such Claim's pendency and thereafter as if no Claim had arisen. During the pendency of any Claim in connection with the payments of moneys, Contractor shall be entitled to receive payments for non-disputed items, subject to any right of set-off by Owner.

13.3 Notwithstanding anything in the Contract Documents to the contrary, the Owner may, in its discretion, assert a Claim without first resorting to any procedures contained in the Contract Documents.

13.4 "Claim" means a "claim" as defined in the Lynchburg Public Procurement Code.

13.5 Notwithstanding anything in the Contract Documents to the contrary, Owner shall not be liable to Contractor for any damages or increase in the Contract Sum due to delays to Contractor, any Subcontractor, or any other person except due to extent required by Virginia Code § 2.2-4335.

ARTICLE 14 UNCOVERING AND CORRECTION OF WORK

14.1 UNCOVERING OF WORK

14.1.1 If any portion of the Work should be covered contrary to: (1) the request of the A/E or Owner; (2) requirements specifically expressed in the Contract Documents; or (3) the requirements of applicable permits, it must, if required in writing by the Owner, be uncovered for the Owner's and A/E's observation and shall be replaced at the Contractor's expense.

14.1.2 If any other portion of the Work has been covered which the Owner has not specifically requested to observe prior to being covered, the Owner may request to see such Work and it shall be uncovered by the Contractor. If such Work be found in accordance with the Contract Documents, the cost of uncovering and replacement shall, by appropriate Change Order, be charged to the Owner. If such

Work be found not in accordance with the Contract Documents, the Contractor shall pay such costs unless it is found that this condition was caused solely by the Owner, in which event the Owner shall be responsible for the payment of such costs. If such Work be found not in accordance with the Contract Documents and the condition was caused by a separate contractor, Contractor may proceed against said separate contractor as provided in Article 6, Work by Owner or by Separate Contractors.

14.2 WARRANTY AND CORRECTION OF WORK

- 14.2.1 The Contractor guarantees and warrants to the Owner all Work as follows:
- .1 That all materials and equipment furnished under this Contract will be new and the best of its respective kind unless otherwise specified;
 - .2 That all Work will be of first-class quality and free of omissions and faulty, imperfect or defective material or workmanship;
 - .3 That the Work shall be entirely watertight and leakproof in accordance with all applicable industry customs and practices, and shall be free of shrinkage and settlement which are attributable to defective materials or workmanship;
 - .4 That the Work, including but not limited to, mechanical and electrical machines, devices and equipment shall be fit and fully usable for its intended and specified purpose and shall operate satisfactorily with ordinary care;
 - .5 That consistent with requirements of the Contract Documents the Work shall be installed and oriented in such a manner as to facilitate unrestricted access for the operation and maintenance of fixed equipment; and
 - .6 That the Work will be free of abnormal or unusual deterioration which occurs because of poor quality materials or workmanship.
- 14.2.2 All Work not conforming to guarantees and warranties specified in the Contract Documents, including substitutions not properly submitted and accepted, may be considered defective. If required by the Owner, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment furnished and installed.
- 14.2.3 The Contractor shall within five (5) working days after receipt of written Notice from the Owner during the performance of the Work, reconstruct, replace or correct all Work rejected by the A/E or Owner as defective, as failing to conform to the Contract Documents, or as not in accordance with the guarantees and warranties specified in the Contract Documents, whether observed before or after Substantial Completion and whether or not fabricated, installed or completed. The Contractor shall bear all costs of reconstructing, replacing or correcting such rejected Work, including compensation for the A/E's additional services made necessary thereby.
- 14.2.4 If, within one (1) year after the Date of Final Completion of the Work or designated portion thereof or within one (1) year after acceptance by the Owner of designated equipment or within such longer period of time as may be prescribed by law or by the terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be defective, not in accordance with the Contract Documents, or not in accordance with the guarantees and warranties specified in the Contract Documents, the Contractor shall correct it within five (5) working days after receipt of a written Notice from the Owner to do so unless the Owner has previously given the Contractor a written acceptance of such condition pursuant to 14.3, Acceptance of Faulty, Defective or Non-Conforming Work. This obligation shall survive termination of the Contract. The Owner shall give such Notice within a reasonable time after discovery of the condition.

- 14.2.5 Subject to limitation as prescribed by law, if at any time deficiencies in the Work are discovered which are found to have resulted from fraud or misrepresentation, or an intent or attempt to defraud the Owner by the Contractor, any Subcontractor or supplier, the Contractor will be liable for replacement or correction of such Work and any damages which Owner has incurred related thereto, regardless of the time limit of any guarantee or warranty.
- 14.2.6 Any materials or other portions of the Work, installed, furnished or stored on site which are not of the character or quality required by the specifications, or are otherwise not acceptable to the Owner, shall be immediately removed and replaced by the Contractor to the satisfaction of the Owner, when notified to do so by the Owner.
- 14.2.7 If the Contractor fails to correct defective or nonconforming Work as required by Articles 13.2.3 and 13.2.4, or if the Contractor fails to remove defective or nonconforming Work from the site, as required by Article 13.2.6, the Owner may elect to either correct such Work in accordance with Article 3.5, Owner's Right to Carry Out the Work, or remove and store materials and equipment at the expense of the Contractor. If the Contractor does not pay the cost of such removal and storage within ten (10) days thereafter, the Owner may, upon ten additional days written Notice, sell such Work at auction or at public or private sale and shall account for the net proceeds thereof, after deducting the costs of the sale and all of the costs that should have been borne by the Contractor, including compensation for the A/E's additional services made necessary thereby. If such proceeds of sale do not cover all costs indicated in the previous sentence, the difference shall be charged to the Contractor and an appropriate Change Order shall be issued. If the payments then or thereafter due the Contractor are not sufficient to cover such amount, the Contractor or its surety shall pay the difference to the Owner.
- 14.2.8 The Contractor shall bear the cost of making good all work of the Owner, separate contractors or others, destroyed or damaged by such correction or removal required under this Article.

14.3 ACCEPTANCE OF FAULTY, DEFECTIVE OR NON-CONFORMING WORK

If the Owner prefers to accept faulty, defective or nonconforming Work, he may do so instead of requiring its removal and correction, in which case a Change Order will be issued at Owner's option, to reflect a reduction in the Contract Sum in an amount to be determined by the Owner.

ARTICLE 15 TERMINATION OF THE CONTRACT

15.1 CONTRACTOR'S RIGHT TO STOP WORK OR TERMINATE CONTRACT

If the Work should be stopped under an order of any court or other public authority for a period of ninety (90) days through no fault of the Contractor or anyone providing services, materials or equipment through him, or if the Owner should fail to pay to the Contractor within thirty (30) days any sum for which a Certificate of Payment has been certified when no dispute exists as to the sum due and Owner has no right to withhold payment under any provision of the Contract Documents, then the Contractor may, upon ten (10) days written Notice to the Owner, stop Work or terminate the Contract and recover from the Owner payment for the cost of the Work actually performed, together with overhead and profit thereon, but profit on the Work performed shall be recovered only to the extent that the Contractor can demonstrate that he would have had profit on the entire Contract if he had completed the Work. The Contractor may not receive profit or any other type of compensation for parts of the Work not performed. The Contractor may recover the reasonable cost of physically closing down the Site, but no other costs of termination. The Owner may offset any claims it may have against the Contractor against the amounts due to the Contractor. In no event shall termination of the Contract by the Contractor terminate the obligations of the Contractor's surety on its payment and performance bonds.

15.2 OWNER'S RIGHT TO TERMINATE CONTRACT FOR CAUSE

- 15.2.1 The Owner may terminate the Contract for cause based upon any of the following grounds:
- 15.2.1.1 If the Contractor should be adjudged as bankrupt, or if he should make a general assignment for the benefit of his creditors, or if a receiver should be appointed on account of his insolvency.
 - 15.2.1.2 If the Contractor should refuse or should repeatedly fail, except in cases for which extension of time is provided, to supply enough properly skilled workmen or proper materials and equipment.
 - 15.2.1.3 If the Contractor should fail to make prompt payment to subcontractors or suppliers of material of labor.
 - 15.2.1.4 If the Contractor should disregard laws, ordinances, codes, regulations, or the written instructions of the Architect/Engineer or the Owner.
 - 15.2.1.5 If the Contractor be in substantial violation of any provision of the Contract Documents.
- 15.2.2 For termination for cause based upon the grounds in 15.2.1.1, Owner may terminate without prior notice and without giving Contractor any opportunity to rectify the basis for termination. For termination for cause based upon any other grounds, prior to termination of the Contract, the Owner shall give the Contractor and his surety Notice followed by a ten (10) day period during which the Contractor and/or his surety may rectify the basis for the Notice. If rectified to the satisfaction of the Owner within said ten (10) days, the Owner may rescind its notice of termination. If not, the termination for cause shall become effective at the end of the ten (10) day notice period. Notwithstanding the foregoing, the Owner may, in writing, postpone the effective date of the termination for cause, at its sole discretion, if it should receive reassurances from the Contractor and/or his surety that the basis for the termination will be remedied within a time and in a manner which the Owner finds acceptable. If at any time after such postponement, the Owner determines that Contractor and/or his surety has not or is not likely to rectify the causes of termination in an acceptable manner or within the time allowed, then the Owner may immediately terminate the Contract for cause, without the necessity of allowing any further opportunity by the Contractor and/or surety to rectify the basis for the Notice, by notifying the Contractor and his surety in writing of the termination. In no event shall termination for cause terminate the obligations of the Contractor's surety on its payment and performance bonds.
- 15.2.3 Upon termination of the Contract, the Contractor shall immediately cease Work, and the Owner may take possession of the site and of all materials, tools and equipment thereon and finish the Work by whatever method he may deem expedient. In such case, the Contractor shall not be entitled to receive any further payment until the Owner has finally completed the Work through its own resources or those of a subsequent contractor. If the Owner's damages, including the expense of finishing the Work, compensation for additional design, managerial and administrative services, any liquidated damages, and any claims by the Owner, shall exceed the unpaid balance of the Contract Sum, the Contractor shall pay the difference to the Owner, together with any other expenses of terminating the Contract and having it completed by others. If the unpaid balance of the Contract Sum exceeds Owner's damages, including the costs of finishing the Work, compensation for additional design, managerial and administrative services, any liquidated damages and any claims by Owner, together with any other expenses of terminating the Contract and having it completed by others, such excess shall be paid to the Contractor.
- 15.2.4 If it should be judicially determined that the Owner improperly terminated this Contract for cause, then the termination shall be deemed to be a termination for the convenience of the Owner, with Contractor's recovery limited to what is allowed for a termination for convenience under the Contract Documents.

15.2.5 Termination of the Contract under this Section is without prejudice to any other right or remedy of the Owner.

15.3 OWNER'S RIGHT TO TERMINATE CONTRACT FOR CONVENIENCE

15.3.1 Owner may terminate this Contract, in whole or in part, at any time without cause upon giving the Contractor written Notice of such termination. Upon such termination, the Contractor shall immediately cease Work and remove from the site all of its labor forces and such of its materials and equipment as Owner elects not to purchase or to assume in the manner hereinafter provided. Upon such termination, the Contractor shall take such steps as Owner may require to assign to the Owner the Contractor's interest in all subcontracts and purchase orders designated by Owner. After all such steps have been taken to Owner's satisfaction, the Contractor shall receive as full compensation for termination and assignment the following:

- (2) Amounts due for Work performed in accordance with the Contract through the date of termination.
- (3) Reasonable compensation for the actual cost of demobilization incurred by the Contractor as a direct result of such termination. The Contractor shall not be entitled to any compensation or damages for lost profits or for any other type of contractual compensation or damages other than those provided by the preceding sentence. Upon payment of the foregoing, Owner shall have no further obligations to Contractor of any nature.

15.3.2 In no event shall termination for the convenience of the Owner terminate the obligations of the Contractor's surety on its payment and performance bonds.

15.3.3 After receipt of a Notice of termination, the Contractor shall promptly submit to the Owner his termination claim. Such claim shall be submitted no later than forty-five (45) days from the effective date of termination. Upon failure of the Contractor to submit his termination claim within the time allowed, the Owner may determine, on the basis of information available to it, the amount, if any, due to the Contractor by reason of the termination.

15.4 CONTRACTOR'S RESPONSIBILITIES UPON TERMINATION

15.4.1 After receipt of a notice of termination pursuant to 15.3, Owner's Right to Terminate Contract for Convenience, the Contractor shall mitigate any damages to the extent reasonably possible.

15.4.2 In addition to the provisions of 15.4.1, the Contractor shall:

- .1 At the option of the Owner, assign to the Owner, in the manner, at the time, and to the extent directed by the Owner, all of the right, title, and interest of the Contractor under the orders and subcontracts so terminated, in which case the Owner shall have the right, in its discretion, to settle or pay any or all claims arising out of the termination of such orders and subcontracts;
- .2 Transfer title and deliver to the Owner in the manner, at the times, and to the extent, if any, directed by the Owner:
 - a) The fabricated or un-fabricated parts, work in process, completed Work, supplies, and other material and equipment procured as a part of, or acquired in connection with the performance of the Work terminated by the Notice of Termination, and
 - b) The completed or partially completed drawings, releases, information, manuals and other property which, if the Contract had been completed, would have been required to be furnished to the Owner;

- .3 Complete performance of such part of the Work as shall not have been terminated by the Notice of Termination; and
- .4 Take such action as may be necessary, or as the Owner may direct, for the protection and preservation of the property related to this Contract which is in the possession of the Contractor and in which the Owner has or may acquire an interest.

END OF GENERAL CONDITIONS



Geotechnical Investigative Report

on
Miller Center Addition
Wadsworth Street
Lynchburg, Virginia 24504

prepared for
Kay Frazier
City of Lynchburg Parks and Recreation
301 Grove Street
Lynchburg, Virginia 24504

submitted to
Kay Frazier
City of Lynchburg Parks and Recreation
301 Grove Street
Lynchburg, Virginia 24504

reviewed by
J. Kenneth Meritt, P.G., P.E.
Hurt & Proffitt, Inc.
2524 Langhorne Road
Lynchburg, Virginia 24501

date
October 26, 2012





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October 26, 2012

Kay Frazier, Director
City of Lynchburg Parks & Recreation
301 Grove Street
Lynchburg, VA 24501

HURT
PROFFITT
INCORPORATED

Re: Miller Center
Lynchburg, Virginia
Subsurface Geotechnical Investigation
Project No. 20120556

Dear Ms. Frazier:

Hurt & Proffitt, Inc. (H&P) has completed the requested subsurface investigation on the above referenced project. The investigation was initiated to evaluate existing site conditions and provide a geotechnical investigative report.

This investigation encompassed the following scope of services:

1. A total of four (4) standard penetration borings in the areas of the proposed building pad and paving sections.
2. One (1) CBR analysis in accordance with VTM-8 Modified.
3. One (1) standard Proctor analysis in accordance with ASTM D 698.
4. One (1) Atterberg limit analysis in accordance with ASTM D 4318.
5. One (1) washed sieve analysis in accordance with ASTM D 1140.
6. One (1) natural moisture analysis in accordance with ASTM D 2216.
7. Evaluation of ground water levels at the complete of the investigation.
8. Geotechnical investigative report preparation.

H&P appreciates the opportunity to complete this study for you. Should you have any questions in reference to this work or the site, please do not hesitate to contact us.

Sincerely,
Hurt & Proffitt, Inc.

Matthew Peters, E.I.T.
Staff Engineer

J. Kenneth Meritt, P.G., P.E.
Director, Geotechnical and Materials Testing

attachments



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**Miller Center
301 Grove Street
Lynchburg, Virginia**

1.0 PROJECT INFORMATION

Preliminary design plans for the facility expansion includes the following:

1. Three-story masonry addition approximately 500 square feet in area.
2. Retaining wall construction.
3. Repaving existing entrance and replacing existing parking with concrete pavers.
4. Newly paved entrance and parking across Grove Street.

Building Loads:

Maximum Column Load = 20 kips

Maximum Wall Footing Load = 4 k/ft

Elevations:

Addition – Finish Floor Elevation = 773.00'

Retaining Wall – Top of Wall = 776.25'

Bottom of Wall = 772.75

2.0 SUMMARY OF FINDINGS

Prior to constructing the new building facilities, a minimal amount of site work will be required. The majority of the site is open with landscaped vegetation in the proposed addition and retaining wall. Based on the proposed finish grades and because of the sloping terrain, limited cutting and filling of soils will be required to establish final subgrades across the building and parking lot areas. Maximum fill depths and cut excavations are estimated at 4± feet. All fill material should be tested and placed under controlled fill conditions (please refer to the Earthwork and Grading Section on page 4 of this report).

Based on the subsurface conditions encountered during the investigation, standard earth working equipment should be adequate to complete the majority of the on-site excavation operations. No evidence of hard bedrock type conditions was encountered during the investigation.

Ground water was not encountered during the site investigation.

The majority of the on-site soils are residual, meaning the soils have formed in place due to the decomposition of the underlying parent rock. The primary soil types are elastic silt (MH) and silty sand (SM). Based on the Standard Penetration Results and estimated settlements, H&P is recommending that foundations bearing on virgin soils be designed for a net allowable soil bearing capacity of 2,000 psf.

3.0 INVESTIGATIVE PROCEDURES

Subsurface conditions at the Miller Center site were analyzed by completing 4 standard penetration test (SPT) borings. One (1) boring was completed in the area of the proposed building pad with the boring depth terminated to 30.5 feet. Three (3) borings were completed in the areas of the proposed roadways and were each terminated at a depth of 10.5 feet. Please refer to the Boring Location Plan in Appendix B.

The test borings were performed in accordance with generally accepted practices with a trailer-mounted CME 45C rotary drill rig. Continuous flight hollow-stem augers were advanced to pre-selected depths, the center plug removed and a disturbed soil sample recovered with a standard split spoon sampler (1.375-inch I.D., 2.0-inch O.D.) in accordance with ASTM D 1586.



A weight of 140 pounds is freely dropped from a height of 30 inches to drive the sampler into the soil to be sampled; this is known as the Standard Penetration Test (SPT). The number of blows required to drive the sampler three consecutive 6-inch increments is recorded and the blows of the last two increments are added to obtain the Standard Penetration Resistance (N-value). The N-value is a measure of in-situ soils conditions and has been correlated with engineering properties of the soils for design purposes.

Hurt & Proffitt personnel placed soil samples in glass jars and transported them to the laboratory for geotechnical personnel to review and classify in accordance with the Unified Soil Classification System (USCS). These samples will be discarded after 90 days.

One (1) composite bulk soil sample was collected from boring B-3 (0'-7' depth range). The following laboratory analyses were completed on the bulk sample:

1. California Bearing Ratio analysis (CBR- VTM-8 Modified)
2. Standard Proctor analysis (ASTM D 698)
3. Atterberg limit analysis (ASTM D 4318)
4. Washed sieve analysis (ASTM D 1140)
5. Natural moisture analysis (ASTM D 2216)

The Atterberg limits and washed sieve analyses are used to classify the soils in accordance with the Unified Soil Classification System (USCS – ASTM D 2487).

Measurements for potential ground water conditions and/or cave-in depths were recorded at the completion of each of the test borings.

The test borings locations were referenced in the field by taking measurements from existing on-site structures. The ground surface elevations as shown on the attached Test Boring Logs in Appendix C were estimated from the topographic contours as shown on the site plan prepared by Hurt & Proffitt, Inc.

4.0 GEOLOGY/SUBSURFACE CONDITIONS

The underlying bedrock in the area of study consists of "Pre-Cambrian" metaigneous and metasedimentary rock units that have been mapped as belonging to the Ashe Formation. The chief lithologies that have been mapped with these formations are biotite gneiss and biotite schist. Geographically, the site is situated in the Blue Ridge Anticlinorium Physiographic Province. The site is also located in the southeast corner of the USGS Lynchburg, Virginia Topographic Quadrangle.

The upper subsurface profile, as described by the Unified Soils Classification System, consists primarily of residual Sandy Elastic SILTS (MH) in the upper five (5) to six (6) feet underlain by Silty SANDs (SM). The residual soils have formed in place due to the decomposition of the parent rock underlying the site. A detailed description of the soil conditions is provided in the Test Boring Logs located in Appendix C of this report.

The consistency of the fine grained MH soils is generally medium stiff to very stiff with SPT "N" values ranging from 8 to 21. The density condition for the sandy soils is generally loose to medium with SPT "N" values ranging from 5 to 26.

Auger refusal, generally indicative of hard rock conditions, did not occur in any of the borings.

Ground water was not observed during the site investigation. Seasonal fluctuations with respect to ground water table elevations do occur; however, H&P does not anticipate ground water being encountered during the construction operations. If water is encountered, H&P will make recommendations in the field concerning possible under drains and soil stabilization requirements.



The following table lists the test boring elevation datum.

TEST BORING LOCATION	GROUND ELEV.	TEST BORING DEPTH (ft)	BOTTOM OF BORING ELEV.	DEPTH TO WATER FROM GROUND (ft)	STATIC WATER LEVEL (SWL) ELEV.
B-1	773.0	10.5	762.5	Dry	Dry
B-2	773.0	30.5	742.5	Dry	Dry
B-3	766.0	10.5	755.5	Dry	Dry
B-4	764.0	10.5	753.5	Dry	Dry

The project site is situated on a gentle slope from Grove Street towards Wadsworth Street. (Please refer to USGS Map in Appendix A). Site drainage, based on the topographic conditions, is to east, and south. Elevations across the proposed construction limits including the building and roadway areas range from approximately 774 feet to 760 feet over a distance of approximately 200 feet.

The majority of the site is open with landscaped vegetation and existing parking lot. Sanitary, phone, and electric underground utilities were observed marked within or adjacent to the proposed construction limits. This notation is only intended to state what was observed by our on-site personnel and does not intend to imply that a full survey or research was performed to locate and/or determine presence of utilities. Full investigation should be performed by others to determine extent and nature of any/all utilities in the project area.

5.0 LABORATORY RESULTS

	Sample Location Boring B-3 (0'-7')
CBR Value (0.1" penetration)	3.0
Proctor Dry Density (pcf)	102.7
Proctor Optimum Moisture (%)	20.7
Atterberg Liquid Limit	45
Atterberg Plasticity Index	11
Minus #200 Sieve (%)	61.8
Natural Moisture (%)	20.3
USCS Classification	Sandy Silt (ML)

Test Methods:

- 1. California Bearing Ratio (CBR) VTM-8 Modified
- 2. Standard Proctor Analysis ASTM D 698
- 3. Atterberg Limit Analysis ASTM D 4318
- 4. Washed Sieve Analysis ASTM D 1140
- 5. Moisture Content Analysis ASTM D 2216

6.0 EARTHWORK AND GRADING

Prior to the earthwork operations, a limited amount of site preparation will be required. The site is vegetated with grasses and landscaping along the existing building. A few existing utility structures will also need to be removed and/or relocated.

After clearing the vegetation and prior to any fill placement, site preparation should begin with the removal of existing surficial organic soils and other deleterious materials. Following the stripping and grubbing operations, the site should be compacted and proof-rolled in the presence of a qualified geotechnical representative. Proof-rolling should be completed with a fully loaded dump truck or other approved equipment across the soil subgrade. During the proof-rolling process, it is recommended that a roller



pattern be established that will maximize the densification of the subgrade prior to fill placement. Proof-rolling should be performed during good weather and not while the site is wet as a result of recent rain or snow. Areas that pump, rut, weave, or are otherwise determined to be unsuitable or unstable by the geotechnical representative, should be excavated and replaced as directed by the geotechnical representative.

Based on the existing grades and based on the proposed elevations, cutting and filling of soils will be required to establish final subgrades across the building and parking lot areas. Maximum fill depths and cut excavations are estimated at 4± feet along the proposed retaining wall.

Compacted structural fill for building areas, pavements, and wall or utility trench backfill may be constructed using on-site soils or approved off-site borrow soils.

Suitable off-site borrow soils for this area generally includes non-cohesive soils and cohesive soils (low to medium plasticity) as defined by the Unified Soils Classification System which are free of organics or other deleterious materials.

Structural fill material under and within 15 feet of the building pad area should be placed in horizontal lifts, with an 8 inch to 9 inch loose thickness, and compacted to at least 98% of the material's maximum dry density as determined by ASTM D 698 (Standard Proctor).

Structural fill material for parking areas and utilities should be placed in horizontal lifts, with an 8 inch to 9 inch loose thickness, and compacted to at least 95% of the material's maximum dry density as determined by ASTM D 698 (Standard Proctor).

Structural fill material placed in slopes and adjacent to retaining wall structures should be placed in horizontal lifts, with an 8 inch to 9 inch loose thickness, and compacted to at least 95% of the material's maximum dry density as determined by ASTM D 698 (Standard Proctor).

The following minimum density test frequencies are recommended:

1. Building pad – One compaction test per 500 square feet per lift.
2. Pavement Areas – One compaction test per 2500 square feet per lift.
3. Slope and Retaining Wall Areas – One compaction test per 2500 square feet per lift.

The site should be graded to provide positive drainage away from the proposed structures and not allow ponding of water on the building pads and pavement sections. A 2% slope across the site is recommended. On-site fill zones should be sealed prior to forecasted rain events using a smooth drum roller to promote drainage and to prevent ponding of storm water.

Excessively wet or excessively dry soils should not be used as fill materials unless the soils are properly dried or wetted to an acceptable moisture content. A moisture content range of plus or minus 3% from the optimum moisture content of the fill material is recommended.

Excavations for footings within the prepared building pad should be made in such a way as to provide bearing-surfaces that are firm and free of loose, wet, or otherwise disturbed soils. If such deleterious materials are allowed to remain below the footing, settlement will increase. Concrete for footings should be placed the same day as the bearing surface is prepared to prevent softening due to overnight rain or other moisture. We recommend that all footing-bearing surfaces be observed and probed by qualified geotechnical personnel. The footing subgrades that do not achieve the allowable soil bearing capacity should be over-excavated to the depth and lateral limits recommended by the on-site geotechnical personnel. H&P recommends that the over-excavated material be replaced with a compacted dense graded aggregate (VDOT #21A or #21B size aggregate).

7.0 FOUNDATION DESIGN RECOMMENDATIONS

This section of the report provides recommendations for geotechnical design aspects of the proposed building addition. The primary requirement in evaluating the most suitable foundation system for a



structure is to determine the stratum on which the structure may be safely supported. This determination includes considerations with regard to the allowable bearing capacity of the strata, anticipated structural loads, and estimated settlement to be experienced by the proposed structure(s).

Based on the subsurface conditions and the expected building loads (maximum column loads estimated at 20 kips, and maximum wall footing loads at 4 k/ft), the proposed building can be supported on conventional shallow spread (column) and strip (wall) footing foundations. H&P recommends that footings bearing on virgin soils be designed for a net allowable soil bearing pressure of 2,000 psf. Foundations bearing on properly placed compacted fill may be designed for a net allowable soil bearing pressure of 2,000 psf. Recommended minimum footing widths (to reduce the risk of localized shear failures) for strip and spread footings are 24 inches and 36 inches, respectively.

Recommended minimum footing depths is 24 inches.

All footing subgrades should be compacted using manually-operated vibratory equipment to promote densification of any loose or disturbed materials resulting from the excavation. Following the compaction operations, the footing subgrades should be tested to ensure the allowable bearing pressure is achieved. It is very important that the concrete for footings be placed as soon as possible once the bearing surfaces are prepared. Settlements will increase if the footing subgrades are exposed to atmospheric conditions for an extended period of time.

7.1 FLOOR SLAB CONSTRUCTION

Floor slabs may be designed as slab-on-grade. A minimum 4" layer of stone should be placed beneath all grade slabs.

A vapor barrier should be used beneath the floor slab if an impermeable floor finish is applied to the floor. A vapor barrier may also be required if moisture sensitive equipment and/or moisture sensitive floor coverings are to be in direct contact with the floor. Vapor barriers can result in excessive curling of floor slabs during curing. For this reason, H&P recommends that the floor slab designer refer to ACI 302.1R-96, Sections 4.1.5 and 11.11 for further discussion associated with concrete shrinkage, curling, and the use of vapor barriers.

In order to minimize cracking due to settlement, it is recommended that the grade slabs be poured independent of wall footings. Isolation joints should be constructed around columns and along bearing walls to minimize cracking associated with minor settlement. Proper jointing for non-reinforced concrete should be completed to minimize cracking. Joint spacing, as suggested by ACI, should be placed at 24 to 36 times the slab thickness.

Based on the elastic silt type on-site soils, H&P recommends using a subgrade modulus (k) of 100 pci.

8.0 RETAINING WALL CONSTRUCTION

Project retaining walls must be designed to resist all lateral pressures that will be imposed. The most common conditions used for retaining wall design are "at rest" and "active" conditions. Below grade walls that are not allowed to rotate such as rigid basement structures should be designed using "at rest" earth pressures. Below grade walls where some rotation and movement may occur to mobilize soil shear strength such as free standing or mechanically stabilized earth retaining walls should be designed using "active" earth pressures. A third condition is the "passive" condition that develops when the base of the retaining wall structure or wall footing moves laterally into the soil. The wall translation to reach the passive state is at least twice that required to reach the active earth pressure state. For this reason, H&P recommends, for design purposes, that the calculated passive earth pressure be reduced by one-half to two-thirds.

Based on the subsurface investigation and the laboratory analyses, the predominant on-site soils are moderate expansive elastic silts (MH) and low expansive silty sands (SM). The MH type soils are not recommended for backfilling the project retaining wall structures.



For design purposes, the following soil parameters are recommended.

- Allowable soil bearing capacity = 2,000 psf
- Dry Soil Density = 105 pcf
- Moist Soil Density = 125 pcf
- Effective Internal Friction Angle (Φ') = 30°
- "At Rest" Earth Pressure Coefficient (K_o) = 0.50
- "Active" Earth Pressure Coefficient (K_a) = 0.33
- "Passive" Earth Pressure Coefficient (K_p) = 3.0
- Equivalent Fluid Pressure for At Rest Condition = 63 psf
- Equivalent Fluid Pressure for Active Condition = 41 psf
- Coefficient of Friction to resist sliding between concrete wall foundations and underlying soils = 0.35

H&P's recommendations assume that a constantly functioning drainage system is installed between the wall and the soil backfill to prevent the build-up of hydrostatic pressures. H&P recommends using an open graded stone (VDOT #57 size aggregate) directly against the wall. The stone should extend from the bottom of the wall to just below the top of the subgrade and be a minimum of one (1) foot in width. A foundation drain should also be installed to remove water away from the retaining wall structure. H&P's recommendations also assume the ground surface above the wall is level. The effect of surcharge loads should be added to the recommended earth pressures to determine total lateral stresses.

Heavy equipment should not be used in close proximity to retaining walls. The use of heavy equipment adjacent to retaining walls can result in excess wall movement and increased lateral earth pressures. Lightweight equipment such as hand-operated tampers should be used for compaction. Heavy equipment should not be utilized within the construction zone measured at a 45-degree angle from the base of the wall structure.

Alternative Backfill Recommendations Using VDOT #57 size aggregate

For design purposes, the following crushed stone parameters are recommended.

- Crushed Stone Unit Weight = 115 pcf (approximated, will vary depending on quarry selection)
- Effective Internal Friction Angle (ϕ) = 40.0 degrees
- "At Rest" Earth Pressure Coefficient (K_o) = 0.36
- "Active" Earth Pressure Coefficient (K_a) = 0.22
- "Passive" Earth Pressure Coefficient (K_p) = 4.5
- Equivalent Fluid Pressure for At Rest Condition = 41psf
- Equivalent Fluid Pressure for Active Condition = 25 psf
- Coefficient of Friction to resist sliding between concrete wall foundations and underlying soils = 0.35

If #57 stone is used for backfill, the stone should extend from the heel of the wall footing to a width at the top of the wall that measures 0.5 times the wall height. The stone should be placed in maximum 18-inch thick lifts and compacted with backhoe bucket or equivalent compacted effort. A geo-textile filter fabric should be placed between the crushed stone and the existing fine grained soils or new soil fill materials. H&P's recommendations assume that a constantly functioning drainage system is installed between the wall and the crushed stone backfill to prevent the build-up of hydrostatic pressures. A foundation drain should also be installed to remove water away from the retaining wall structure. H&P's recommendations also assume the ground surface above the wall is level. The effect of surcharge loads should be added to the recommended earth pressures to determine total lateral stresses.

Heavy equipment should not be used in close proximity to retaining walls. The use of heavy equipment adjacent to retaining walls can result in excess wall movement and increased lateral earth pressures. Lightweight equipment such as hand-operated tampers should be used for compaction. Heavy equipment should not be utilized within the construction zone measured at a 45-degree angle from the base of the wall structure.



9.0 PAVEMENT DESIGN

Laboratory California Bearing Ratio (CBR) testing was completed during this site investigation. Based on the CBR results, a design CBR value of 2 should be used for designing pavement sections. The recommended resiliency factor (RF) is 1.5. Using a design CBR value of 2 and RF value of 1.5, the soil support value (SSV) computes to 3.

Final soil subgrades should be compacted to a minimum of 98% of the soil's maximum dry density as determined by a Standard Proctor (ASTM D 698). A proof roll should be completed on the soil subgrade prior to placement of any crushed stone. Proof roll should be completed in the same manner as described in the Earthwork and Grading Section on Pages 3 and 4 of this report. Crushed stone subgrades should be compacted to 98% of the material's maximum dry density as determined by a Standard Proctor or as determined by a roller pattern.

Based on the expected volume of traffic and anticipated wheel loads, the recommended minimum pavement designs for the facility are as follows:

Flexible Asphalt Concrete Sections:

Heavy Duty Pavement - 12"

- Subbase 6" of Untreated #21B VDOT Size Aggregate
- Base 4" of BM-25.0
- Surface 2" of SM-9.5D

Light Duty Pavement - 10"

- Base 8" of 21B VDOT Size Aggregate
- Surface 2" of SM-9.5A

Rigid Portland Cement (PC) Concrete Sections:

Heavy Duty Pavement

- 6" x 0.14 = 0.84
- 6" x 0.44 = 2.64
- Structural Number (S.N.) = 3.48
- Concrete Thickness: $3.48/0.50 = 7.0"$

Light Duty Pavement

- 8" x 0.14 = 1.12
- 2" x 0.44 = 0.88
- Structural Number (S.N.) = 2.00
- Concrete Thickness: $2.00/0.50 = 4.0"$

10.0 ANTICIPATED SETTLEMENT

Based on the subsurface conditions that were encountered during the investigation; the engineering properties of the soils; and the standard penetration results, maximum total settlements, if the recommendations in this report are adhered to, are estimated at less than one (1) inch.

11.0 SLOPE STABILITY

A detailed slope stability analysis was not completed as part of this site investigation. Based on the elastic silt and silty sand type conditions, no permanent slopes should be steeper than 2H to 1V (horizontal to vertical). For long term stability and maintenance considerations, 3H to 1V (horizontal to vertical) is recommended.

Appropriate measures should be taken to prevent excess surface storm water from impacting the fill slopes and retaining wall areas. Both temporary berms and slope drains should be utilized until permanent diversion structures are in place.



Surface protection measures including erosion control fabric and protective vegetation cover should be implemented immediately following the slope construction operations.

H&P recommends that building foundations be placed no closer than 15 feet from the top of slopes and retaining wall structures. Also, H&P recommends that pavement sections be placed no closer than 10 feet from the top of slopes and retaining wall structures.

12.0 FROST DEPTH

Foundation footings should be placed a minimum of 24 inches below finish soil subgrade elevations.

13.0 SEISMIC CLASSIFICATION

In accordance with the International Building Code 2009, a site class seismic rating is required to complete the structural engineering analysis. Based on the standard penetration results and based on the expected depth of bedrock, a "D" site class seismic rating is recommended in evaluating the foundation designs for the new building structure(s).

The mapped Spectral Response Acceleration at short periods is $S_s = 0.24$. The mapped Spectral Response Acceleration at one-second periods is $S_1 = 0.07$. Site coefficient values of $F_a = 1.6$ and $F_v = 1.7$ correspond to the site class and mapped spectral response accelerations.

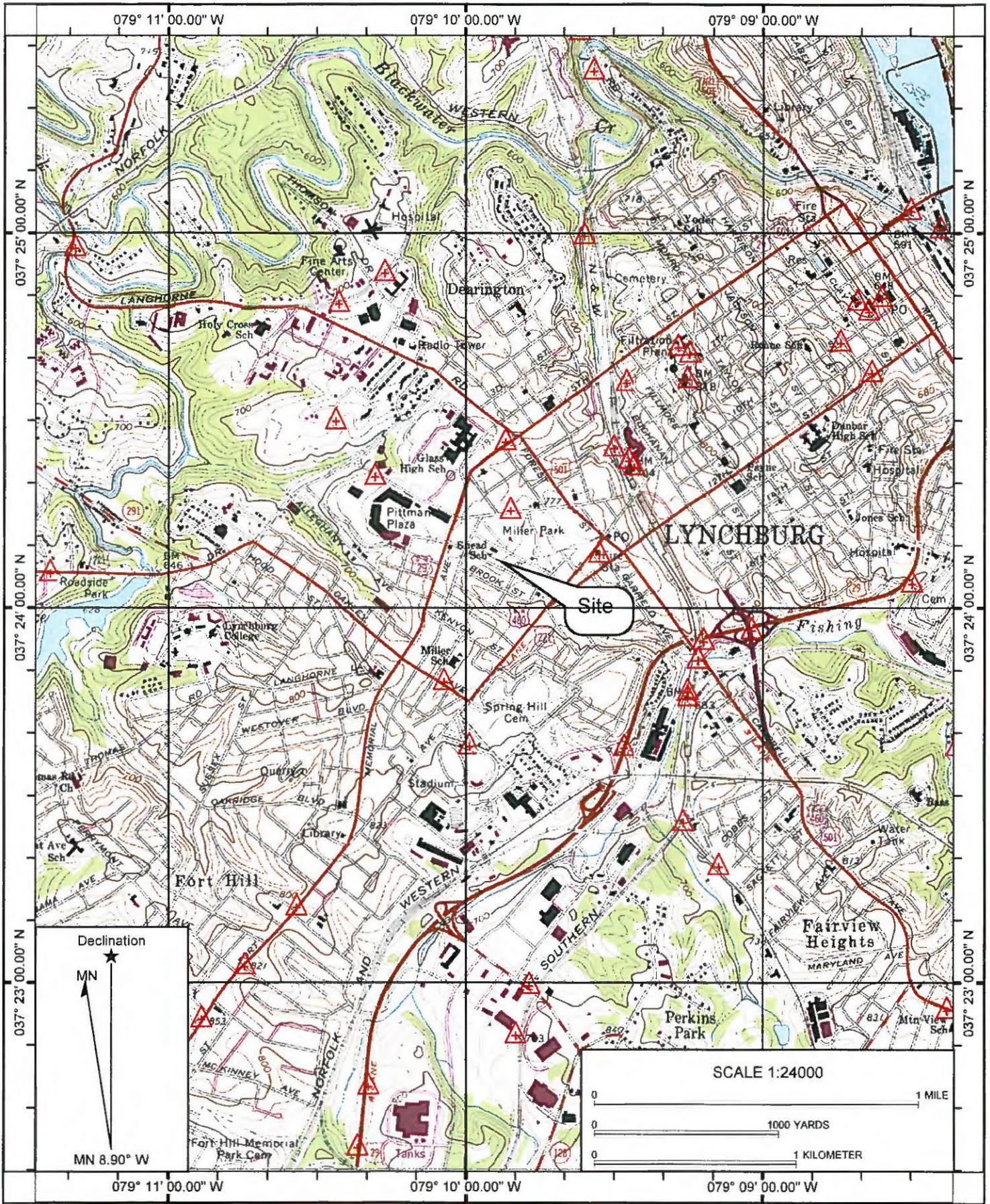
14.0 LIMITATIONS

The analyses and recommendations submitted in this report are based upon data obtained from soil borings performed at the locations shown on the Test Hole Location Map in Appendix B. Variations that may occur between these borings and other unexplored areas of the site are not reflected in this report. The nature and extent of variations between these borings may not become evident until construction is underway. If variations become apparent, H&P should be notified immediately to observe site conditions and to make appropriate recommendations.

This report has been prepared for the exclusive use of City of Lynchburg Parks and Recreation and their authorized design team for the design of the Miller Center Expansion. The conclusions and recommendations made in this report are based on the data obtained in the subsurface geotechnical investigation as described in this report and on the design information furnished to H&P for this project. H&P's recommendations are in accordance with generally accepted soil and foundation engineering practices. No warranty, express or implied, is made by H&P. Interpretations of this report by anyone other than H&P may not be valid.



Appendix A
USGS Topographic Map

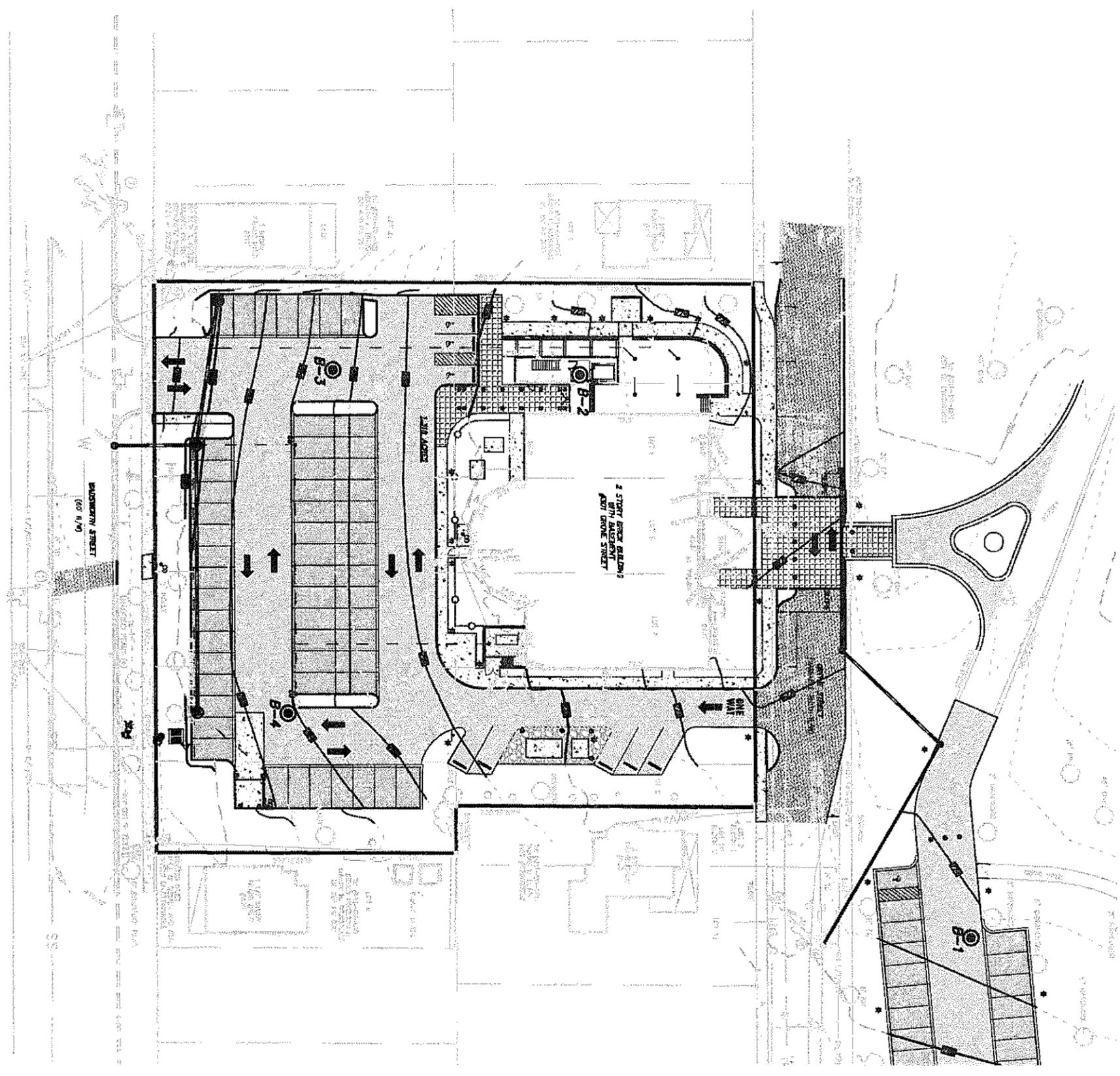


Name: [Lynchburg]
 Date: 10/18/12
 Scale: 1 inch = 2,000 ft.

Location: 037° 24' 00.69" N 079° 09' 54.12" W



Appendix B
Boring Location Plan



PROPOSED LEGEND

BH#
BORE HOLE



**BORE HOLE PLAN
FOR
MILLER CENTER
CITY OF LYNCHBURG, VIRGINIA**

HURT & PROFFITT
INCORPORATED
2524 LANGHORNE ROAD
LYNCHBURG VA 24501
800.242.4906 TOLL FREE
434.847.7796 MAIN
434.847.0047 FAX

*ENGINEERING >> SURVEYING >> PLANNING



PROJECT NO. 20090500
G.L. NO.
FILE NO.
DATE: 10/25/2012
DRAWN BY: NRO
CHECKED BY: JKM

SHEET NO.
1 OF 1



Appendix C
Test Boring Logs

LOG OF BORING B-1



Hurt & Proffitt, Inc.
 2524 Langhorne Road
 Lynchburg, VA 24501
 Telephone: (434) 847-7796
 Fax: (434) 847-0047
 http://www.HandP.com

CLIENT: City of Lynchburg
 PROJECT: Miller Center
 LOCATION: Lynchburg, Virginia

 PROJECT NO. 20120556

		FIELD DATA				LAB DATA				DRILLING DETAILS:
ELEVATION (feet)	SOIL SYMBOL	DEPTH (feet)	SAMPLES BLOW COUNT	PERCENT RECOVERY / R.Q.D. N-value	MOISTURE CONTENT (%)	ATTERBERG LIMITS			MINUS NO. 200 SIEVE (%)	Drilled by N. Hurdis using CME-45C and Continuous Flight Hollow Stem Augers. Boring completed 10/15/2012. SURFACE ELEVATION: 773.0 BORING DEPTH (ft): 10.50 PROPOSED SUBGRADE ELEVATION: GROUNDWATER DEPTH AT COMPLETION (ft): GROUNDWATER DEPTH AFTER 24 HRS (ft):
						LL	PL	PI		
										6 inches of Topsoil
770		1	5	15						RESIDUUM: Stiff, Reddish Brown ELASTIC SILT (MH), moist Very stiff
		2	8							
		3	6	20						
		4	8							
		5	7	21						contains quartz rock fragments
		6	12							
		7	12							
		8	7	20						Firm, Dark Gray Silty SAND (SM), micaceous, moist-dry
765		9	8							
		10	12							
			7	24						Yellowish Grayish Brown
			12							Boring Terminated at 10.5 feet.

N - Standard Penetration Test Resistance (ASTM D 1586)
 R.Q.D. - Rock Quality Designation

NOTES:
 Cave-in at 6.9 feet

LOG OF BORING B-2



Hurt & Proffitt, Inc.
 2524 Langhorne Road
 Lynchburg, VA 24501
 Telephone: (434) 847-7796
 Fax: (434) 847-0047
 http://www.HandP.com

CLIENT: City of Lynchburg
 PROJECT: Miller Center
 LOCATION: Lynchburg, Virginia

 PROJECT NO. 20120556

ELEVATION (feet)	SOIL SYMBOL	FIELD DATA			LAB DATA				DRILLING DETAILS:		
		DEPTH (feet)	SAMPLES	BLOW COUNT	PERCENT RECOVERY / R.Q.D.	N-value	MOISTURE CONTENT (%)			MINUS NO. 200 SIEVE (%)	Drilled by N. Hurdis using CME-45C and Continuous Flight Hollow Stem Augers. Boring completed 10/15/2012. SURFACE ELEVATION: 773.0 BORING DEPTH (ft): 30.50 PROPOSED SUBGRADE ELEVATION: GROUNDWATER DEPTH AT COMPLETION (ft): GROUNDWATER DEPTH AFTER 24 HRS (ft):
							LL	PL	PI		
										6 inches of Topsoil	
770		1	3	3	9					RESIDUUM: Stiff, Reddish Brown Sandy ELASTIC SILT (MH), moist	
		2	4	4							
		3	4	4	11						
		4	4	7							
		5	5	7	16					Firm, Grayish Brown fine Silty SAND (SM), micaceous, moist-dry	
		6	4	9							
765		7	8	9	17						
		8									
		9									
		10	6	6	15						
		11									
		12									
760		13									
		14	6	8	17						
		15	8	9							
		16									
		17									
755		18									
		19	9							Very firm	
		20	9	12	21						
		21									
		22									
750		23									
		24	7								
		25	10	10	20						
		26									
		27									
745		28									
		29	10								
		30	12	14	26						
										Boring Terminated at 30.5 feet.	

LOB 20120556.GPJ 10/19/12

N - Standard Penetration Test Resistance (ASTM D 1586)
 R.Q.D. - Rock Quality Designation

NOTES:
 Cave-in at 24 feet

LOG OF BORING B-3



Hurt & Proffitt, Inc.
 2524 Langhorne Road
 Lynchburg, VA 24501
 Telephone: (434) 847-7796
 Fax: (434) 847-0047
 http://www.HandP.com

CLIENT: City of Lynchburg
 PROJECT: Miller Center
 LOCATION: Lynchburg, Virginia

PROJECT NO. 20120556

FIELD DATA				LAB DATA				DRILLING DETAILS: Drilled by N. Hurdis using CME-45C and Continuous Flight Hollow Stem Augers. Boring completed 10/15/2012.
ELEVATION (feet)	SOIL SYMBOL	DEPTH (feet)	PERCENT RECOVERY / R.Q.D. N-value	MOISTURE CONTENT (%)	ATTERBERG LIMITS			
					LL	PL	PI	
								SURFACE ELEVATION: 766.0 BORING DEPTH (ft): 10.50 PROPOSED SUBGRADE ELEVATION: GROUNDWATER DEPTH AT COMPLETION (ft): GROUNDWATER DEPTH AFTER 24 HRS (ft):
								DESCRIPTION OF STRATUM
765		1		20				2 inches of Asphalt and 3 inches of Base Stone
		2						RESIDUUM: Stiff, Reddish Brown ELASTIC SILT (MH), moist
		3	10					
		4						
		5	9					
760		6						Loose, Reddish Brown Silty SAND (SM), micaceous, moist-dry
		7	5					
		8						
		9						Firm
		10	15					Boring Terminated at 10.5 feet.

LOB 20120556.GPJ 10/19/12

N - Standard Penetration Test Resistance (ASTM D 1586)
 R.Q.D. - Rock Quality Designation

NOTES:
 Cave-in at 8 feet

LOG OF BORING B-4



Hurt & Proffitt, Inc.
 2524 Langhorne Road
 Lynchburg, VA 24501
 Telephone: (434) 847-7796
 Fax: (434) 847-0047
 http://www.HandP.com

CLIENT: City of Lynchburg
 PROJECT: Miller Center
 LOCATION: Lynchburg, Virginia

PROJECT NO. 20120556

FIELD DATA		LAB DATA				DRILLING DETAILS:							
							DESCRIPTION OF STRATUM						
ELEVATION (feet)	SOIL SYMBOL	DEPTH (feet)	SAMPLES	BLOW COUNT	PERCENT RECOVERY / R.Q.D. N-value	MOISTURE CONTENT (%)	ATTERBERG LIMITS				MINUS NO. 200 SIEVE (%)	Drilled by N. Hurdis using CME-45C and Continuous Flight Hollow Stem Augers. Boring completed 10/15/2012. SURFACE ELEVATION: 764.0 BORING DEPTH (ft): 10.50 PROPOSED SUBGRADE ELEVATION: GROUNDWATER DEPTH AT COMPLETION (ft): GROUNDWATER DEPTH AFTER 24 HRS (ft):	
							LL	PL	PI	DESCRIPTION OF STRATUM			
													2.5 inches of Asphalt and 5.5 inches of Base Stone
760		1											RESIDUUM: Firm, Reddish Brown ELASTIC SILT (MH), moist
		2											
		3		3	8								
		4		3									
		5		5	8								Loose, Reddish Brown Silty SAND (SM), micaceous, moist-dry
		6		3									
		7		4	9								
		8		5									
755		9		3									
		10		4	9								Boring Terminated at 10.5 feet.

LOB 20120556.GPJ 10/19/12

N - Standard Penetration Test Resistance (ASTM D 1586)
 R.Q.D. - Rock Quality Designation

NOTES:
 Cave-in at 6.9 feet



Appendix D

CBR Results

Hurt & Proffitt, Inc.
 2524 Langhorne Road
 Lynchburg, Virginia 24501
 (phone) 434-847-7796 (fax) 434-847-0047

Project: Miller Center
 Project No: 20120556
 Location: City of Lynchburg
 Date: October 23, 2012

California Bearing Ratio Computations (VTM-8 Modified)

Sample # B-3

Soil Description: Red & Yellowish Brown Sandy Silt (ML) Minus 200 (%): 61.8
 Liquid Limit: 45 Proctor Density (pcf): 102.7
 Plasticity Index: 11 Optimum Moisture (%): 20.7

Computed Weight of Compacted Soil in CBR Mold

0.0754	x	102.7	=	7.74	lbs., weight of dry soil
453.6	x	7.74	=	3512	grams, weight of dry soil
3512	x	1.207	=	4240	grams, weight of wet soil

Actual Weight and Density of Soil in CBR Mold

	Soaked Mold (s)	Soaked Mold After Immersion (i)	
Wt. of mold and wet soil	11349	11475	grams
Wt. of mold	7112	7112	grams
Wt. of wet soil (S _w)	4237	4363	grams
Moisture content (w)	20.5	29.1	percent
Wt. of dry soil	3518	3381	grams
Percent Density Obtained:	100.1 %	94.4 %	

Compaction Effort
 3 Layers
 56 Blows/Layer

Mold ID: # 1

Density (D) = S_w / (V x (1+w) x 453.6), w is expressed as a decimal

D_s = $\frac{102.9}{97.0}$ V_s = $\frac{0.0754}{0.0769}$ w = $\frac{0.205}{0.291}$

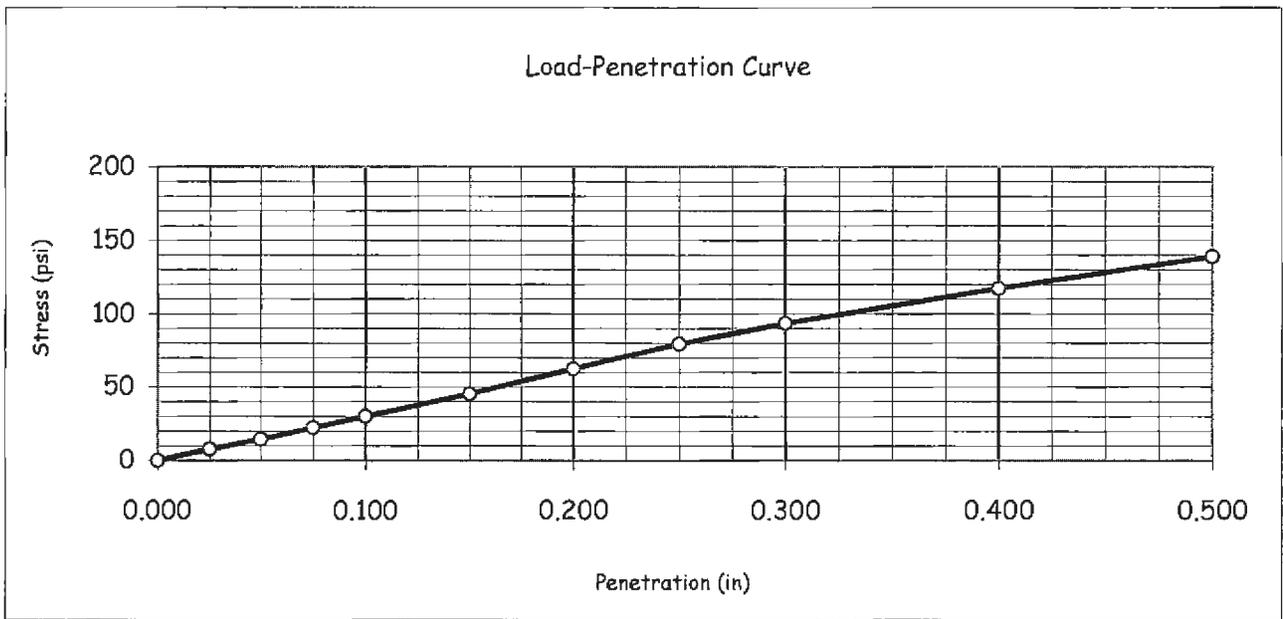
V_i = resulting volume after soak, V_i = [(1/4πd²) x (h_o + Δh)] x 0.0005787

Computation of Swell

Reading before immersion: 0.020 points
 Reading after immersion: 0.134 points
 Amount of Swell: 0.114 points % Swell = 2.5

Determination of CBR Value (Penetration and Total Load)

Inches	0.000	0.025	0.050	0.075	0.100	0.150	0.200	0.250	0.300	0.400	0.500
Stress on Piston (psi)	0	8	14	22	30	45	62	79	93	117	139
Total load after 4 day soak	0	23	43	66	90	136	187	238	280	352	417

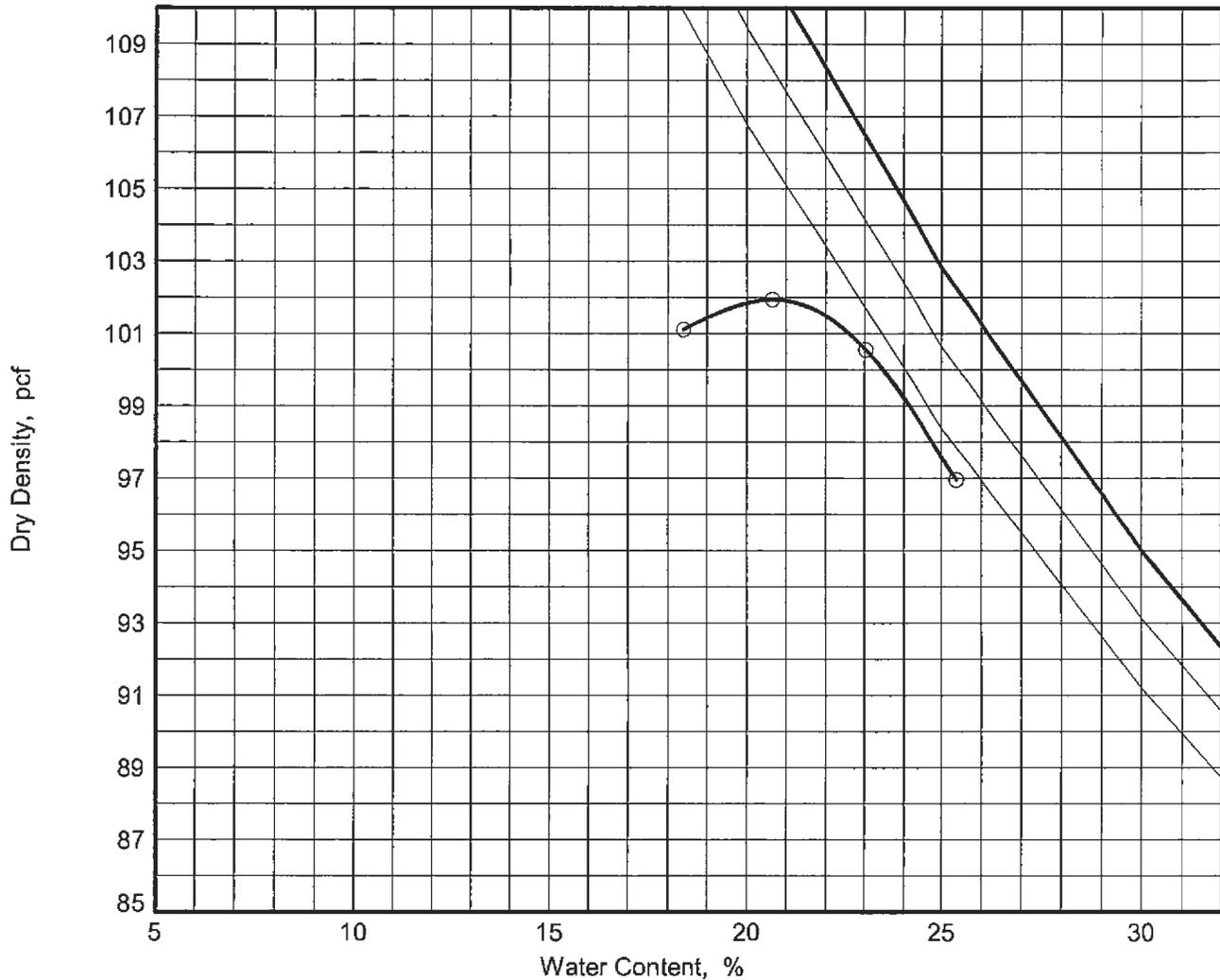


CBR Value (0.1") = 3.0 %



Appendix E
Standard Proctor Curve

MOISTURE - DENSITY RELATIONSHIP



85

Standard Proctor - ASTM D 698, Method A, using the Dry Preparation method and Manual Rammer

MATERIAL DESCRIPTION				AASHTO	SAMPLE ID: B-3		
Yellowish Brown SANDY SILT (ML)				A-7-5(6)	Maximum Dry Density =		102.0 pcf
				Optimum Moisture =		20.7 %	
Natural Moisture	Specific Gravity	Liquid Limit	Plasticity Index	% < 3/4 in.	% < 3/8 in.	% < No. 4	% < No. 200
20.3		45	11	100.0	100.0	99.9	61.8

Sampled by October 15, 2012

Sample location:

Proposed use:



Hurt & Proffitt, Inc.
 2524 Langhorne Road
 Lynchburg, Virginia 24501
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 Fax: (434) 847-0047
<http://www.HandP.com>

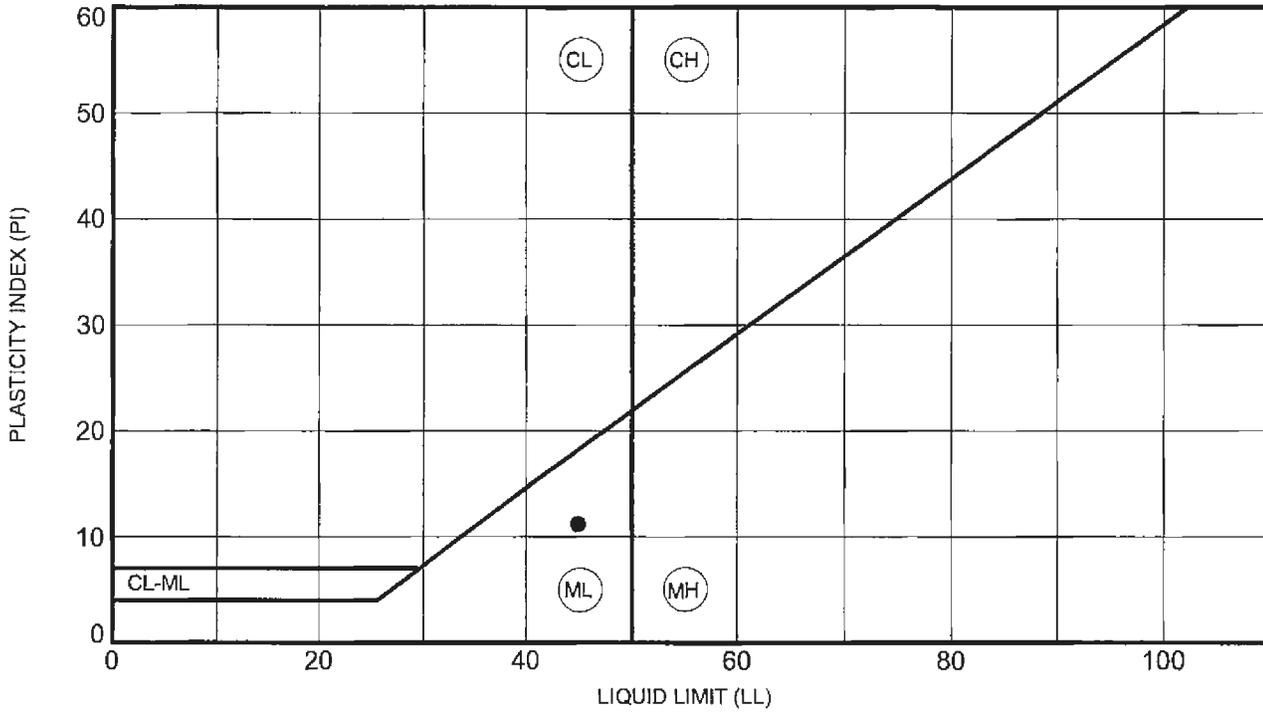
CLIENT: City of Lynchburg
 PROJECT: Miller Center
 LOCATION: Lynchburg, Virginia

PROJECT NO. 20120556



Appendix F
Atterberg Limit Results

ATTERBERG LIMITS' RESULTS



Specimen Identification	LL	PL	PI	Fines	Classification	
● B-3	0.0	45	34	11	61.8	Yellowish Brown SANDY SILT (ML)

LIMITS 20120556.GPJ 10/26/12



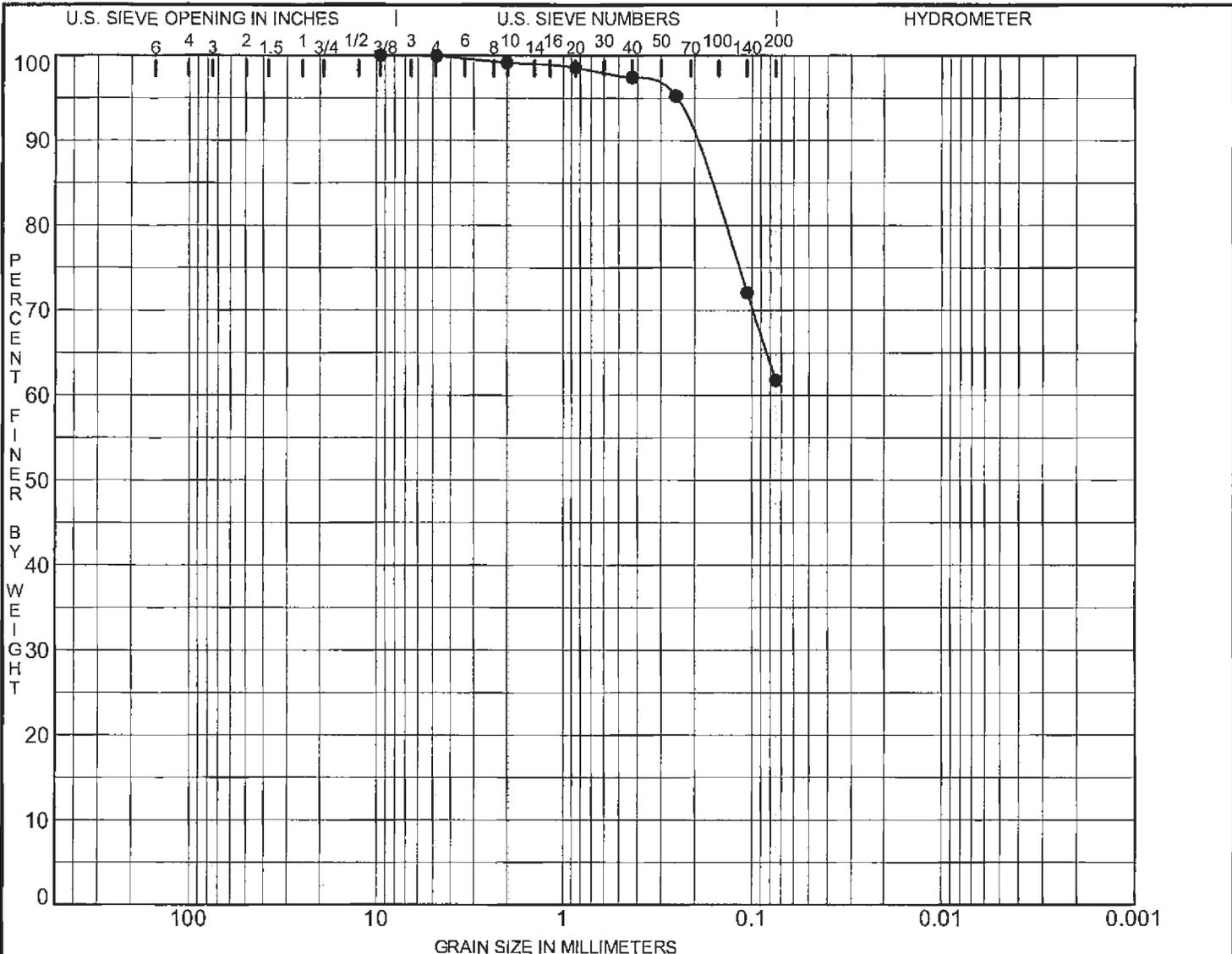
Hurt & Proffitt, Inc.
 2524 Langhorne Road
 Lynchburg, Virginia 24501
 Telephone: (434) 847-7796
 Fax: (434) 847-0047
<http://www.HandP.com>

CLIENT: City of Lynchburg
 PROJECT: Miller Center
 LOCATION: Lynchburg, Virginia

 PROJECT NO. 20120556



Appendix G
Sieve Analysis Results



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	Classification	MC%	LL	PL	PI
● B-3 0.0	Yellowish Brown SANDY SILT (ML)	20.3	45	34	11

Specimen Identification	D100	D60	D30	D10	Cc	Cu	%Gravel	%Sand	%Silt	%Clay
● B-3 0.0	9.50						0.1	38.2	61.8	



Hurt & Proffitt, Inc.
 2524 Langhorne Road
 Lynchburg, Virginia 24501
 Telephone: (434) 847-7796
 Fax: (434) 847-0047
<http://www.HandP.com>

CLIENT: City of Lynchburg
 PROJECT: Miller Center
 LOCATION: Lynchburg, Virginia
 PROJECT NO. 20120556

SIEVE 20120556.GPJ 10/26/12



HURT & PROFFITT
INCORPORATED

September 11, 2012

Mr. Kevin Kattwinkel, AIA, LEED AP
Associate Senior Architect
H&A Architects & Engineers
222 Central Park Ave. Suite 1200
Virginia Beach, Virginia 23462

Re: Hazardous Materials Assessment
The Miller Center, Lynchburg Virginia
H&P Project No.: 20090500

Dear Mr. Kattwinkel:

This letter and attachments represent Hurt & Proffitt's (H&P) report for the above-referenced project.

Introduction

H&P was retained by H&A Architects and Engineers to conduct a limited hazardous building materials assessment of the interior and exterior portions of the building associated with the planned renovation of The Miller Center located at 301 Grove Street in the City of Lynchburg, Virginia. The following makes up our report in its entirety.

Part I: Limited Asbestos-Containing Materials Survey, with Attachments A, B & C
Part II: Lead-Based Paint Survey, with Enclosures: Lead Inspector/Risk Assessor License
Photo Log

Each survey was performed in compliance with Local, State and Federal regulations.

The limited asbestos-containing materials survey was performed in general conformance with the National Emission Standards for Hazardous Air Pollutants (NESHAPs). General sampling protocol was in accordance with both NESHAPs and the US EPA-Asbestos Hazard Emergency Response Act (AHERA) regulations for K-12 public and private schools.

The lead-based paint survey was performed in compliance with EPA and OSHA requirements and guidelines.

Each material of concern was assessed and/or investigated starting on the week of July 19th completed on the week of July 25th, 2012. The asbestos sample inspection was performed by H&P representatives Walter C. Nixon and Randal L. Doss. Mr. Nixon's and Mr. Doss's Virginia Asbestos Inspector Licenses are enclosed in Appendix A for your files.

The lead-based paint investigation was performed by H&P representative Stephen A. Bliley. Mr. Bliley's Virginia Lead-Based Paint Inspector/Risk Assessor license is enclosed as part of the Lead-based paint survey.



Mr. Kevin Kattwinkel, AIA, LEED AP
RE: Limited Hazardous Materials Assessment
H&P Project No.: 20090500
September 11, 2012

Thank you for allowing Hurt & Proffitt to provide you with our hazardous building materials assessment services. Should you have any questions please call me at (434) 847-7796 ext 691. It was a pleasure working with you on this project and I hope we can be of service to you in the future.

Sincerely,
Hurt & Proffitt, Inc

A handwritten signature in black ink that reads "W. Chris Nixon". The signature is written in a cursive, flowing style.

W. Chris Nixon
Director of Environmental Services

Enclosures:

Part I: Asbestos-Building Survey
Part II: Lead-Based Paint Survey

PART I

Asbestos-Containing Materials Survey



September 11, 2012

HURT & PROFFITT
INCORPORATED

Kevin Kattwinkel, AIA, LEED AP
Associate Senior Architect
H&A Architects & Engineers
222 Central Park Ave., Suite 1200
Virginia Beach, Virginia 23462

RE: Pre-Renovation Asbestos Inspection Services
The Miller Center Building
H&P Project No.: 20090500

Dear Mr. Kattwinkel:

This letter and attachments represent Hurt & Proffitt's (H&P) report for the above-referenced project as requested to obtain the proper permits for a planned demolition/renovation.

Introduction

H&P was retained to conduct a pre-renovation asbestos inspection of The Miller Center, located at 301 Grove Street in Lynchburg Virginia. The building is currently occupied by the City of Lynchburg Recreation Department and Extension Service offices.

The inspection was performed in compliance with Local, State and Federal regulations as required by the National Emission Standards for Hazardous Air Pollutants (NESHAPs). General sampling protocol was in accordance with both NESHAPs and the US EPA-Asbestos Hazard Emergency Response Act (AHERA) regulations.

The asbestos building inspection was performed on July 25th, 2012 by H&P representatives, W. Chris Nixon and Randal L. Doss. Mr. Nixon's and Mr. Doss' Virginia Asbestos Inspector Licenses are attached for your records within Attachment A.

Asbestos Survey and Laboratory Procedures

Physical Inspection was conducted throughout each room and office area as well as exterior building components (excluding roofs). Samples were collected from functional spaces that were accessible at the time of the sampling event, which is representative of suspect homogenous materials (based on material type, color, texture, etc).

Suspect asbestos samples were submitted for analysis by EPA Method No. 600/R-93/116 and 600/M4-82-020 (polarized light microscopy (PLM)). All samples were analyzed by SanAir Technologies Laboratory of Powhatan, Virginia, a NVLAP accredited laboratory licensed to perform asbestos bulk analysis within the State of Virginia. A positive stop was asked for, if any sample was proved positive for the presence of asbestos fibers for each sample set, ie: SAMPLE-000 A,B,C, etc.

In order to determine the extent and locations of asbestos-containing materials and potential degree of abatement activities to take place within the building, all floors of the building were inspected for the presence of asbestos-containing building materials (ACBMs).

The building consists of three floors. Original walls are constructed of plaster with some drywall and wood paneling walls added at a later date to create or enclose office spaces. The upper two floors primarily contain original wood flooring and the basement floor is constructed of concrete.

Exterior inspection of the building was also performed and samples of suspect materials were collected. Please note that no samples were taken of roofing materials since sampling is a destructive process and



Mr. Kevin Kattwinkel
 RE: Pre-Renovation Asbestos Inspection Services
 The Miller Center Building
 H&P Project No.: 20090500

September 11, 2012

the building is still in use at this time. Once the building has been vacated and gross removal and replacement of roofing materials becomes imminent, sampling and testing of roofing materials currently designated as presumed asbestos-containing materials (PACM) should be performed prior to demolition.

The attached laboratory report confirms that the following materials are asbestos-containing:

Interior Door and Window Caulk, Basement (Floor #1)

There were various materials not sampled (due to health and safety reasons), but are designated as presumed asbestos-containing materials (PACM) and should be removed as asbestos-containing materials, The PACM identified throughout the building is as follows:

- Corrugated Pipe Insulation Materials**
- Fire Doors**
- Roofing Materials**

The following Table 1 illustrates the sample identification, location and analytical results as received from the laboratory. The laboratory results and sample chain-of-custody are included in Attachment B for your review.

TABLE 1:

Sample No.	Material Description/ Location	Estimated Quantity	Lab Results (% Asbestos)	Condition/ Friable Y/N	Estimated Abatement Cost
NOT SAMPLED	AEROCCELL TYPE PIPE INSULATION MATERIAL / BASEMENT	<10 LF VISIBLE	PRESUMED ACM	FAIR / Y	\$1,500.00
NOT SAMPLED	STEEL FIRE DOORS	<10 DOORS	PRESUMED ACM	GOOD / N	\$1,000.00
NOT SAMPLED	ROOFING MATERIALS	Entire	PRESUMED ACM	GOOD / N	\$10,000.00
CPL-001 A, B, C	CEILING PLASTER (TYPICAL)	NA	NONE DETECTED	NA	NA
WLPL-002 A, B, C	WALL PLASTER (TYPICAL)	NA	NONE DETECTED	NA	N/A
FLVCS-003	WHITE VINYL FLOOR SHEETING/1 ST FLOOR	NA	NONE DETECTED	NA	N/A
LCPL-004 A, B, C	2'X4' WHITE LAY-IN CEILING PANELS (TYPICAL)	NA	NONE DETECTED	NA	N/A



Mr. Kevin Kattwinkel
 RE: Pre-Renovation Asbestos Inspection Services
 The Miller Center Building
 H&P Project No.: 20090500
 September 11, 2012

Sample No.	Material Description/ Location	Estimated Quantity	Lab Results (% Asbestos)	Condition/ Friable Y/N	Estimated Abatement Cost
DHVAC-005 A,B,C	WHITE DECORATIVE HVAC DUCT COATING/1 ST FLOOR	NA	NONE DETECTED	NA	N/A
CLBRD-006 A, B,C	4'X8' CEILING BOARD	NA	NONE DETECTED	NA	N/A
IWCLK-007	INTERIOR WINDOW CAULK/2 ND FLOOR	NA	NONE DETECTED	NA	N/A
FLVCS-008	GREY FLOOR SHEETING/1 ST FLOOR	NA	NONE DETECTED	NA	N/A
CLPT-009 A, B,C	WHITE CEILING PAINT/1 ST FLOOR	NA	NONE DETECTED	NA	N/A
WLSH-010 A, B,C	SHEETROCK WALLBOARD (TYPICAL)	NA	NONE DETECTED	NA	NA
IDCLK-011	INTERIOR DOOR CAULK/2 ND FLOOR	NA	NONE DETECTED	NA	N/A
IWCLK-012	INTERIOR WINDOW AND DOOR CAULK/1 ST FLOOR	50 SQFT	7% CHRYSOTILE	FAIR/N	\$1,000.00
EWCLK-013	EXTERIOR WINDOW CAULK (TYPICAL)	NA	NONE DETECTED	NA	NA
EWGLZ-014	EXTERIOR WINDOW GLAZING (TYPICAL)	NA	NONE DETECTED	NA	NA

NA=Not Addressed, N/A Not Applicable, SQFT = Square Feet, LF = Linear Feet; ,1% Considered non-asbestos containing for disposal purposes, OSHA regulations still apply for PPE.

Quantities and locations are estimates only, each location and quantity of materials identified within this summary report must be field verified by contractors prior to bid.

Drawings 1-4 illustrates the locations of samples collected, a positive or negative result and locations of presumed asbestos-containing materials (PACMs), ie: pipe insulation materials.



Mr. Kevin Kattwinkel
RE: Pre-Renovation Asbestos Inspection Services
The Miller Center Building
H&P Project No.: 20090500
September 11, 2012

Recommendations and Discussion

In order to obtain a work permit, this report must accompany the application to the county, town and/or city for which the work is to take place. It is the responsibility of the contractor performing the building renovation to have the asbestos-containing materials removed prior to disturbance.

Asbestos-containing materials must be removed by Virginia DPOR licensed personnel only. The materials must be disposed of in a Virginia DEQ managed landfill, licensed to manage asbestos-containing waste, ie: First Piedmont, Chatham, Virginia.

Asbestos abatement project monitoring must be performed during the asbestos-containing materials removal process to insure that asbestos fibers are not being released during the removal process. Once the abatement effort is complete a final set of air sample clearance results must illustrate an indoor air quality result of <0.01 fibers per cubic centimeter (F/cc) of air for each work area prior to re-occupancy by other trades or employees.

Hurt & Proffitt has licensed asbestos abatement project monitoring personnel, who would be glad to fulfill the necessary role as owner representative throughout the asbestos materials removal process, monitor for asbestos fibers and clear the project at completion for re-occupancy by other trades.

Qualifications of Asbestos Survey

This report summarizes our evaluation of the conditions associated with the Miller Center as described within, only. The findings prepared by H&P are based upon our observations in the field, within the laboratory and the analytical analysis of the samples collected at the time of the field inspection. Additional ACM/PACM may exist (undetected and/or inaccessible) in other portions of the building. Our recommendations are based on the guidelines presented by the EPA, Commonwealth of Virginia and OSHA. Any conditions discovered which deviate from the data contained in this report should be presented to us for our evaluation.

Closing

Thank you for allowing Hurt & Proffitt to provide you with our asbestos pre-renovation inspection services. Should you have any questions please call me at (434) 847-7796 ext 691. It was a pleasure working with you on this project and I hope we can be of service to you in the future.

Sincerely,
HURT & PROFFITT, INC

A handwritten signature in blue ink that reads "W. Chris Nixon". The signature is written in a cursive style and is placed on a light-colored rectangular background.

W. Chris Nixon
Director of Environmental Services

Attachment A: Asbestos Inspector Licenses
Attachment B: Laboratory Reports and Sample Chain-of-Custody
Attachment C: Drawings 1-4 Sample Location Maps

Attachment A

Virginia Asbestos Inspector License

DEPARTMENT OF PROFESSIONAL AND OCCUPATIONAL REGULATION
COMMONWEALTH OF VIRGINIA

9960 Mayland Dr., Suite 400, Richmond, VA 23233
Telephone: (804) 367-8500

EXPIRES ON

07-31-2013

NUMBER

3303 003214

VIRGINIA ASBESTOS LICENSE
INSPECTOR LICENSE

WALTER CHRISTOPHER NIXON
175 SAGE LN

MADISON HEIGHTS, VA 24572



Gordon N. Dixon
Gordon N. Dixon, Director

ALTERATION OF THIS DOCUMENT, USE AFTER EXPIRATION, OR USE BY PERSONS OR FIRMS OTHER
THAN THOSE NAMED MAY RESULT IN CRIMINAL PROSECUTION UNDER THE CODE OF VIRGINIA.

(SEE REVERSE SIDE FOR NAME AND/OR ADDRESS CHANGE)

DEPARTMENT OF PROFESSIONAL AND OCCUPATIONAL REGULATION
COMMONWEALTH OF VIRGINIA

EXPIRES ON

09-30-2013

9960 Mayland Dr., Suite 400, Richmond, VA 23233
Telephone: (804) 367-8500

NUMBER

3303 003679

VIRGINIA ASBESTOS LICENSE
INSPECTOR LICENSE

RANDAL LEE DOSS
4484 NEW CHAPEL ROAD
CONCORD, VA 24538



Gordon N. Dixon
Gordon N. Dixon, Director

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Attachment B

Laboratory Reports and Sample Chain-of-Custody

SanAir Technologies Laboratory

Analysis Report prepared for Hurt & Proffitt, Inc.

Report Date: 8/2/2012
Project Name: Miller School Rehab
Project #: 20090500
SanAir ID#: 12014666



NVLAP LAB CODE 200870-0



Certification # 652931



License # LAB0166



804.897.1177

www.sanair.com



SanAir Technologies Laboratory, Inc.

1551 Oakbridge Drive, Suite B, Powhatan, VA 23139
804.897.1177 Toll Free: 888.895.1177 Fax: 804.897.0070
Web: <http://www.sanair.com> E-mail: iaq@sanair.com

Hurt & Proffitt, Inc.
2524 Langhorne Road
Lynchburg, VA 24501

August 2, 2012

SanAir ID # 12014666
Project Name: Miller School Rehab
Project Number: 20090500

Dear Randal L. Doss,

We at SanAir would like to thank you for the work you recently submitted. The 28 sample(s) were received on Thursday, July 26, 2012 via FedEx. The final report(s) is enclosed for the following sample(s): CLPL-001A, CLPL-001B, CLPL-001C, WLPL-002A, WLPL-002B, WLPL-002C, FLVCS-003, LCPL-004A, LCPL-004B, LCPL-004C, DHVAC-005A, DHVAC-005B, DHVAC-005C, CLBRD-006A, CLBRD-006B, CLBRD-006C, IWCLK-007, FLVCS-008, CLPT-009A, CLPT-009B, CLPT-009C, WLSH-010A, WLSH-010B, WLSH-010C, IDCLK-011, IWCLK-012, EWCLK-013, EWGLZ-014.

These results only pertain to this job and should not be used in the interpretation of any other job. This report is only complete in its entirety. Refer to the listing below of the pages included in a complete final report.

Sincerely,

Sandra Sobrino
Asbestos & Materials Laboratory Manager
SanAir Technologies Laboratory

Final Report Includes:
- Cover Letter
- Analysis Pages
- Disclaimers and Additional Information

sample conditions:
28 sample(s) in Good condition



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SanAir ID Number

12014666

FINAL REPORT

Name: Hurt & Proffitt, Inc.
Address: 2524 Langhorne Road
Lynchburg, VA 24501

Project Number: 20090500
P.O. Number:
Project Name: Miller School Rehab

Collected Date: 7/25/2012
Received Date: 7/26/2012 9:55:00 AM
Report Date: 8/2/2012 11:22:15 AM
Analyst: Vaughan, Nathaniel

Asbestos Bulk PLM EPA 600/R-93/116

SanAir ID / Description	Stereoscopic Appearance	% Fibrous	Components		Asbestos Fibers
			% Non-Fibrous		
CLPL-001A / 12014666-001 Ceiling Plaster	Grey Non-Fibrous Heterogeneous		100%	Other	None Detected

SanAir ID / Description	Stereoscopic Appearance	% Fibrous	Components		Asbestos Fibers
			% Non-Fibrous		
CLPL-001B / 12014666-002 Ceiling Plaster	Grey Non-Fibrous Heterogeneous		100%	Other	None Detected

SanAir ID / Description	Stereoscopic Appearance	% Fibrous	Components		Asbestos Fibers
			% Non-Fibrous		
CLPL-001C / 12014666-003 Ceiling Plaster	Grey Non-Fibrous Heterogeneous		100%	Other	None Detected

SanAir ID / Description	Stereoscopic Appearance	% Fibrous	Components		Asbestos Fibers
			% Non-Fibrous		
WLPL-002A / 12014666-004 Wall Plaster	Beige Non-Fibrous Heterogeneous		100%	Other	None Detected

SanAir ID / Description	Stereoscopic Appearance	% Fibrous	Components		Asbestos Fibers
			% Non-Fibrous		
WLPL-002B / 12014666-005 Wall Plaster	Beige Non-Fibrous Heterogeneous		100%	Other	None Detected

SanAir ID / Description	Stereoscopic Appearance	% Fibrous	Components		Asbestos Fibers
			% Non-Fibrous		
WLPL-002C / 12014666-006 Wall Plaster	Beige Non-Fibrous Heterogeneous		100%	Other	None Detected

SanAir ID / Description	Stereoscopic Appearance	% Fibrous	Components		Asbestos Fibers
			% Non-Fibrous		
FLVCS-003 / 12014666-007 Vinyl Floor Sheeting	White Non-Fibrous Heterogeneous	45%	Cellulose	55% Other	None Detected

Certification

Signature: 

Date: 8/2/2012

Reviewed: 

Date: 8/2/2012



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FINAL REPORT

Name: Hurt & Proffitt, Inc.
Address: 2524 Langhorne Road
Lynchburg, VA 24501

Project Number: 20090500
P.O. Number:
Project Name: Miller School Rehab

Collected Date: 7/25/2012
Received Date: 7/26/2012 9:55:00 AM
Report Date: 8/2/2012 11:22:15 AM
Analyst: Vaughan, Nathaniel

Asbestos Bulk PLM EPA 600/R-93/116

SanAir ID / Description	Stereoscopic Appearance	Components		Asbestos Fibers
		% Fibrous	% Non-Fibrous	
LCPL-004A / 12014666-008 2x4' Lay In Ceiling Panel	Beige Fibrous Heterogeneous	65% Cellulose 20% Glass 10% Min. Wool	5% Other	None Detected

SanAir ID / Description	Stereoscopic Appearance	Components		Asbestos Fibers
		% Fibrous	% Non-Fibrous	
LCPL-004B / 12014666-009 2x4' Lay In Ceiling Panel	Beige Fibrous Heterogeneous	65% Cellulose 20% Glass 10% Min. Wool	5% Other	None Detected

SanAir ID / Description	Stereoscopic Appearance	Components		Asbestos Fibers
		% Fibrous	% Non-Fibrous	
LCPL-004C / 12014666-010 2x4' Lay In Ceiling Panel	Beige Fibrous Heterogeneous	65% Cellulose 20% Glass 10% Min. Wool	5% Other	None Detected

SanAir ID / Description	Stereoscopic Appearance	Components		Asbestos Fibers
		% Fibrous	% Non-Fibrous	
DHVAC-005A / 12014666-011 Decorative HVAC Duct Coating	White Non-Fibrous Heterogeneous		100% Other	None Detected

SanAir ID / Description	Stereoscopic Appearance	Components		Asbestos Fibers
		% Fibrous	% Non-Fibrous	
DHVAC-005B / 12014666-012 Decorative HVAC Duct Coating	White Non-Fibrous Heterogeneous		100% Other	None Detected

SanAir ID / Description	Stereoscopic Appearance	Components		Asbestos Fibers
		% Fibrous	% Non-Fibrous	
DHVAC-005C / 12014666-013 Decorative HVAC Duct Coating	White Non-Fibrous Heterogeneous		100% Other	None Detected

SanAir ID / Description	Stereoscopic Appearance	Components		Asbestos Fibers
		% Fibrous	% Non-Fibrous	
CLBRD-006A / 12014666-014 4x8' Ceiling Board	White Fibrous Homogeneous	98% Cellulose	2% Other	None Detected

Certification

Signature: 

Date: 8/2/2012

Reviewed: 

Date: 8/2/2012



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FINAL REPORT

Name: Hurt & Proffitt, Inc.
Address: 2524 Langhorne Road
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Project Number: 20090500
P.O. Number:
Project Name: Miller School Rehab

Collected Date: 7/25/2012
Received Date: 7/26/2012 9:55:00 AM
Report Date: 8/2/2012 11:22:15 AM
Analyst: Vaughan, Nathaniel

Asbestos Bulk PLM EPA 600/R-93/116

SanAir ID / Description	Stereoscopic Appearance	Components		Asbestos Fibers
		% Fibrous	% Non-Fibrous	
CLBRD-006B / 12014666-015 4x8' Ceiling Board	White Fibrous Homogeneous	98% Cellulose	2% Other	None Detected

SanAir ID / Description	Stereoscopic Appearance	Components		Asbestos Fibers
		% Fibrous	% Non-Fibrous	
CLBRD-006C / 12014666-016 4x8' Ceiling Board	White Fibrous Homogeneous	98% Cellulose	2% Other	None Detected

SanAir ID / Description	Stereoscopic Appearance	Components		Asbestos Fibers
		% Fibrous	% Non-Fibrous	
IWCLK-007 / 12014666-017 Interior Window Caulk (2nd Fl)	White Non-Fibrous Homogeneous		100% Other	None Detected

SanAir ID / Description	Stereoscopic Appearance	Components		Asbestos Fibers
		% Fibrous	% Non-Fibrous	
FLVCS-008 / 12014666-018 Vinyl Floor Sheeting	Grey Non-Fibrous Homogeneous	10% Cellulose 2% Glass	88% Other	None Detected

SanAir ID / Description	Stereoscopic Appearance	Components		Asbestos Fibers
		% Fibrous	% Non-Fibrous	
CLPT-009A / 12014666-019 Ceiling Paint	White Non-Fibrous Homogeneous	3% Wollastonite	97% Other	None Detected

SanAir ID / Description	Stereoscopic Appearance	Components		Asbestos Fibers
		% Fibrous	% Non-Fibrous	
CLPT-009B / 12014666-020 Ceiling Paint	White Non-Fibrous Homogeneous	3% Wollastonite	97% Other	None Detected

SanAir ID / Description	Stereoscopic Appearance	Components		Asbestos Fibers
		% Fibrous	% Non-Fibrous	
CLPT-009C / 12014666-021 Ceiling Paint	White Non-Fibrous Homogeneous	3% Wollastonite	97% Other	None Detected

Certification

Signature: 

Date: 8/2/2012

Reviewed: 

Date: 8/2/2012



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SanAir ID Number

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FINAL REPORT

Name: Hurt & Proffitt, Inc.
Address: 2524 Langhorne Road
Lynchburg, VA 24501

Project Number: 20090500
P.O. Number:
Project Name: Miller School Rehab

Collected Date: 7/25/2012
Received Date: 7/26/2012 9:55:00 AM
Report Date: 8/2/2012 11:22:15 AM
Analyst: Vaughan, Nathaniel

Asbestos Bulk PLM EPA 600/R-93/116

SanAir ID / Description	Stereoscopic Appearance	Components		Asbestos Fibers
		% Fibrous	% Non-Fibrous	
WLSH-010A / 12014666-022 Typical Sheetrock Wallboard	White Non-Fibrous Homogeneous	10% Cellulose	90% Other	None Detected

SanAir ID / Description	Stereoscopic Appearance	Components		Asbestos Fibers
		% Fibrous	% Non-Fibrous	
WLSH-010B / 12014666-023 Typical Sheetrock Wallboard	White Non-Fibrous Homogeneous	10% Cellulose	90% Other	None Detected

SanAir ID / Description	Stereoscopic Appearance	Components		Asbestos Fibers
		% Fibrous	% Non-Fibrous	
WLSH-010C / 12014666-024 Typical Sheetrock Wallboard	White Non-Fibrous Homogeneous	10% Cellulose	90% Other	None Detected

SanAir ID / Description	Stereoscopic Appearance	Components		Asbestos Fibers
		% Fibrous	% Non-Fibrous	
IDCLK-011 / 12014666-025 Interior Door Caulk (2nd FL)	White Non-Fibrous Homogeneous		100% Other	None Detected

SanAir ID / Description	Stereoscopic Appearance	Components		Asbestos Fibers
		% Fibrous	% Non-Fibrous	
IWCLK-012 / 12014666-026 Interior Window/Door Caulks (Basement)	White Non-Fibrous Homogeneous		93% Other	7% Chrysotile

SanAir ID / Description	Stereoscopic Appearance	Components		Asbestos Fibers
		% Fibrous	% Non-Fibrous	
EWCLK-013 / 12014666-027 Exterior Window Caulk	White Non-Fibrous Homogeneous		100% Other	None Detected

SanAir ID / Description	Stereoscopic Appearance	Components		Asbestos Fibers
		% Fibrous	% Non-Fibrous	
EWGLZ-014 / 12014666-028 Exterior Window Glazing	White Non-Fibrous Homogeneous		100% Other	None Detected

Certification

Signature: 

Date: 8/2/2012

Reviewed: 

Date: 8/2/2012

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Asbestos Chain of Custody

SanAir ID Number
 120196666

Company: Hurt & Proffitt, Inc	Project #: 20090500	Phone #: 4348477796
Address: 2524 Langhorne Road	Project Name: Miller School Rehab	Phone #: 434-546-5330
City, St., Zip: Lynchburg, Virginia 24501	Date Collected: 25 Jul 12	Fax #: 4348470047
Samples Collected By: Randal L. Doss	P.O. Number:	Email: RLD@handp.com

Asbestos Analysis Types

Bulk		Air		Soil/Vermiculite	
ABB	PLM EPA 600/R-93/116 <input checked="" type="checkbox"/>	ABA	PCM NIOSH 7400 <input type="checkbox"/>	ABSE	PLM EPA 600/R-93/116 (Qual.) <input type="checkbox"/>
	Positive Stop <input checked="" type="checkbox"/>	ABA-2	OSHA w/ TWA* <input type="checkbox"/>	ABSP	PLM CARB 435 (LOD <1%) <input type="checkbox"/>
ABEPA	PLM EPA 400 Point Count <input type="checkbox"/>	ABTEM	TEM AHERA <input type="checkbox"/>	ABSP1	PLM CARB 435 (LOD 0.25%) <input type="checkbox"/>
ABBIK	PLM EPA 1000 Point Count <input type="checkbox"/>	ABATN	TEM NIOSH 7402 <input type="checkbox"/>	ABSP2	PLM CARB 435 (LOD 0.1%) <input type="checkbox"/>
ABBEN	PLM EPA NOB <input type="checkbox"/>	ABT2	TEM Level II <input type="checkbox"/>		
ABBCH	TEM Chatfield <input type="checkbox"/>				
ABBTM	TEM EPA NOB <input type="checkbox"/>	Water		Dust	
ABBNY	TEM NY ELAP 198.4 <input type="checkbox"/>	ABHE	EPA 100.2 <input type="checkbox"/>	ABWA	TEM Wipe ASTM D-6480 <input type="checkbox"/>
OTHER/ Matrix :	<input type="checkbox"/>			ABDMV	TEM Microvac ASTM D-5755 <input type="checkbox"/>

Turn Around	<input type="checkbox"/> 3 HR (4 HR TEM)	<input type="checkbox"/> 6 HR (8HR TEM)	<input type="checkbox"/> 12 HR	<input checked="" type="checkbox"/> 24 HR
Times	2 Days <input type="checkbox"/>	3 Days <input type="checkbox"/>	4 Days <input type="checkbox"/>	5 Days <input checked="" type="checkbox"/>

Sample #	Sample Identification/Location	Volume or Area	Sample Type	Flow Rate*	Time* Start - Stop
CLPL- 001 A,B,C	Ceiling Plaster		ABB		
WLPL-002 A,B, C	Wall Plaster		ABB		
FLVCS- 003	Tan Vinyl Floor Sheeting		ABB		
LCPL- 004 A,B,C	2x4' White Lay in Ceiling Panel		ABB		
DHVAC- 005 A,B,C	Decorative HVAC Duct Coating		ABB		
CLBRD- 006 A,B,C	4x8' Ceiling Board		ABB		
IWCLK- 007	Interior Window Caulk (2nd Fl)		ABB		
FLVCS- 008	Grey w/ Black Vinyl Floor Sheeting		ABB		
CLPT- 009 A,B,C	Ceiling paint		ABB		
WLSH-010 A,B,C	Typical Sheetrock wallboard		ABB		
IDCLK- 011	Interior Door Caulk (2nd FL)		ABB		
IWCLK- 012	Interior Window/Door Caulks (Basement)		ABB		

Special Instructions	PLEASE EMAIL RESULTS
----------------------	----------------------

Relinquished by	Date	Time	Received by	Date	Time
Randal L. Doss	25 Jul 12	TO FEDEX	[Signature]	JUL 26 2012	[Signature]

Unless scheduled, the turn around time for all samples received after 5 pm Friday will begin at 8 am Monday morning.
 Weekend or Holiday work must be scheduled ahead of time and is charged for rush turn around time.
 Work with standard turn around time sent Priority Overnight and Billed To Recipient will be charged a \$10 shipping fee.

SanAir Technologies Laboratory, Inc.

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 www.sanair.com

Asbestos Chain of Custody

SanAir ID Number
 120146660

Company: Hurt & Proffitt, Inc	Project #: 20090500	Phone #: 4348477796
Address: 2524 Langhorne Road	Project Name: Miller School Rehab	Phone #: 434-546-5330
City, St., Zip: Lynchburg, Virginia 24501	Date Collected: 25 Jul 12	Fax #: 4348470047
Samples Collected By: Randal L. Doss	P.O. Number:	Email: RLD@handp.com

Asbestos Analysis Types

Bulk		Air		Soil/Vermiculite	
ABB	PLM EPA 600/R-93/116	<input checked="" type="checkbox"/>	ABA	PCM NIOSH 7400	<input type="checkbox"/>
	Positive Stop	<input checked="" type="checkbox"/>	ABA-2	OSHA w/ TWA*	<input type="checkbox"/>
ABEPA	PLM EPA 400 Point Count	<input type="checkbox"/>	ABTEM	TEM AHERA	<input type="checkbox"/>
ABB1K	PLM EPA 1000 Point Count	<input type="checkbox"/>	ABATN	TEM NIOSH 7402	<input type="checkbox"/>
ABBEN	PLM EPA NOB	<input type="checkbox"/>	ABT2	TEM Level II	<input type="checkbox"/>
ABBCH	TEM Chatfield	<input type="checkbox"/>			
ABBTM	TEM EPA NOB	<input type="checkbox"/>			
			Water		
ABBNY	TEM NY ELAP 198.4	<input type="checkbox"/>	ABHE	EPA 100.2	<input type="checkbox"/>
OTHER/ Matrix :		<input type="checkbox"/>			
			Dust		
			ABWA	TEM Wipe ASTM D-6480	<input type="checkbox"/>
			ABDMV	TEM Microvac ASTM D-5755	<input type="checkbox"/>

Turn Around Times	<input type="checkbox"/> 3 HR (4 HR TEM)	<input type="checkbox"/> 6 HR (8HR TEM)	<input type="checkbox"/> 12 HR	<input checked="" type="checkbox"/> 24 HR
	2 Days <input type="checkbox"/>	3 Days <input type="checkbox"/>	4 Days <input type="checkbox"/>	5 Days <input checked="" type="checkbox"/>

Sample #	Sample Identification/Location	Volume or Area	Sample Type	Flow Rate*	Time* Start - Stop
EWCLK- 013	Exterior Window Caulk		ABB		
EWGLZ- 014	Exterior Window Glazing		ABB		

Special Instructions PLEASE EMAIL RESULTS

Relinquished by	Date	Time	Received by	Date	Time
Randal L. Doss	25 Jul 12	TO FEDEX	[Signature]	JUL 26 2012	[Signature]

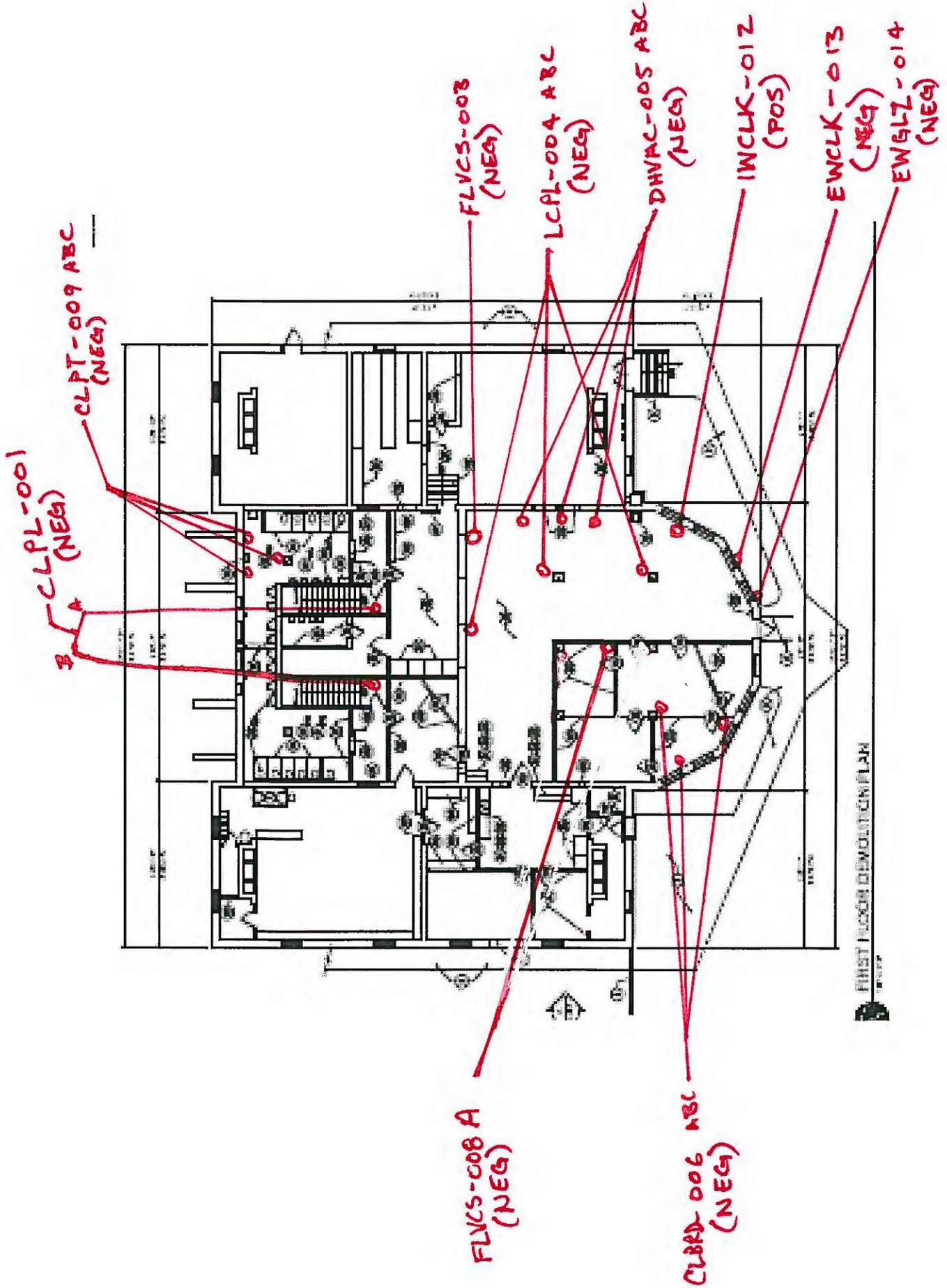
Unless scheduled, the turn around time for all samples received after 5 pm Friday will begin at 8 am Monday morning. Weekend or Holiday work must be scheduled ahead of time and is charged for rush turn around time. Work with standard turn around time sent Priority Overnight and Billed To Recipient will be charged a \$10 shipping fee.

Disclaimer

The final report cannot be reproduced, except in full, without written authorization from SanAir. Fibers smaller than 5 microns cannot be seen with this method due to scope limitations. The accuracy of the results is dependent upon the client's sampling procedure and information provided to the laboratory by the client. SanAir assumes no responsibility for the sampling procedure and will provide evaluation reports based solely on the sample and information provided by the client. This report may not be used by the client to claim product endorsement by NVLAP, AIHA or any other agency of the U.S. government; *and may not be certified by every local, state and federal regulatory agencies.*

Attachment C

**Drawings 1-4
Sample Location Maps**

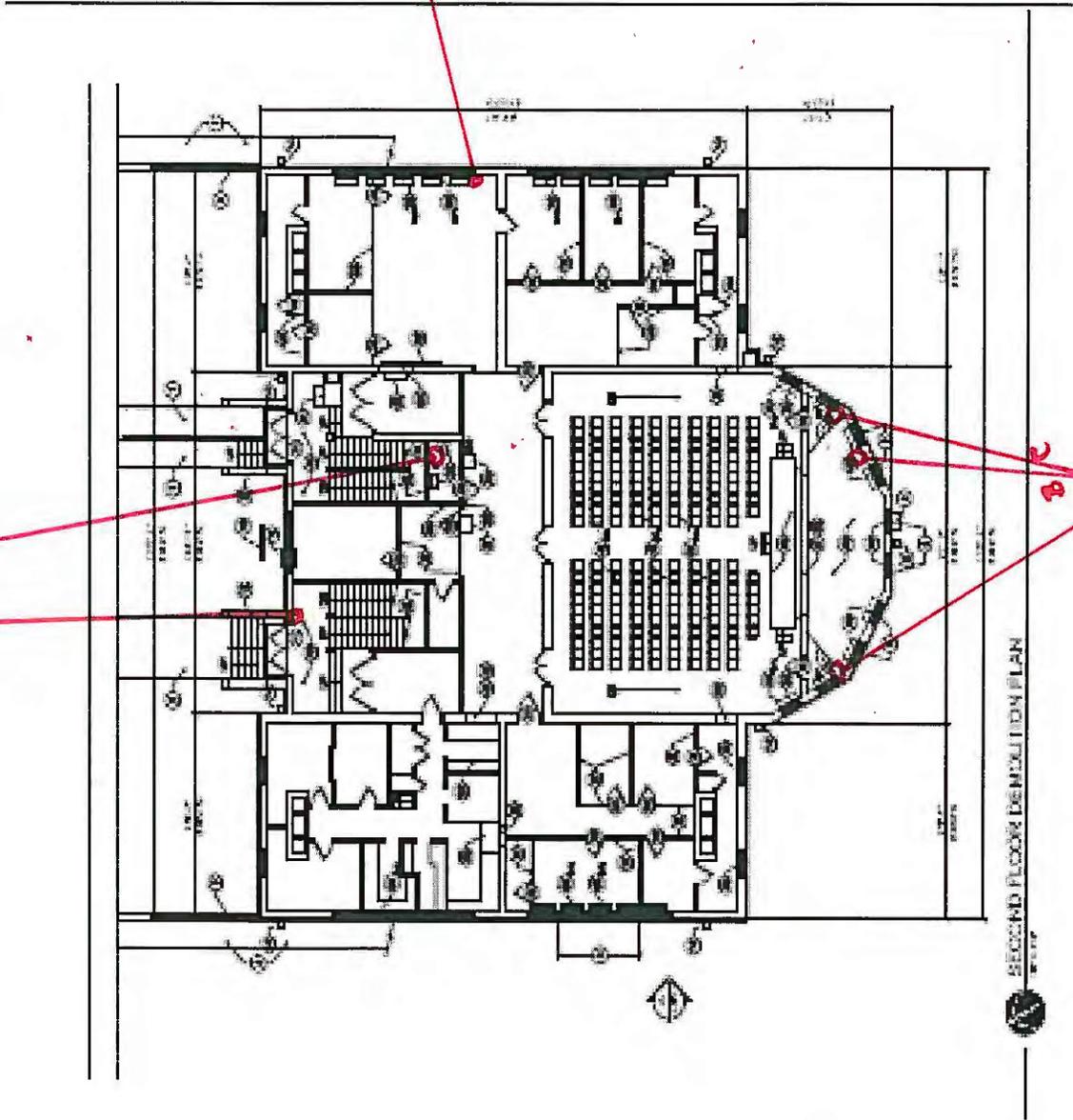


1DCLK-011
(NEG)

CLPL-001C
(NEG)

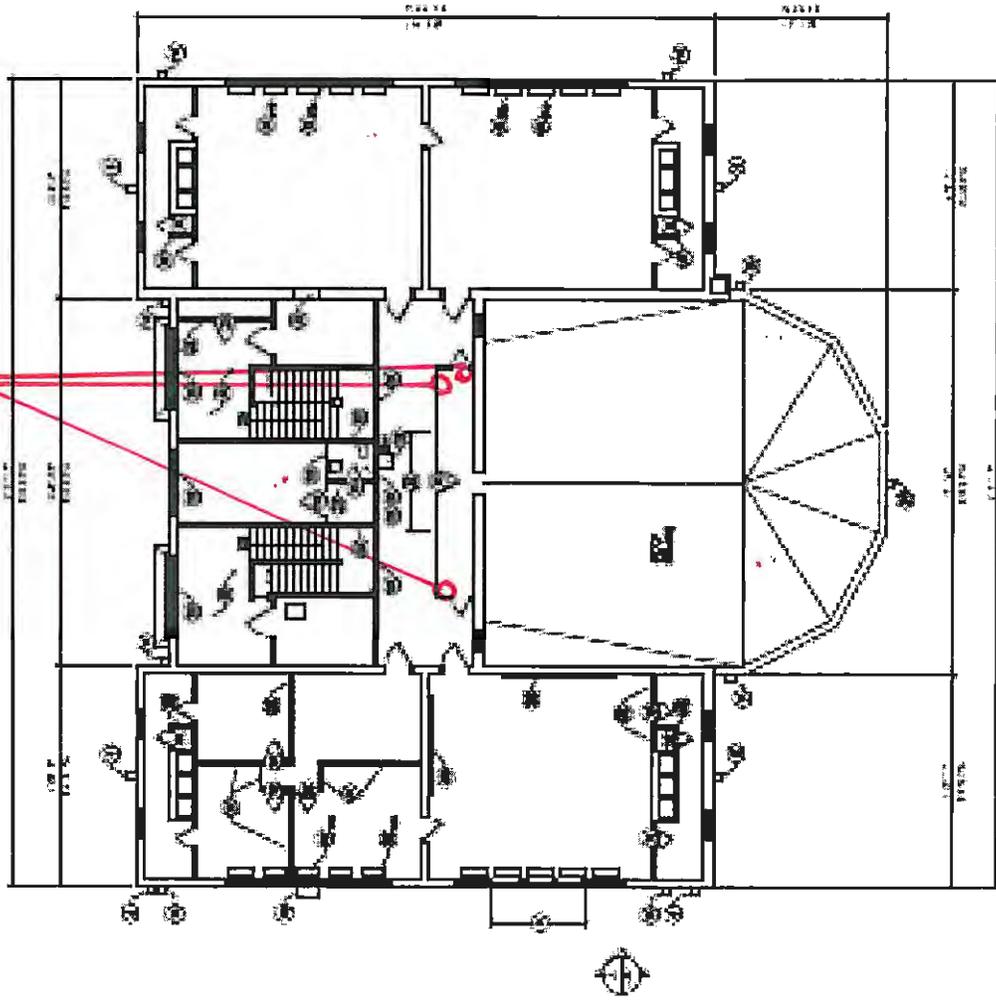
1WCLK-007
(NEG)

WLPL-002
(NEG)

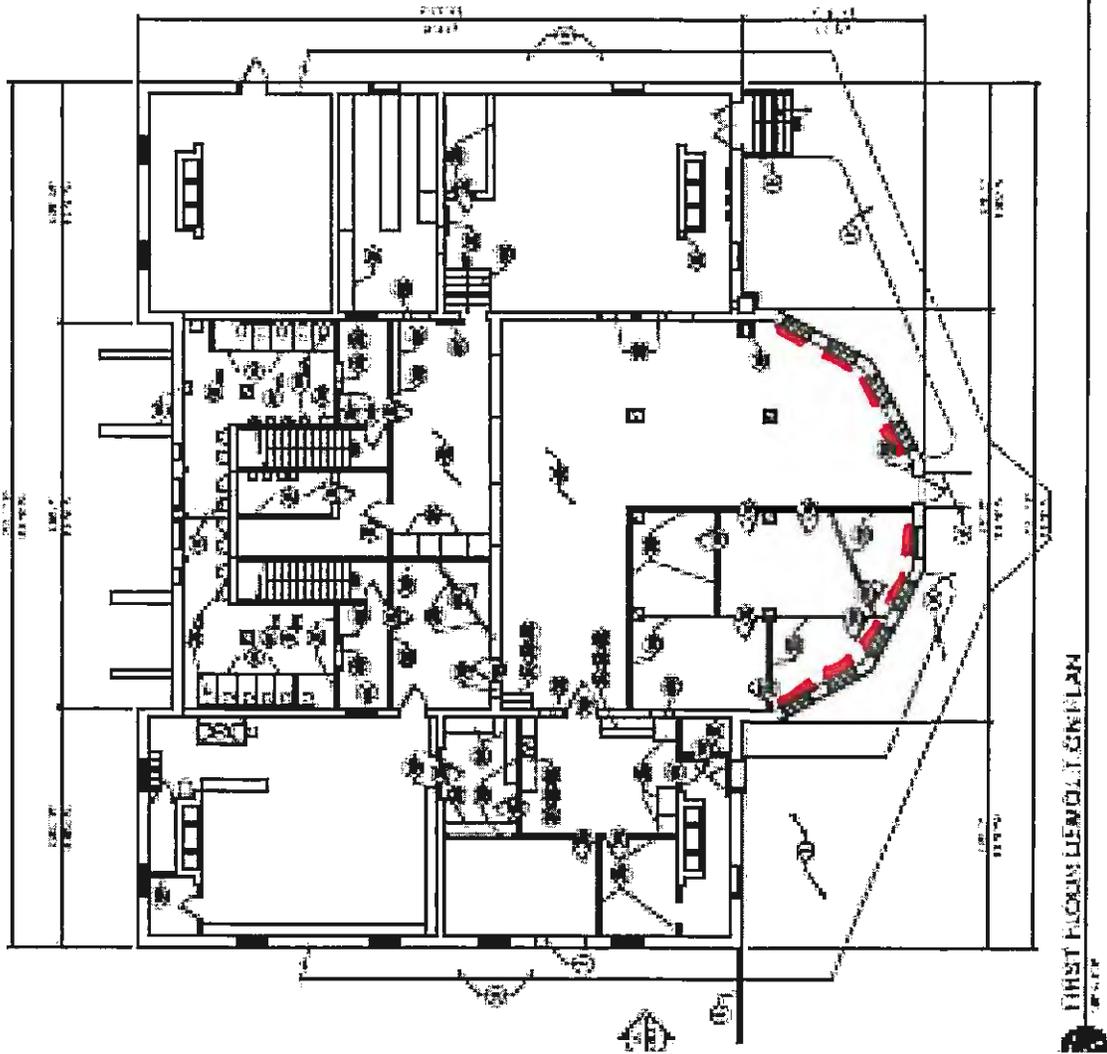


SECOND FLOOR DEMOLITION PLAN

WL SH-010 ABC
(NEG)



1-10-2011 FLOOR DEVELOPMENT PLAN



POS. ACM

IWCLK-01Z

White, Homogeneous
Interior window cask
(First Floor)

■ = Window w/ IWCLK-01Z

Part II

Lead-Based Paint Survey



LEAD-BASED PAINT AND LEAD-CONTAINING MATERIALS SURVEY REPORT

MILLER CENTER, 301 GROVE STREET, LYNCHBURG, VIRGINIA

1. INTRODUCTION

Stephen A. Bliley has been sub-contracted by Hurt and Proffitt Inc. of Lynchburg, VA, to perform an inspection for Lead-based paint (LBP) and Lead-containing materials (LCM) of portions of the Miller Center, 301 Grove Street, Lynchburg, Virginia. The specific intent of this task is to investigate for Lead contamination the portions of the Miller Center that will be subjected to demolition and reconstruction activities in a proposed renovation of these facilities. Mr. Bliley, a Virginia licensed Lead Risk Assessor (#3356 000624), performed the investigation on 19 and 20 July 2012.

2. SITE DESCRIPTION

The portions of the Miller Center investigated are distributed throughout the building and was guided by a demolition plan prepared by H&A Architects and Engineers. The Miller Center structure, built in 1911, is a three- story, former educational institution. The building is constructed with masonry exterior and (some) interior walls, original plaster on the interior side of the exterior walls and the principal interior partition walls, and some additional wood paneled or gypsum partitioning added in later years. Door and window elements are wood-framed. Floors are concrete on the First Floor, wood on the Second and Third Floors.

3. PRELIMINARY SITE ASSESSMENT

Miller Center personnel provided access to the proposed renovation site and a set of demolition drawings from which the investigator was able to deduce the existing building components that would be disturbed during the renovation. After study of the plans, a walk-through of the building ensued during which materials and coated surfaces were noted as suspect Lead-contaminated surfaces/substances if such surfaces and materials would be impacted by the renovation and reconstruction activities. Eleven types of coated surfaces and one type of ceramic tile were identified for further investigation by the collection of samples for laboratory analysis.

4. SAMPLING AND ANALYSIS

The portions of the Miller Center investigated are distributed throughout the building and was guided by a demolition plan prepared by H&A Architects and Engineers. The inspection of coated surfaces for LBP was performed by means of collecting paint chip samples from the coated surfaces identified during the preliminary site assessment. The paint chip samples were collected using a manual paint scraper. The removed paint chips were collected in a piece of clean construction paper for transfer into a plastic centrifuge tube.



The container was sealed with a screw-on cap and labeled with a unique sample number. Pertinent information for each sample including date of collection, location, color and condition of the surface coating and description of constituent layers was recorded on a sampling log form. In a similar fashion, bulk pieces of ceramic tile were collected, contained, labeled, and documented. A floor plan diagram indicating locations where paint-chip and ceramic tile samples were collected accompany this narrative document.

The paint chip and ceramic tile samples collected during the inspection were logged onto chain-of-custody forms, packaged with custody seals, and delivered by Federal Express to the analytical laboratory, SanAir Technologies Laboratory Inc. of Powhatan, VA. SanAir is licensed by the Commonwealth of Virginia for Lead analysis. SanAir analyzed the paint chip and ceramic tile samples for Lead content following EPA's Method SW 846/3051A/6010B (preparation by microwave-assisted acid digestion followed by analysis via inductively coupled plasma). Analytical results were reported as percent Lead by weight. A copy of the analytical laboratory report accompanies this narrative.

Table 1 presents analytical results and details about the paint chip samples collected during the inspection. Table 2 presents similar details about the ceramic tile samples. Each sample was collected in a location where a demolition/renovation operation has been specified to occur. The tables contain a citation from the H & A Architects and Engineers plan referencing the specific demolition/renovation operation associated with each sample. The analytical result for each sample provides an indication of the amount of Lead likely to be disturbed for each demolition/renovation operation cited where such operations impact similar materials in locations throughout the entire building.



Table 1 LBP Survey in Existing Miller Center

Sample Number	Building Component & Room	Color/Paint Condition	Substrate	Demolition Plan Note Number	Lead Content % weight
MC-Pb-01	Window Sill, 3F, Pottery/Stained Glass	Tan/Fair	Wood	No. 38	0.4342%
MC-Pb-02	Interior Wall, 3F Closet, Pottery/Stained Glass	White/Intact	Plaster	No. 22	0.4297%
MC-Pb-03	Door, 3F Closet, Pottery/Stained Glass	Lt. Blue/Intact	Wood	No. 23	5.0278%
MC-Pb-04	Radiator, 3F Dance	White/Intact	Metal	No. 56	0.3392%
MC-Pb-05	Interior Window sill, 3F Bathroom	White/Intact	Wood	Nos. 61, 62	0.8445%
MC-Pb-06	Blackboard Eraser Ledge, 3F Painting Room	Tan/Fair	Wood	No. 58	1.7596%
MC-Pb-07	Chair, Auditorium	Clear Varnish/Fair	Wood	No. 45	0.0088%
MC-Pb-08	Floor, Auditorium stage	Clear Varnish/Fair	Wood	No. 46	0.0203%



MC-Pb-09	Radiator, Auditorium	White/Poor	Metal	No. 56	0.1633%
MC-Pb-10	Window sill, Auditorium	Plum/Fair	Wood	No. 38	0.9026%
MC-Pb-11	Wall, Auditorium	White/Intact	Plaster	No. 50, No. 26	0.3715%
MC-Pb-12	Temporary Wall, Business Services Suite	Yellow/Intact	Wood Panel	No. 22	0.0013%
MC-Pb-13	Temporary Wall, Arts and Athletics Suite	Blue/Intact	Wood Panel	No. 22	0.0064%
MC-Pb-14	Doorway Casing Trim, 2F Exterior, Main Entry Doorway	White/Intact	Wood	No. 11	15.6587%
MC-Pb-15	Wall Baseboard, Auditorium	Plum/Intact	Wood	No. 26	1.44%
MC-Pb-16	Wall, 1F Game Room	Pale Green /Intact	Brick	No. 26	0.3703%
MC-Pb-17	Wall Baseboard, 1F Game Room	Light Green /Intact	Wood	No. 26	0.0038%
MC-Pb-18	Wall, Boiler Room	White, Red /Intact	Brick	No. 29	0.1397%
MC-Pb-19	Closet Door Frame, Boiler Room	Light Green /Intact	Wood	No. 23	2.1395%



MC-Pb-20	Fire Door. Boiler Room	Light Green /Fair	Metal	No. 27	8.5185%
MC-Pb-21	Stall Partition, 1F Men's Room	Light Blue /Fair	Metal	No. 24	0.0021%
MC-Pb-22	Temporary Wall, 1F Park Admin. Conf.	White/Intact	Wood	No. 22	0.0013%
MC-Pb-23	Window Unit, Exterior West Elevation	White/Intact	Wood	No. D1	10.746%

Table 2 Lead-Containing Ceramic Building Components					
Sample Number	Building Component & Room	Color	Dimension	Material Condition	Lead Content % weight
MC-CT-01	Wall, 1F Men's Room,	White w/Specks	4" x 4"	Intact	>0.001%

5. REGULATORY STANDARDS

The U.S. Environmental Protection Agency (EPA), Toxic Substances Control Act (TSCA) regulation 40 CFR Part 745; and the U.S. Department of Housing and Urban Development (US HUD) in *Guidelines for the Control of Lead-based Paint Hazards in Housing*; define Lead-based Paint (LBP) as any surface coating containing an amount of Lead equal to or greater than one-half (0.5%) percent by weight of the entire coating material. This is the applicable standard for the regulation of paint in housing and child-occupied facilities; and this standard is a generally accepted definition of Lead-based paint.

The U.S. Consumer and Safety Commission has published a standard that requires that surface coatings intended for use in occupied building interiors contain no greater than 0.06% Lead content by weight. Surface coatings that meet this requirement are referred to as CPSC Compliant in this report. Surface coatings that contain less than 0.5% and more than 0.06% Lead by weight are referred to as Lead-containing Paint LCP in this report.



US Occupational Health and Safety Administration (OSHA) regulation 29 CFR 1926.62 regulates Lead exposures at any level to the construction workforce. Specifically to the Miller Center, OSHA regulations pertain to workforce exposure where Lead-based Paint and Lead-containing Paint will be disturbed in construction, demolition and renovation operations.

A photographic log that presents photos of the locations where paint chip samples were collected follows the text portion of this report. The paints and varnish samples are classified as LBP, LCP and CPSC compliant in the photo captions.

Child-occupied facility is defined in the Virginia Administrative Code Section 15-30-20 as any facility constructed prior to 1978, visited regularly by the same child 6 years of age or under, on at least two different days within any week, provided that each day's visit lasts at least three hours and the combined weekly visits last six hours, and the combined annual visits last at least sixty hours. The investigator conducted an interview with Miller Center administrative personnel during which it was determined that The Miller Center likely meets the definition of a child-occupied facility.

6. INVESTIGATION FINDINGS

- The ceramic tiled surface that was tested contained extremely low levels of Lead.
- The two varnished components tested, Auditorium chairs and stage floor, found CPSC compliant surface coatings.
- Testing of painted surfaces found a wide range of Lead content in the paints:
- Two samples of paint(s) on exterior components, one door frame trim and one window trim, found LBP with Lead content in excess of 10%.
- One sample of paint on a fire door found LBP with Lead content in excess of 8.5%.
- Three samples of interior window sills found LBP (2) and LCP (1).
- Two samples collected, one from an interior door, one from an interior door frame, found LBP.
- One sample from a blackboard eraser ledge found LBP.
- Two samples collected from interior baseboard trim found LBP (1) and CPSC compliant (1) paint.
- Two samples collected from plaster walls found LCP. The plaster ceiling in the Auditorium scheduled for demolition was not accessible for testing. The ceiling is likely to have LCP or LBP comparable to the wall samples.
- Two samples collected from metal radiators found LCP.
- Two samples collected from brick walls found LCP.
- Three samples collected from "temporary" partition walls; likely installed well after 1911, found CPSC Compliant paint.
- One sample collected from a bathroom stall partition found CPSC Compliant paint.

Paint testing in the Miller Center indicates that significant amounts of Lead-based paint and Lead-containing paint will be disturbed during the proposed renovation. Disturbance of LBP/LCP in child-occupied facilities is regulated by the US EPA in 40 CFR Part 745 and US Department of Housing and



Urban Development regulations in *Guidelines for the Evaluation and Control of LBP Hazards in Housing*. These regulations specify the use of trained, certified (and/or licensed) personnel, specific work practices to be utilized (and avoided) during the conduct of the renovation, containment of Lead-contamination during construction operations, decontamination (cleaning) of contaminated areas post construction and post construction clearance testing prior to re-occupancy. Additionally, OSHA regulations for protection of the construction workforce mentioned in Section Four of this report will be applicable to the proposed renovation.

Considering the extent of the proposed renovation, the presumption that the Miller Center is a child-occupied facility, the significant amounts of Lead-based Paint and Lead-containing Paint to be disturbed, the complexity of Federal and State regulation pertaining to the proposed renovation, and the significant legal liabilities inherent in a project that can expose children, building occupants and the workforce to adverse health consequences; the City of Lynchburg and the Miller Center would be well-advised to employ a Virginia-licensed Lead Abatement Project Designer to produce a design plan for the management of Lead contamination issues during the renovation and the LBP/LCP that will remain in the building after the completion of the renovation.

Miller Center employees, maintenance personnel and construction contractors employed by the Miller Center must be informed of the findings of this investigation. Maintenance personnel who work on this building require Lead-awareness training that focuses on the avoidance of disturbance of LBP/LCP, personal and occupant protection from lead exposure, and appropriate clean-up of work sites where LBP/LCP has, of necessity, been disturbed. Occupants and employees who visit and/or work in the building should be informed as to the presence of LBP/LCP in the building; and provided access to the EPA-approved pamphlets *Protect Your Family from Lead in Your Home*, or *Renovate Right: Important Lead Hazard Information for Families, Child Care Providers and Schools*. These materials are available at www.epa.gov or from the local Health Department.

7. ENCLOSURES

Photographic Record

Analytical Laboratory Report

Virginia DPOR Licenses

LBP INVESTIGATION PHOTOGRAPH LOG



Photograph 1 Sample MC-Pb-01 from Windowsill contains 0.4342% Lead; Lead-containing Paint



Photograph 2 Sample MC-Pb-02 from Plaster Wall contains 0.4297% Lead; Lead-containing Paint



Photograph 3 Sample MC-Pb-03 from Door contains 5.0278% Lead; Lead-based Paint



Photograph 4 Sample MC-Pb-04 from Radiator contains 0.3392% Lead; Lead-containing Paint



Photograph 5 Sample MC-Pb-05 from Windowsill contains 0.8445% Lead; Lead-based Paint



Photograph 6 Sample MC-Pb-06 from Eraser Ledge contains 1.7596% Lead; Lead-based Paint



Photograph 7 Sample MC-Pb-07, Varnish from Chair contains 0.0088% Lead; CPSC Compliant Surface-coating



Photograph 8 Sample MC-Pb-08; Varnish from Stage Floor contains 0.0203% Lead; CPSC Compliant Surface-coating



Photograph 9 Sample MC-Pb-09 from Radiator contains 0.1633% Lead; Lead-containing Paint



Photograph 10 Sample MC-Pb-10 from Windowsill contains 0.9026% Lead; Lead-based Paint



Photograph 11 Sample MC-Pb-11 from Wall contains 0.3715% Lead; Lead-containing Paint



Photograph 12 Sample MC-Pb-12 from Wall contains 0.0013% Lead; CPSC Compliant Paint



Photograph 13 MC-Pb-13 from Wall contains 0.0064% Lead; CPSC Compliant Paint



Photograph 14 Sample MC-Pb-14 from Door Frame Trim contains 15.6587% Lead; Lead-based Paint



Photograph 15 Sample MC-Pb-15 from Baseboard contains 1.44% Lead; Lead-based Paint



Photograph 16 Sample MC-Pb-16 from Wall contains 0.3703% Lead; Lead-containing Paint.
Sample MC-Pb-17 from Baseboard contains 0.0038% Lead; CPSC Compliant Paint



Photograph 17 Sample MC-Pb-18 from Wall contains 0.1397% Lead; Lead-containing Paint



Photograph 18 Sample MC-Pb-19 from Door Frame contains 2.1395% Lead; Lead-based Paint



Photograph 19 Sample MC-Pb-20 from Fire Door contains 8.5185% Lead; Lead-based Paint

SAMPLE MC-PB-21 PHOTO NOT AVAILABLE

Sample MC-Pb-21 from Bathroom Stall Partition contains 0.0021% Lead; CPSC Compliant Paint



Photograph 6 Sample MC-Pb-22 from Wall contains 0.0013% Lead; CPSC Compliant Paint



Photograph 7 Sample MC-Pb-23 from Window Frame contains 10.745% Lead; Lead-based Paint

SanAir Technologies Laboratory

Analysis Report prepared for Hurt & Proffitt, Inc.

Report Date: 7/24/2012
**Project Name: Miller Center
Renovation**
Project #: 20090500 Task 624
SanAir ID#: 12014349



NVLAP LAB CODE 200870-0



Certification # 652931



License # LAB0166



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www.sanair.com



SanAir Technologies Laboratory, Inc.

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Hurt & Proffitt, Inc.
2524 Langhorne Road
Lynchburg, VA 24501

July 24, 2012

SanAir ID # 12014349
Project Name: Miller Center Renovation
Project Number: 20090500 Task 624

Dear Stephen A. Bliley,

We at SanAir would like to thank you for the work you recently submitted. The 23 sample(s) were received on Monday, July 23, 2012 via FedEx. The final report(s) is enclosed for the following sample(s): MC-PB-01, MC-PB-02, MC-PB-03, MC-PB-04, MC-PB-05, MC-PB-06, MC-PB-07, MC-PB-08, MC-PB-09, MC-PB-10, MC-PB-11, MC-PB-12, MC-PB-13, MC-PB-14, MC-PB-15, MC-PB-16, MC-PB-17, MC-PB-18, MC-PB-19, MC-PB-20, MC-PB-21, MC-PB-22, MC-PB-23.

These results only pertain to this job and should not be used in the interpretation of any other job. This report is only complete in its entirety. Refer to the listing below of the pages included in a complete final report.

Sincerely,

Stephanie Hobaugh
Lead Laboratory Manager
SanAir Technologies Laboratory

Final Report Includes:
- Cover Letter
- Analysis Pages
- Disclaimers and Additional Information

sample conditions:
23 sample(s) in Good condition



SanAir Technologies Laboratory, Inc.

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Web: <http://www.sanair.com> E-mail: iaq@sanair.com

SanAir ID Number

12014349

FINAL REPORT

Name: Hurt & Proffitt, Inc.
Address: 2524 Langhorne Road
Lynchburg, VA 24501

Project Number: 20090500 Task 624
P.O. Number:
Project Name: Miller Center Renovation

Collected Date: 7/20/2012
Received Date: 7/23/2012 10:00:00 AM
Report Date: 7/24/2012 12:17:59 PM
Analyst: Hobaugh, Stephanie

Lead Paint Analysis

Test Method: SW846/3051A/6010B

Sample	Description	Results In % By Weight
12014349-001	MC-PB-01 / Window Sill-3rd Flr	0.4342 %

Test Method: SW846/3051A/6010B

Sample	Description	Results In % By Weight
12014349-002	MC-PB-02 / Plaster Wall - 3rd Flr	0.4297 %

Test Method: SW846/3051A/6010B

Sample	Description	Results In % By Weight
12014349-003	MC-PB-03 / Door/Frame-3rd Flr	5.0278 %

Test Method: SW846/3051A/6010B

Sample	Description	Results In % By Weight
12014349-004	MC-PB-04 / Radiator-3rd Flr	0.3392 %

Test Method: SW846/3051A/6010B

Sample	Description	Results In % By Weight
12014349-005	MC-PB-05 / Window Sill-3rd Flr	0.8445 %

Test Method: SW846/3051A/6010B

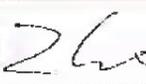
Sample	Description	Results In % By Weight
12014349-006	MC-PB-06 / Blackboard-3rd Flr	1.7596 %

Test Method: SW846/3051A/6010B

Sample	Description	Results In % By Weight
12014349-007	MC-PB-07 / Chair Varnish-Auditorium	0.0088 %

Certification

Signature: 
Date: 7/24/2012

Reviewed:  
Date: 7/24/2012



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SanAir ID Number

12014349

FINAL REPORT

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Address: 2524 Langhorne Road
Lynchburg, VA 24501

Project Number: 20090500 Task 624
P.O. Number:
Project Name: Miller Center Renovation

Collected Date: 7/20/2012
Received Date: 7/23/2012 10:00:00 AM
Report Date: 7/24/2012 12:17:59 PM
Analyst: Hobaugh, Stephanie

Paint Analysis

Test Method: SW846/3051A/6010B

Sample	Description	Results In % By Weight
12014349-008	MC-PB-08 / Stage Floor Varnish-Auditorium	0.0203 %

Test Method: SW846/3051A/6010B

Sample	Description	Results In % By Weight
12014349-009	MC-PB-09 / Radiator-Auditorium	0.1633 %

Test Method: SW846/3051A/6010B

Sample	Description	Results In % By Weight
12014349-010	MC-PB-10 / Window Sill - Auditorium	0.9026 %

Test Method: SW846/3051A/6010B

Sample	Description	Results In % By Weight
12014349-011	MC-PB-11 / Plaster Wall-Auditorium	0.3715 %

Test Method: SW846/3051A/6010B

Sample	Description	Results In % By Weight
12014349-012	MC-PB-12 / Partition Wall - 2F- Bussiness SVCS	0.0013 %

Test Method: SW846/3051A/6010B

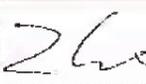
Sample	Description	Results In % By Weight
12014349-013	MC-PB-13 / Partition Wall -2F-Arts/Athletics	0.0064 %

Test Method: SW846/3051A/6010B

Sample	Description	Results In % By Weight
12014349-014	MC-PB-14 / Doorway Trim-2F-Exterior	15.6587 %

Certification

Signature: 
Date: 7/24/2012

Reviewed:  
Date: 7/24/2012



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SanAir ID Number

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FINAL REPORT

Name: Hurt & Proffitt, Inc.
Address: 2524 Langhorne Road
Lynchburg, VA 24501

Project Number: 20090500 Task 624
P.O. Number:
Project Name: Miller Center Renovation

Collected Date: 7/20/2012
Received Date: 7/23/2012 10:00:00 AM
Report Date: 7/24/2012 12:17:59 PM
Analyst: Hobaugh, Stephanie

Paint Analysis

Test Method: SW846/3051A/6010B

Sample	Description	Results In % By Weight
12014349-015	MC-PB-15 / Baseboard-Auditorium	1.44 %

Test Method: SW846/3051A/6010B

Sample	Description	Results In % By Weight
12014349-016	MC-PB-16 / Brick Wall - 1 Floor Game Room	0.3703 %

Test Method: SW846/3051A/6010B

Sample	Description	Results In % By Weight
12014349-017	MC-PB-17 / Baseboard - 1 Floor Game Room	0.0038 %

Test Method: SW846/3051A/6010B

Sample	Description	Results In % By Weight
12014349-018	MC-PB-18 / Brick Wall - 1 Flr Boiler Room	0.1397 %

Test Method: SW846/3051A/6010B

Sample	Description	Results In % By Weight
12014349-019	MC-PB-19 / Door Frame-1Flr Boiler Rm	2.1395 %

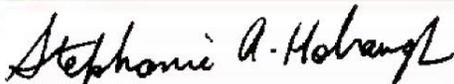
Test Method: SW846/3051A/6010B

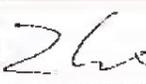
Sample	Description	Results In % By Weight
12014349-020	MC-PB-20 / Fire Door - 1 Flr Boiler Room	8.5185 %

Test Method: SW846/3051A/6010B

Sample	Description	Results In % By Weight
12014349-021	MC-PB-21 / Stall Partition-1Flr-Mens Room	0.0021 %

Certification

Signature: 
Date: 7/24/2012

Reviewed:  
Date: 7/24/2012



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Name: Hurt & Proffitt, Inc.
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Project Number: 20090500 Task 624
P.O. Number:
Project Name: Miller Center Renovation

Collected Date: 7/20/2012
Received Date: 7/23/2012 10:00:00 AM
Report Date: 7/24/2012 12:17:59 PM
Analyst: Hobaugh, Stephanie

Paint Analysis

Test Method: SW846/3051A/6010B

Sample	Description	Results In % By Weight
12014349-022	MC-PB-22 / Partition Wall-1 Flr-Park Admin.	0.0013 %

Test Method: SW846/3051A/6010B

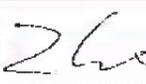
Sample	Description	Results In % By Weight
12014349-023	MC-PB-23 / Exterior Window	10.746 %

Minimum Quantitative Limit < 0.001%

SanAir Technologies Laboratory, Inc participates in the AIHA ELPAT for environmental Lead.
AIHA Lab Id: 162952

Certification

Signature: 
Date: 7/24/2012

Reviewed:  
Date: 7/24/2012



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FINAL REPORT

Name: Hurt & Proffitt, Inc.
Address: 2524 Langhorne Road
Lynchburg, VA 24501

Project Number: 20090500 Task 624
P.O. Number:
Project Name: Miller Center Renovation

Collected Date: 7/20/2012
Received Date: 7/23/2012 10:00:00 AM
Report Date: 7/24/2012 12:17:59 PM

ORGANISM DESCRIPTIONS

The descriptions of the organisms presented are derived from various reference materials. The laboratory report is based on the data derived from the samples submitted and no interpretation of the data, as to potential, or actual, health effects resulting from exposure to the numbers of organisms found, can be made by laboratory personnel. Any interpretation of the potential health effects of the presence of this organism must be made by qualified professional personnel with first hand knowledge of the sample site, and the problems associated with that site.

Disclaimer

- Results relate only to the items tested
- Results are not corrected for blanks
- All quality control results are acceptable unless otherwise noted
- SanAir Technologies Laboratory, Inc is not responsible for sample collection or interpretation made by others
- This report does not constitute endorsement by AIHA/NVLAP and/or any other U.S. governmental Agencies; and may not be certified by every local, state or federal regulatory agencies

Lead Exposure Limits

Air

1.5 $\mu\text{g}/\text{m}^3$	EPA National Ambient Air Quality Standard (Quality Time – Weight Average)
30 $\mu\text{g}/\text{m}^3$	OSHA Action Level (8-hour time weighted average)
50 $\mu\text{g}/\text{m}^3$	OSHA Permissible Exposure Limit (General Industry)
50 $\mu\text{g}/\text{m}^3$	OSHA Permissible Exposure Limit (Construction)

Dust

40 $\mu\text{g}/\text{ft}^2$	HUD Clearance Level for Floors
250 $\mu\text{g}/\text{ft}^2$	HUD Clearance Level for Interior Window Sills
800 $\mu\text{g}/\text{ft}^2$	HUD Clearance Level for Window Wells

Water

15 ppb ($\mu\text{g}/\text{liter}$)	EPA Maximum Containment Level
---------------------------------------	-------------------------------

Paint

0.5% by weight	HUD definition of lead based paint
1.0 mg/cm^2	
5000 ppm	

Soil

400 ppm	HUD-Play areas and high-contact areas for children
---------	--

Hazardous Waste

5 ppm	Analyzed as "leachable" using Toxicity Characteristic Leachate Procedure (TCLP)
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Metals & Lead
Chain of Custody

SanAir ID Number

12014390

Company: Hurt & Proffitt, Inc	Project #: 20090500 TASK 024	Phone #: 434-847-7796
Address: 2524 Langhorne Road	Project Name: Miller Center Renovation	Phone #: 434-841-3893
City, St., Zip: Lynchburg, Virginia 24501	Date Collected: 20 July 2012	Fax #: 434-847-0096
Samples Collected By: Stephen A. Bliley	P.O. Number:	Email: wcn@handp.com

Matrix

Metals Analysis Types

<input type="checkbox"/> Air	<input type="checkbox"/> Aqueous	<input type="checkbox"/> Bulk	<input checked="" type="checkbox"/> Total Concentration of Lead	<input type="checkbox"/> Other:
<input checked="" type="checkbox"/> Paint	<input type="checkbox"/> Sludge	<input type="checkbox"/> Soil	<input type="checkbox"/> TCLP Lead	
<input type="checkbox"/> Solid	<input type="checkbox"/> Wipe	<input type="checkbox"/> Water, DW	<input type="checkbox"/> GFAA	
<input type="checkbox"/> Dust	<input type="checkbox"/> Sludge	<input type="checkbox"/> Wastewater	<input type="checkbox"/> TCLP / RCRA Metals	
<input type="checkbox"/> Other:			<input type="checkbox"/> TCLP/ Full (w/ organics)	

*Turn Around Times	<input type="checkbox"/> Same Day	<input type="checkbox"/> 1 Day	<input type="checkbox"/> 2 days	<input type="checkbox"/> 3 Days
	Standard (5 day) <input checked="" type="checkbox"/>	Full TCLP (10d) <input type="checkbox"/>	Weekend <input type="checkbox"/>	

*Courier charge for same day and 1 day TAT.

Sample #	Sample Identification/Location	Sample Type	Volume or Area
MC-Pb-01	Window Sill - 3rd Flr	Paint chip	N/A
MC-Pb-02	Plaster wall - 3rd Flr	↓	↓
MC-Pb-03	Door/Frames - 3rd Flr		
MC-Pb-04	Radiator - 3rd Flr		
MC-Pb-05	Window Sill - 3rd Flr		
MC-Pb-06	Blackboard - 3rd Flr		
MC-Pb-07	Chair - Auditorium		
MC-Pb-08	Stage Floor - Auditorium		
MC-Pb-09	Radiator - Auditorium		
MC-Pb-10	Window Sill - Auditorium		
MC-Pb-11	Plaster wall - Auditorium		
MC-Pb-12	Partition wall - 2nd - Business Sucs		

Special Instructions	Please Email Results
----------------------	----------------------

Relinquished by	Date	Time	Received by	Date	Time
Stephen A. Bliley	20 July 2012	1800 - TOPEKA	WCD	JUL 23 2012	10AM

Unless scheduled, the turn around time for all samples received after 5 pm Friday will begin at 8 am Monday morning. Weekend or Holiday work must be scheduled ahead of time and is charged for rush turn around time. Work with standard turn around time sent Priority Overnight and Billed To Recipient will be charged a shipping fee.

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 www.sanair.com

Metals & Lead
 Chain of Custody

SanAir ID Number

12014349

Company: Hurt & Proffitt, Inc	Project #: 20090500 TASK 624	Phone #: 434-847-7796
Address: 2524 Langhorne Road	Project Name: Miller Center Renovation	Phone #: 434-841-3893
City, St., Zip: Lynchburg, Virginia 24501	Date Collected: 20 July 2012	Fax #: 434-847-0096
Samples Collected By: Stephen A. Bliley	P.O. Number:	Email: wcn@handp.com

Matrix *NOTE: LAST SAMPLE ONLY*

Matrix			Metals Analysis Types		
<input type="checkbox"/> Air	<input type="checkbox"/> Aqueous	<input checked="" type="checkbox"/> Bulk	<input checked="" type="checkbox"/> Total Concentration of Lead	<input type="checkbox"/> Other:	
<input checked="" type="checkbox"/> Paint	<input type="checkbox"/> Sludge	<input type="checkbox"/> Soil	<input type="checkbox"/> TCLP Lead		
<input type="checkbox"/> Solid	<input type="checkbox"/> Wipe	<input type="checkbox"/> Water, DW	<input type="checkbox"/> GFAA		
<input type="checkbox"/> Dust	<input type="checkbox"/> Sludge	<input type="checkbox"/> Wastewater	<input type="checkbox"/> TCLP / RCRA Metals		
<input type="checkbox"/> Other:			<input type="checkbox"/> TCLP/ Full (w/ organics)		

*Turn Around Times	<input type="checkbox"/> Same Day	<input type="checkbox"/> 1 Day	<input type="checkbox"/> 2 days	<input type="checkbox"/> 3 Days
	Standard (5 day) <input checked="" type="checkbox"/>	Full TCLP (10d) <input type="checkbox"/>	Weekend <input type="checkbox"/>	

*Courier charge for same day and 1 day TAT.

Sample #	Sample Identification/Location	Sample Type	Volume or Area	
MC-Pb-13	Partition Wall - 2F - Arts/Athletics	Paint Chip	}	
MC-Pb-14	Doorway Trim - 2F - Exterior			
MC-Pb-15	Baseboard - 2F - [unclear]			
MC-Pb-16	Brick Wall - 1F - [unclear] Room			
MC-Pb-17	Baseboard - 1F - [unclear] Room			
MC-Pb-18	Brick Wall - 1F - [unclear] Room			
MC-Pb-19	Door Frame - 1F - [unclear] Room			
MC-Pb-20	Fire Door - 1F - [unclear] Room			
MC-Pb-21	Stall Partition - 1F - Men's Room			
MC-Pb-22	Partition Wall - 1F - Park Admin.			
MC-Pb-23	Exterior Window			
MC-CT-01	Ceramic Tile - 1F - Men's Room	Bulk - Analyze Gazing		

Special Instructions	Please Email Results
----------------------	----------------------

Relinquished by	Date	Time	Received by	Date	Time
Stephen A. Bliley	20 July 2012	1800 - To Fedex	<i>MM</i>	Jul 23 2012	10AM

Unless scheduled, the turn around time for all samples received after 5 pm Friday will begin at 8 am Monday morning. Weekend or Holiday work must be scheduled ahead of time and is charged for rush turn around time. Work with standard turn around time sent Priority Overnight and Billed To Recipient will be charged a shipping fee.

END of Samples
 23 PAINTCHIP - 1 Bulk - SIBU

SanAir Technologies Laboratory

Analysis Report prepared for Hurt & Proffitt, Inc.

Report Date: 7/24/2012
**Project Name: Miller Center
Renovation**
Project #: 20090500 Task 624
SanAir ID#: 12014350



NVLAP LAB CODE 200870-0



Certification # 652931



License # LAB0166



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www.sanair.com



SanAir Technologies Laboratory, Inc.

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804.897.1177 Toll Free: 888.895.1177 Fax: 804.897.0070
Web: <http://www.sanair.com> E-mail: iaq@sanair.com

Hurt & Proffitt, Inc.
2524 Langhorne Road
Lynchburg, VA 24501

July 24, 2012

SanAir ID # 12014350
Project Name: Miller Center Renovation
Project Number: 20090500 Task 624

Dear Stephen A. Billey,

We at SanAir would like to thank you for the work you recently submitted. The 1 sample(s) were received on Monday, July 23, 2012 via FedEx. The final report(s) is enclosed for the following sample(s): MC-CT-01.

These results only pertain to this job and should not be used in the interpretation of any other job. This report is only complete in its entirety. Refer to the listing below of the pages included in a complete final report.

Sincerely,

Stephanie Hobaugh
Lead Laboratory Manager
SanAir Technologies Laboratory

Final Report Includes:
- Cover Letter
- Analysis Pages
- Disclaimers and Additional Information

sample conditions:
1 sample(s) in Good condition



SanAir Technologies Laboratory, Inc.

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SanAir ID Number

12014350

FINAL REPORT

Name: Hurt & Proffitt, Inc.
Address: 2524 Langhorne Road
Lynchburg, VA 24501

Project Number: 20090500 Task 624
P.O. Number:
Project Name: Miller Center Renovation

Collected Date: 7/20/2012
Received Date: 7/23/2012 10:00:00 AM
Report Date: 7/24/2012 12:18:19 PM
Analyst: Hobaugh, Stephanie

Lead Bulk Analysis

Test Method: SW846/3051A/6010B

Sample	Description	Results in % By Weight
12014350-001	MC-CT-01 / Ceramic Tile-1 Flr Men's Room	< 0.001%

Minimum Quantitative Limit < 0.001%

SanAir Technologies Laboratory, Inc participates in the AIHA ELPAT for environmental Lead.
AIHA Lab Id: 162952

Certification

Signature: Stephanie A. Hobaugh
Date: 7/24/2012

Reviewed: [Signature]
Date: 7/24/2012



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Web: <http://www.sanair.com> E-mail: iaq@sanair.com

SanAir ID Number

12014350

FINAL REPORT

Name: Hurt & Proffitt, Inc.
Address: 2524 Langhorne Road
Lynchburg, VA 24501

Project Number: 20090500 Task 624
P.O. Number:
Project Name: Miller Center Renovation

Collected Date: 7/20/2012
Received Date: 7/23/2012 10:00:00 AM
Report Date: 7/24/2012 12:18:19 PM

ORGANISM DESCRIPTIONS

The descriptions of the organisms presented are derived from various reference materials. The laboratory report is based on the data derived from the samples submitted and no interpretation of the data, as to potential, or actual, health effects resulting from exposure to the numbers of organisms found, can be made by laboratory personnel. Any interpretation of the potential health effects of the presence of this organism must be made by qualified professional personnel with first hand knowledge of the sample site, and the problems associated with that site.

Disclaimer

- Results relate only to the items tested
- Results are not corrected for blanks
- All quality control results are acceptable unless otherwise noted
- SanAir Technologies Laboratory, Inc is not responsible for sample collection or interpretation made by others
- This report does not constitute endorsement by AIHA/NVLAP and/or any other U.S. governmental Agencies; and may not be certified by every local, state or federal regulatory agencies

Lead Exposure Limits

Air

1.5 $\mu\text{g}/\text{m}^3$	EPA National Ambient Air Quality Standard (Quality Time – Weight Average)
30 $\mu\text{g}/\text{m}^3$	OSHA Action Level (8-hour time weighted average)
50 $\mu\text{g}/\text{m}^3$	OSHA Permissible Exposure Limit (General Industry)
50 $\mu\text{g}/\text{m}^3$	OSHA Permissible Exposure Limit (Construction)

Dust

40 $\mu\text{g}/\text{ft}^2$	HUD Clearance Level for Floors
250 $\mu\text{g}/\text{ft}^2$	HUD Clearance Level for Interior Window Sills
800 $\mu\text{g}/\text{ft}^2$	HUD Clearance Level for Window Wells

Water

15 ppb ($\mu\text{g}/\text{liter}$)	EPA Maximum Containment Level
---------------------------------------	-------------------------------

Paint

0.5% by weight	HUD definition of lead based paint
1.0 mg/cm^2	
5000 ppm	

Soil

400 ppm	HUD-Play areas and high-contact areas for children
---------	--

Hazardous Waste

5 ppm	Analyzed as "leachable" using Toxicity Characteristic Leachate Procedure (TCLP)
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Metals & Lead
 Chain of Custody

SanAir ID Number
 12014380

Company: Hurt & Proffitt, Inc	Project #: 20090500 TASK 024	Phone #: 434-847-7796
Address: 2524 Langhorne Road	Project Name: Miller Center Renovation	Phone #: 434-841-3893
City, St., Zip: Lynchburg, Virginia 24501	Date Collected: 20 July 2012	Fax #: 434-847-0096
Samples Collected By: Stephen A. Bliley	P.O. Number:	Email: wcn@handp.com

Matrix

Metals Analysis Types

<input type="checkbox"/> Air	<input type="checkbox"/> Aqueous	<input type="checkbox"/> Bulk	<input checked="" type="checkbox"/> Total Concentration of Lead	<input type="checkbox"/> Other:
<input checked="" type="checkbox"/> Paint	<input type="checkbox"/> Sludge	<input type="checkbox"/> Soil	<input type="checkbox"/> TCLP Lead	
<input type="checkbox"/> Solid	<input type="checkbox"/> Wipe	<input type="checkbox"/> Water, DW	<input type="checkbox"/> GFAA	
<input type="checkbox"/> Dust	<input type="checkbox"/> Sludge	<input type="checkbox"/> Wastewater	<input type="checkbox"/> TCLP / RCRA Metals	
<input type="checkbox"/> Other:			<input type="checkbox"/> TCLP/ Full (w/ organics)	

*Turn Around Times	<input type="checkbox"/> Same Day	<input type="checkbox"/> 1 Day	<input type="checkbox"/> 2 days	<input type="checkbox"/> 3 Days
	Standard (5 day) <input checked="" type="checkbox"/>	Full TCLP (10d) <input type="checkbox"/>	Weekend <input type="checkbox"/>	

*Courier charge for same day and 1 day TAT.

Sample #	Sample Identification/Location	Sample Type	Volume or Area
MC-Pb-01	Window Sill - 3rd Flr	Paint chip	N/A
MC-Pb-02	Plaster wall - 3rd Flr	↓	↓
MC-Pb-03	Door/Frames - 3rd Flr		
MC-Pb-04	Radiator - 3rd Flr		
MC-Pb-05	Window Sill - 2nd Flr		
MC-Pb-06	Black Board - 2nd Flr		
MC-Pb-07	Chair - Auditorium		
MC-Pb-08	Stage Floor - Auditorium		
MC-Pb-09	Radiator - Auditorium		
MC-Pb-10	Window Sill - Auditorium		
MC-Pb-11	Plaster wall - Auditorium		
MC-Pb-12	Partition wall - 2F - Business SCS		

Special Instructions	Please Email Results
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Relinquished by	Date	Time	Received by	Date	Time
Stephen A. Bliley	20 July 2012	1800 - Total Ex	[Signature]	JUL 23 2012	10AM

Unless scheduled, the turn around time for all samples received after 5 pm Friday will begin at 8 am Monday morning.
 Weekend or Holiday work must be scheduled ahead of time and is charged for rush turn around time.
 Work with standard turn around time sent Priority Overnight and Billed To Recipient will be charged a shipping fee.

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Metals & Lead
 Chain of Custody

SanAir ID Number
 12014380

Company: Hurt & Proffitt, Inc	Project #: 20090500 TASK 624	Phone #: 434-847-7796
Address: 2524 Langhorne Road	Project Name: Miller Center Renovation	Phone #: 434-841-3893
City, St., Zip: Lynchburg, Virginia 24501	Date Collected: 20 July 2012	Fax #: 434-847-0096
Samples Collected By: Stephen A. Bliley	P.O. Number:	Email: wcn@handp.com

Matrix *NOTE: LAST SAMPLE ONLY*

Matrix			Metals Analysis Types		
<input type="checkbox"/> Air	<input type="checkbox"/> Aqueous	<input checked="" type="checkbox"/> Bulk	<input checked="" type="checkbox"/> Total Concentration of Lead	<input type="checkbox"/> Other:	
<input checked="" type="checkbox"/> Paint	<input type="checkbox"/> Sludge	<input type="checkbox"/> Soil	<input type="checkbox"/> TCLP Lead		
<input type="checkbox"/> Solid	<input type="checkbox"/> Wipe	<input type="checkbox"/> Water, DW	<input type="checkbox"/> GFAA		
<input type="checkbox"/> Dust	<input type="checkbox"/> Sludge	<input type="checkbox"/> Wastewater	<input type="checkbox"/> TCLP / RCRA Metals		
<input type="checkbox"/> Other:			<input type="checkbox"/> TCLP/ Full (w/ organics)		

*Turn Around Times	<input type="checkbox"/> Same Day	<input type="checkbox"/> 1 Day	<input type="checkbox"/> 2 days	<input type="checkbox"/> 3 Days
	Standard (5 day) <input checked="" type="checkbox"/>	Full TCLP (10d) <input type="checkbox"/>	Weekend <input type="checkbox"/>	

*Courier charge for same day and 1 day TAT.

Sample #	Sample Identification/Location	Sample Type	Volume or Area	
MC-Pb-13	Partition Wall - 2F - ARTS/ATHLETICS	Paint chip	}	
MC-Pb-14	Doorway Trim - 2F - EXTERIOR			
MC-Pb-15	Baseboard - 2F - MEN'S ROOM			
MC-Pb-16	Brick wall - 2F - MEN'S ROOM			
MC-Pb-17	Baseboard - 2F - MEN'S ROOM			
MC-Pb-18	Brick wall - 2F - MEN'S ROOM			
MC-Pb-19	Door frame - 2F - MEN'S ROOM			
MC-Pb-20	Fire door - 2F - MEN'S ROOM			
MC-Pb-21	Stall partition - 1F/R - Men's Room			
MC-Pb-22	Partition wall - 1F/R - PARK Admin.			
MC-Pb-23	Exterior window			
MC-C-01	Ceramic tile - 1F/R Men's Room	Bulk - Analyze Glazing		

Special Instructions	Please Email Results
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Relinquished by	Date	Time	Received by	Date	Time
Stephen A. Bliley	20 July 2012	1800 - ToFedex	MM	JUL 23 2012	MM

Unless scheduled, the turn around time for all samples received after 5 pm Friday will begin at 8 am Monday morning.
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 Work with standard turn around time sent Priority Overnight and Billed To Recipient will be charged a shipping fee.

END of Samples
 23 PAINTCHIP - 1 Bulk - Glazing

Details of license number 3356000624

Name:	BLILEY, STEPHEN ANDREW, SR
License Number:	3356000624
License Description:	Lead Risk Assessor License
Address:	FABER VA, 22938
Initial Certification Date:	May 23, 2002
Expiration Date:	April 30, 2013

Complaints

No Open Complaints

"Open Complaints" reflect only those complaints for which a departmental investigation has determined that sufficient evidence exists to establish probable cause of a violation of the law or regulations. Only those cases that have proceeded through an investigation to the adjudication stage are displayed. **State law prohibits the disclosure of any information about open complaints** [[Code of Virginia Section 54.1-108](#)]. Members of the public may review official records and obtain copies only after a complaint investigation is closed.

No Closed Complaints

"Closed Complaints" reflect complaints closed since 1990. Cases closed without disciplinary action are purged after three years in accordance with DPOR's record retention policy.

To inquire about closed complaints, see the department's [Public Records Access](#) or contact the department's Information Management Section at (804) 367-8583 or publicrecords@dpor.virginia.gov.

SanAir Technologies Laboratory

Analysis Report prepared for Hurt & Proffitt, Inc.

Report Date: 2/13/2013
Project Name: Miller Center
Renovation - Roof
Project #: 20090500 Task 623
SanAir ID#: 13002842



NVLAP LAB CODE 200870-0



Certification # 652931



License # LAB0166



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SanAir Technologies Laboratory, Inc.

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Hurt & Proffitt, Inc.
2524 Langhorne Road
Lynchburg, VA 24501

February 13, 2013

SanAir ID # 13002842
Project Name: Miller Center Renovation - Roof
Project Number: 20090500 Task 623

Dear W. Chris Nixon,

We at SanAir would like to thank you for the work you recently submitted. The 13 sample(s) were received on Wednesday, February 06, 2013 via FedEx. The final report(s) is enclosed for the following sample(s): RFDP-001A, RFM-002A, RFDS-003A, RFVS-004A, RFFL-005A, RFVFL-006A, RFRB-007A, RFEC-008A, RFEF-009A, RFEC-010A, RFPT-011A, RFBD-012A, RFSS-013A.

These results only pertain to this job and should not be used in the interpretation of any other job. This report is only complete in its entirety. Refer to the listing below of the pages included in a complete final report.

Sincerely,

Sandra Sobrino
Asbestos & Materials Laboratory Manager
SanAir Technologies Laboratory

Final Report Includes:

- Cover Letter
- Analysis Pages
- Disclaimers and Additional Information

sample conditions:

13 sample(s) in Good condition



SanAir Technologies Laboratory, Inc.

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Web: <http://www.sanair.com> E-mail: iaq@sanair.com

SanAir ID Number

13002842

FINAL REPORT

Name: Hurt & Proffitt, Inc.
Address: 2524 Langhorne Road
Lynchburg, VA 24501

Project Number: 20090500 Task 623
P.O. Number:
Project Name: Miller Center Renovation - Roof

Collected Date: 2/5/2013
Received Date: 2/6/2013 9:25:00 AM
Report Date: 2/13/2013 11:07:41 AM
Analyst: Sobrino, Sandra

Asbestos Bulk PLM EPA 600/R-93/116

SanAir ID / Description	Stereoscopic Appearance	Components		Asbestos Fibers
		% Fibrous	% Non-Fibrous	
RFDP-001A / 13002842-001 Roof Decking Paint / Theater Roof	Silver Non-Fibrous Homogeneous	100%	Other	None Detected

SanAir ID / Description	Stereoscopic Appearance	Components		Asbestos Fibers
		% Fibrous	% Non-Fibrous	
RFM-002A / 13002842-002 Roof Membrane / Layered Theater Roof, Insulation	Brown Fibrous Homogeneous	100% Cellulose	< 1% Other	None Detected
RFM-002A / 13002842-002 Roof Membrane / Layered Theater Roof, Tar Roof	Black Non-Fibrous Homogeneous		100% Other	None Detected

SanAir ID / Description	Stereoscopic Appearance	Components		Asbestos Fibers
		% Fibrous	% Non-Fibrous	
RFDS-003A / 13002842-003 Roof Drain Sealant / Theater Roof	Silver Non-Fibrous Homogeneous		97% Other	3% Chrysotile

SanAir ID / Description	Stereoscopic Appearance	Components		Asbestos Fibers
		% Fibrous	% Non-Fibrous	
RFVS-004A / 13002842-004 Roof Vent Sealant / Theater Roof	Black Non-Fibrous Homogeneous		96% Other	4% Chrysotile

SanAir ID / Description	Stereoscopic Appearance	Components		Asbestos Fibers
		% Fibrous	% Non-Fibrous	
RFFL-005A / 13002842-005 Roof Edge Flashing / Theater Roof	Silver Non-Fibrous Homogeneous		97% Other	3% Chrysotile

SanAir ID / Description	Stereoscopic Appearance	Components		Asbestos Fibers
		% Fibrous	% Non-Fibrous	
RFVFL-006A / 13002842-006 Roof Vent Flashing / Main	Black Non-Fibrous Homogeneous		95% Other	5% Chrysotile

Certification

Signature: *Sandra Sobrino*
Date: 2/13/2013

Reviewed: *Sandra Sobrino*
Date: 2/13/2013



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SanAir ID Number

13002842

FINAL REPORT

Name: Hurt & Proffitt, Inc.
Address: 2524 Langhorne Road
Lynchburg, VA 24501

Project Number: 20090500 Task 623
P.O. Number:
Project Name: Miller Center Renovation - Roof

Collected Date: 2/5/2013
Received Date: 2/6/2013 9:25:00 AM
Report Date: 2/13/2013 11:07:41 AM
Analyst: Sobrino, Sandra

Asbestos Bulk PLM EPA 600/R-93/116

SanAir ID / Description	Stereoscopic Appearance	Components		Asbestos Fibers
		% Fibrous	% Non-Fibrous	
RFRE-007A / 13002842-007 Roof Rubber Membrane / Main	Black Non-Fibrous Homogeneous		96% Other	4% Chrysotile

SanAir ID / Description	Stereoscopic Appearance	Components		Asbestos Fibers
		% Fibrous	% Non-Fibrous	
RFEC-008A / 13002842-008 Roof Edge Caulk / Main	Silver Non-Fibrous Heterogeneous		100% Other	None Detected

SanAir ID / Description	Stereoscopic Appearance	Components		Asbestos Fibers
		% Fibrous	% Non-Fibrous	
RFEF-009A / 13002842-009 Roof Edge Flashing / Main	Silver Non-Fibrous Homogeneous		100% Other	None Detected

SanAir ID / Description	Stereoscopic Appearance	Components		Asbestos Fibers
		% Fibrous	% Non-Fibrous	
RFEC-010A / 13002842-010 Roof Edge Caulk / Main	White Non-Fibrous Homogeneous		100% Other	None Detected

SanAir ID / Description	Stereoscopic Appearance	Components		Asbestos Fibers
		% Fibrous	% Non-Fibrous	
RFPT-011A / 13002842-011 Roof Paint / Main	Silver Non-Fibrous Homogeneous		100% Other	None Detected

SanAir ID / Description	Stereoscopic Appearance	Components		Asbestos Fibers
		% Fibrous	% Non-Fibrous	
RFBD-012A / 13002842-012 Roof Cellulose Board / Main	Brown Fibrous Homogeneous	100% Cellulose	< 1% Other	None Detected

SanAir ID / Description	Stereoscopic Appearance	Components		Asbestos Fibers
		% Fibrous	% Non-Fibrous	
RFSS-013A / 13002842-013 Roof Membrane Seam Sealant / Main Roof	Black Non-Fibrous Homogeneous		100% Other	None Detected

Certification

Signature: *Sandra Sobrino*
Date: 2/13/2013

Reviewed: *Sandra Sobrino*
Date: 2/13/2013

Disclaimer

The final report cannot be reproduced, except in full, without written authorization from SanAir. Fibers smaller than 5 microns cannot be seen with this method due to scope limitations. The accuracy of the results is dependent upon the client's sampling procedure and information provided to the laboratory by the client. SanAir assumes no responsibility for the sampling procedure and will provide evaluation reports based solely on the sample and information provided by the client. This report may not be used by the client to claim product endorsement by NVLAP, AIHA or any other agency of the U.S. government; *and may not be certified by every local, state and federal regulatory agencies.*

SanAir Technologies Laboratory, Inc.

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**Asbestos
Chain of Custody**

SanAir ID Number

130008212

Company: Hurt & Proffitt, Inc	Project #: 20090500 Task 623	Phone #: 4348477796
Address: 2524 Langhorne Road	Project Name: Miller Center Renovation-Roof	Phone #: 4348413893
City, St., Zip: Lynchburg, Virginia 24501	Date Collected: 02/05/2013	Fax #: 4348470047
Samples Collected By: W. Chris Nixon	P.O. Number:	Email: wcn@handp.com

Asbestos Analysis Types

Bulk		Air		Soil/Vermiculite	
ABB	PLM EPA 600/R-93/116 <input checked="" type="checkbox"/>	ABA	PCM NIOSH 7400 <input type="checkbox"/>	ABSE	PLM EPA 600/R-93/116 (Qual.) <input type="checkbox"/>
	Positive Stop <input type="checkbox"/>	ABA-2	OSHA w/ TWA* <input type="checkbox"/>	ABSP	PLM CARB 435 (LOD <1%) <input type="checkbox"/>
ABEPA	PLM EPA 400 Point Count <input type="checkbox"/>	ABTEM	TEM AHERA <input type="checkbox"/>	ABSP1	PLM CARB 435 (LOD 0.25%) <input type="checkbox"/>
ABB1K	PLM EPA 1000 Point Count <input type="checkbox"/>	ABATN	TEM NIOSH 7402 <input type="checkbox"/>	ABSP2	PLM CARB 435 (LOD 0.1%) <input type="checkbox"/>
ABBEN	PLM EPA NOB <input type="checkbox"/>	ABT2	TEM Level II <input type="checkbox"/>		
ABBCH	TEM Chatfield <input type="checkbox"/>				
ABBTM	TEM EPA NOB <input type="checkbox"/>				
		Water		Dust	
ABBNY	TEM NY ELAP 198.4 <input type="checkbox"/>	ABHE	EPA 100.2 <input type="checkbox"/>	ABWA	TEM Wipe ASTM D-6480 <input type="checkbox"/>
OTHER/ Matrix :	<input type="checkbox"/>			ABDMV	TEM Microvac ASTM D-5755 <input type="checkbox"/>

Turn Around Times	<input type="checkbox"/> 3 HR (4 HR TEM)	<input type="checkbox"/> 6 HR (8HR TEM)	<input type="checkbox"/> 12 HR	<input type="checkbox"/> 24 HR
	2 Days <input type="checkbox"/>	3 Days <input type="checkbox"/>	4 Days <input type="checkbox"/>	5 Days <input checked="" type="checkbox"/>

Sample #	Sample Identification/Location	Volume or Area	Sample Type	Flow Rate*	Time* Start - Stop
RFDP-001A	ROOF DECKING PAINT / THEATER ROOF		ABB		
RFM-002A	ROOF MEMBRANE / LAYERED THEATER ROOF		ABB		
RFDS-003A	ROOF DRAIN SEALANT / THEATER ROOF		ABB		
RFVS-004A	ROOF VENT SEALANT / THEATER ROOF		ABB		
RFFL-005A	ROOF EDGE FLASHING / THEATER ROOF		ABB		
RFVFL-006A	ROOF VENT FLASHING / MAIN		ABB		
RFRB-007A	ROOF RUBBER MEMBRANE / MAIN		ABB		
RFEC-008A	ROOF TAN EDGE CAULK/MAIN		ABB		
RFEF-009A	ROOF EDGE FLASHING /MAIN		ABB		
RFEC-010A	ROOF WHITE EDGE CAULK /MAIN		ABB		
RFPT-011A	ROOF SILVER PAINT /MAIN		ABB		
RFBD-012A	ROOF CELLULOUS BOARD /MAIN		ABB		

Special Instructions	PLEASE EMAIL RESULTS
-----------------------------	----------------------

Relinquished by	Date	Time	Received by	Date	Time
W. Chris Nixon <i>WCN</i>	2/05/2013	TO FEDEX	<i>[Signature]</i>	FEB 06 2013	<i>9:25 AM</i>

Unless scheduled, the turn around time for all samples received after 5 pm Friday will begin at 8 am Monday morning.
 Weekend or Holiday work must be scheduled ahead of time and is charged for rush turn around time.
 Work with standard turn around time sent Priority Overnight and Billed To Recipient will be charged a \$10 shipping fee.

SanAir Technologies Laboratory, Inc.

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 www.sanair.com

**Asbestos
Chain of Custody**

SanAir ID Number
 13002842

Company: Hurt & Proffitt, Inc	Project #: 20090500 Task 623	Phone #: 4348477796
Address: 2524 Langhorne Road	Project Name: Miller Center Renovation-Roof	Phone #: 4348413893
City, St., Zip: Lynchburg, Virginia 24501	Date Collected: 02/05/2013	Fax #: 4348470047
Samples Collected By: W. Chris Nixon	P.O. Number:	Email: wcn@handp.com

Asbestos Analysis Types

Bulk		Air		Soil/Vermiculite	
ABB	PLM EPA 600/R-93/116	<input checked="" type="checkbox"/> ABA	PCM NIOSH 7400	<input type="checkbox"/> ABSE	PLM EPA 600/R-93/116 (Qual.)
	Positive Stop <input type="checkbox"/>	<input type="checkbox"/> ABA-2	OSHA w/ TWA*	<input type="checkbox"/> ABSP	PLM CARB 435 (LOD <1%)
ABEPA	PLM EPA 400 Point Count	<input type="checkbox"/> ABTEM	TEM AHERA	<input type="checkbox"/> ABSP1	PLM CARB 435 (LOD 0.25%)
ABB1K	PLM EPA 1000 Point Count	<input type="checkbox"/> ABATN	TEM NIOSH 7402	<input type="checkbox"/> ABSP2	PLM CARB 435 (LOD 0.1%)
ABBEN	PLM EPA NOB	<input type="checkbox"/> ABT2	TEM Level II		
ABBCH	TEM Chatfield				
ABBTM	TEM EPA NOB				
ABBNY	TEM NY ELAP 198.4	<input type="checkbox"/> ABHE	EPA 100.2	<input type="checkbox"/> ABWA	TEM Wipe ASTM D-6480
OTHER/ Matrix :				<input type="checkbox"/> ABDMV	TEM Microvac ASTM D-5755

Turn Around Times	<input type="checkbox"/> 3 HR (4 HR TEM)	<input type="checkbox"/> 6 HR (8HR TEM)	<input type="checkbox"/> 12 HR	<input type="checkbox"/> 24 HR
	2 Days <input type="checkbox"/>	3 Days <input type="checkbox"/>	4 Days <input type="checkbox"/>	5 Days <input checked="" type="checkbox"/>

Sample #	Sample Identification/Location	Volume or Area	Sample Type	Flow Rate*	Time* Start - Stop
RFSS-013A	ROOF BLACK MEMBRANE SEAM SEALANT / MAIN ROOF		ABB		

Special Instructions PLEASE EMAIL RESULTS

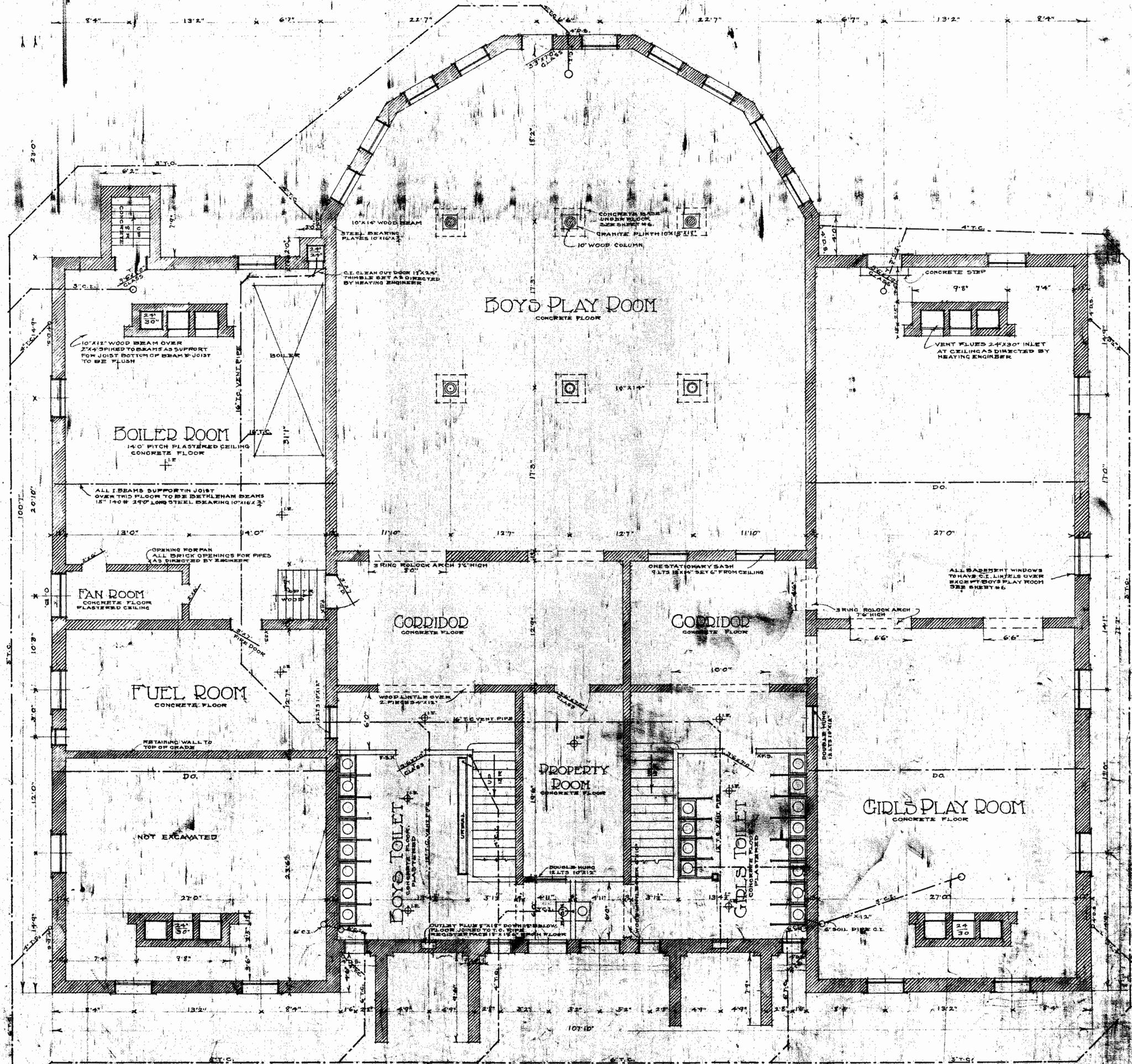
Relinquished by	Date	Time	Received by	Date	Time
W. Chris Nixon	2/05/2013	TO FEDEX		FEB 06 2013	

Unless scheduled, the turn around time for all samples received after 5 pm Friday will begin at 8 am Monday morning.
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 Work with standard turn around time sent Priority Overnight and Billed To Recipient will be charged a \$10 shipping fee.

SCALE 1/4" = 1'-0"
MARCH 1910.

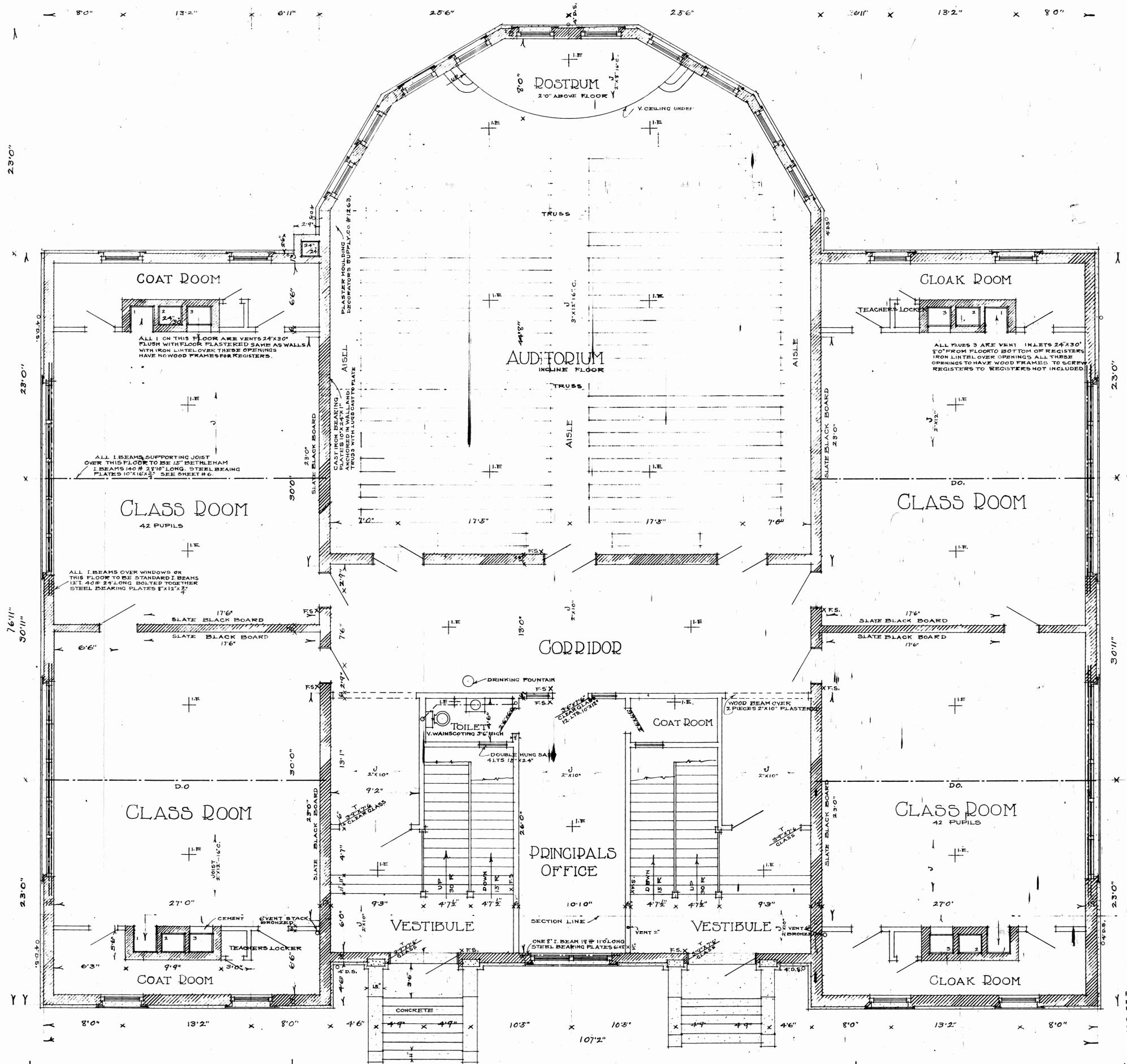
MILLER PARK SCHOOL, LYNCHBURG, VA.

M'LAUGHLIN-PETTING & JOHNSON,
ARCHITECTS,
LYNCHBURG & DANVILLE, VA.



BASEMENT PLAN

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ALL CEILING OUTLETS TO BE DROP CORDS HUNG 9'-0" FROM FLOOR. ALL CLASS ROOM CORRIDORS OFFICE CLOSET & TOILET TO BE WIRED FOR 60 WATT LAMPS. AUDITORIUM TO BE WIRED FOR 80 WATT LAMPS. CLOSET & TOILET LIGHTS 60 WATT HUNG 8" FROM CEILING.

FIRST FLOOR

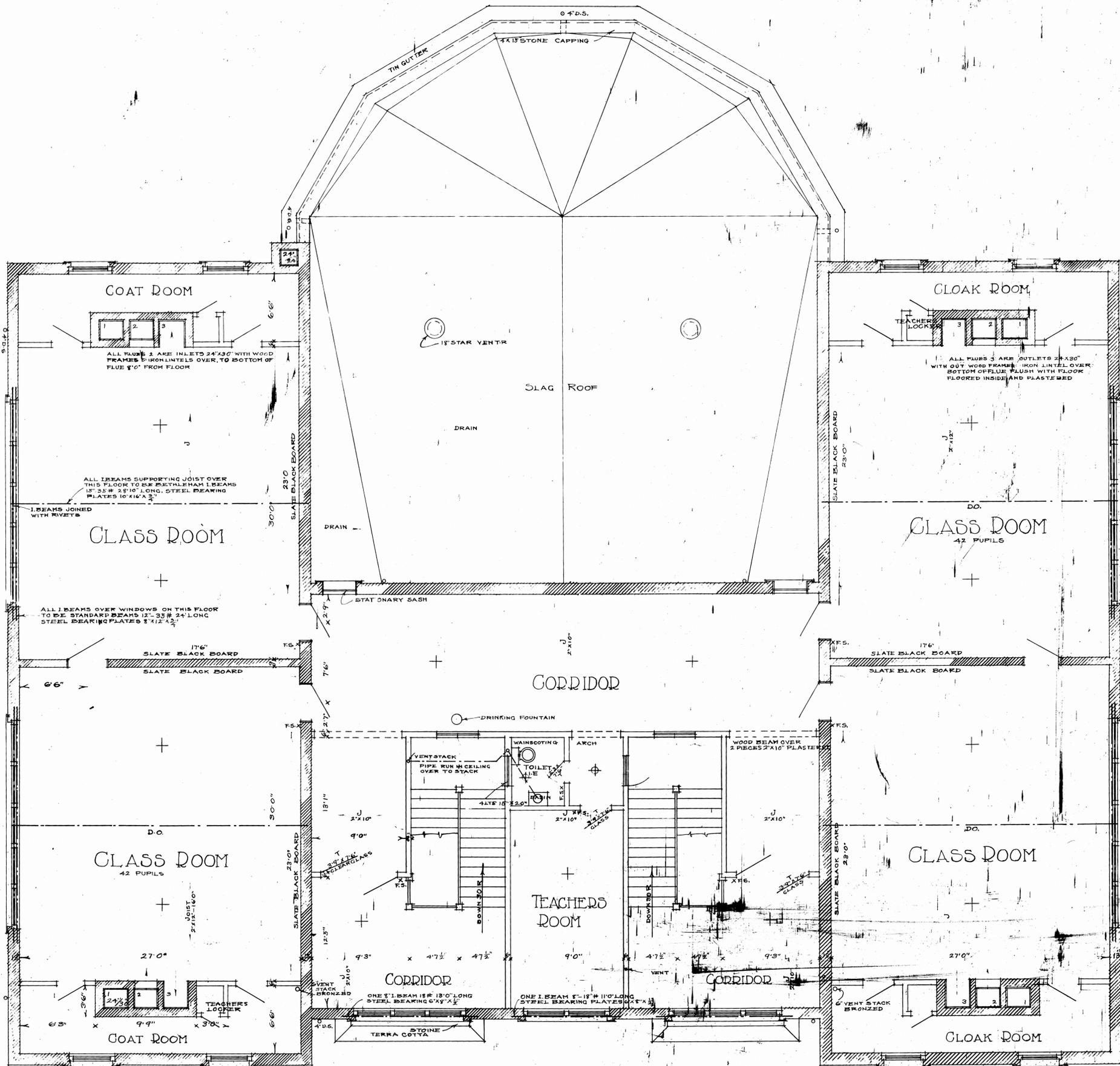
ALL CLASS ROOM DOORS ON THIS FLOOR TO BE 3'-6" X 7'-6" X 1 1/2" THICK THREE CROSS PANELS AND CHIPPED GLASS 32" X 42". CLOAK ROOM DOORS 3'-0" X 7'-6" X 1 1/2" CHIPPED GLASS 2'-6" X 42". TEACHERS LOCKER DOORS 2'-0" X 7'-6" X 1 1/2" PANELED. AUDITORIUM DOORS 2'-9" X 7'-6" X 1 1/2" CHIPPED GLASS 2'-3" X 42". ALL DOORS EXCEPT TOILET, CLOSET & OUTSIDE DOORS TO HAVE 24" TRANSOM CLEAR GLASS.

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SCALE 1/4" = 1'-0"
MARCH 1910.

MILLED PARK SCHOOL,
LYNCHBURG, VA.

McLAUGHLIN, PETTIT & JOHNSON,
ARCHITECTS,
LYNCHBURG & DANVILLE, VA.



ALL CEILING OUTLETS TO BE DROP CORDS HUNG 90° FROM FLOOR ALL WIRED FOR 60 WATT LAMPS

SECOND FLOOR

ALL CLASS ROOM DOORS ON THIS FLOOR TO BE 3'-6\"/>

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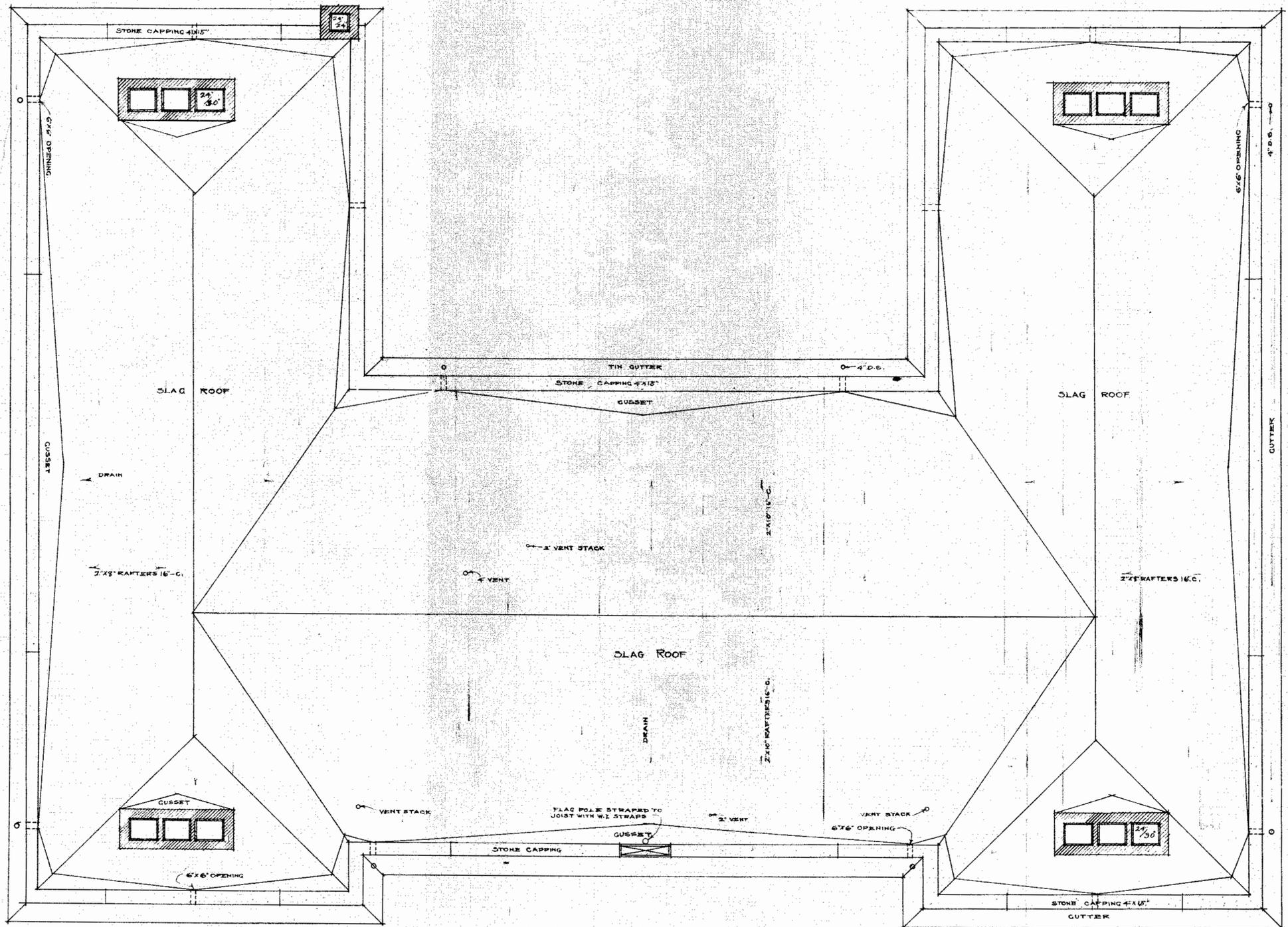
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3

SCALE 1/4" = 1'-0"
MARCH 1910.

MILLED PARK SCHOOL. LYNCHBURG, VA.

M'LAUGHLIN, PETTIT & JOHNSON
ARCHITECTS.
LYNCHBURG & DANVILLE, VA.



ROOF PLAN

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SCALE 1/4" = 1'-0"
MARCH 1910.

MILLED PARK SCHOOL,
LYNCHEURG, VA.

M'LAUGHLIN PETTIT & JOHNSON,
ARCHITECTS,
LYNCHEURG & DANVILLE, VA.



FRONT ELEVATION

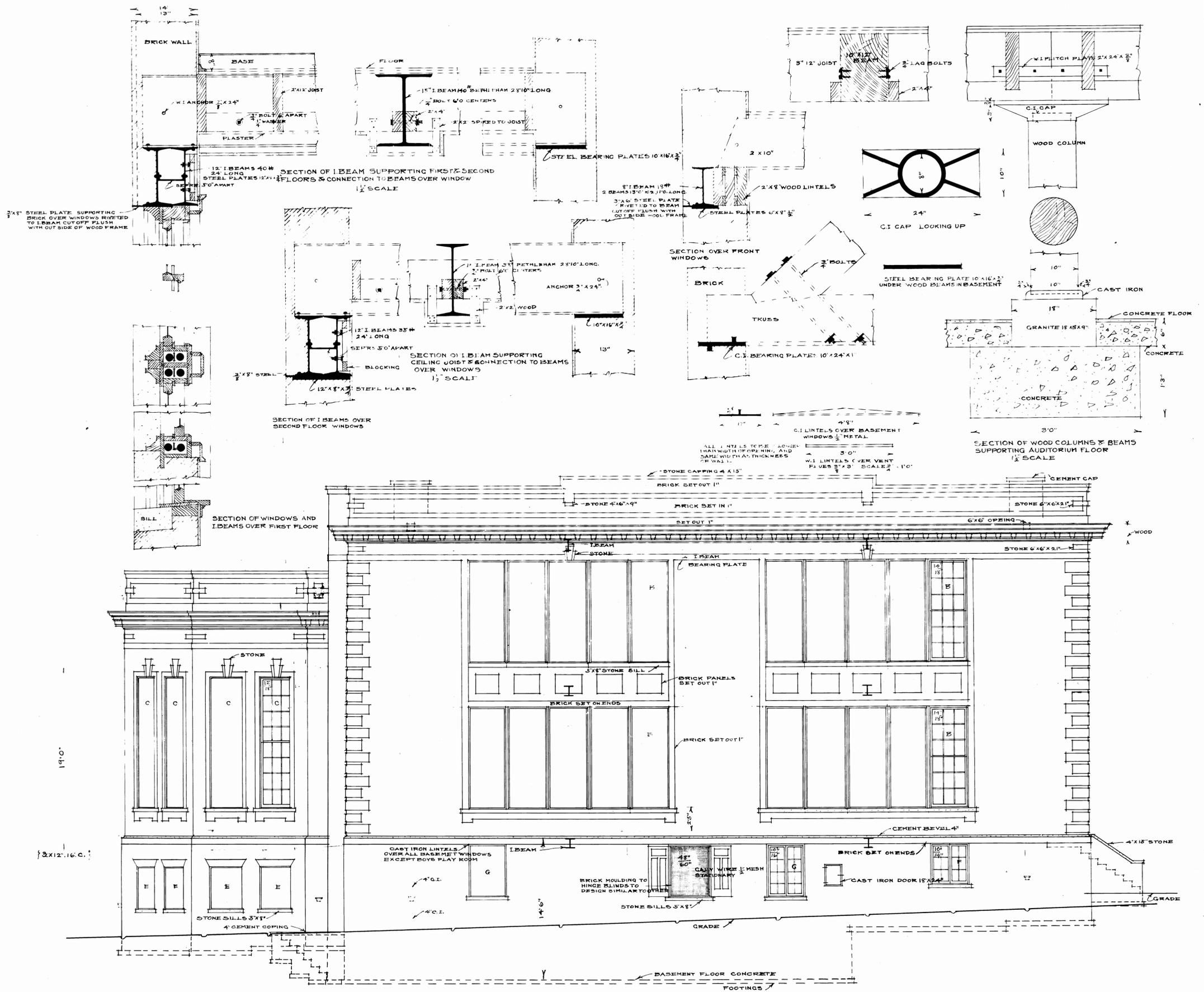
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SCALE 1/4" = 1'-0"
MARCH 1910.

MILLED PARK SCHOOL. LYNCHBURG, VA.

McLAUGHLIN PETTIT & JOHNSON
ARCHITECTS.
LYNCHBURG & DANVILLE, VA.



SIDE ELEVATION - SOUTH

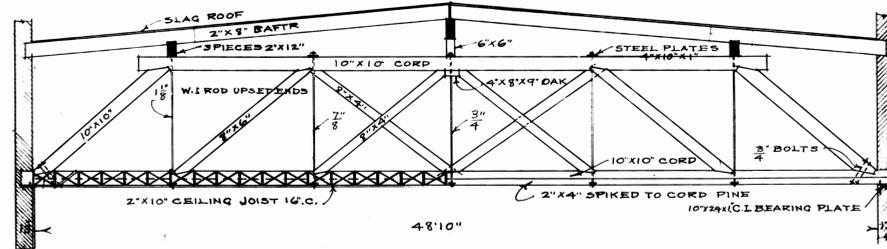
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6

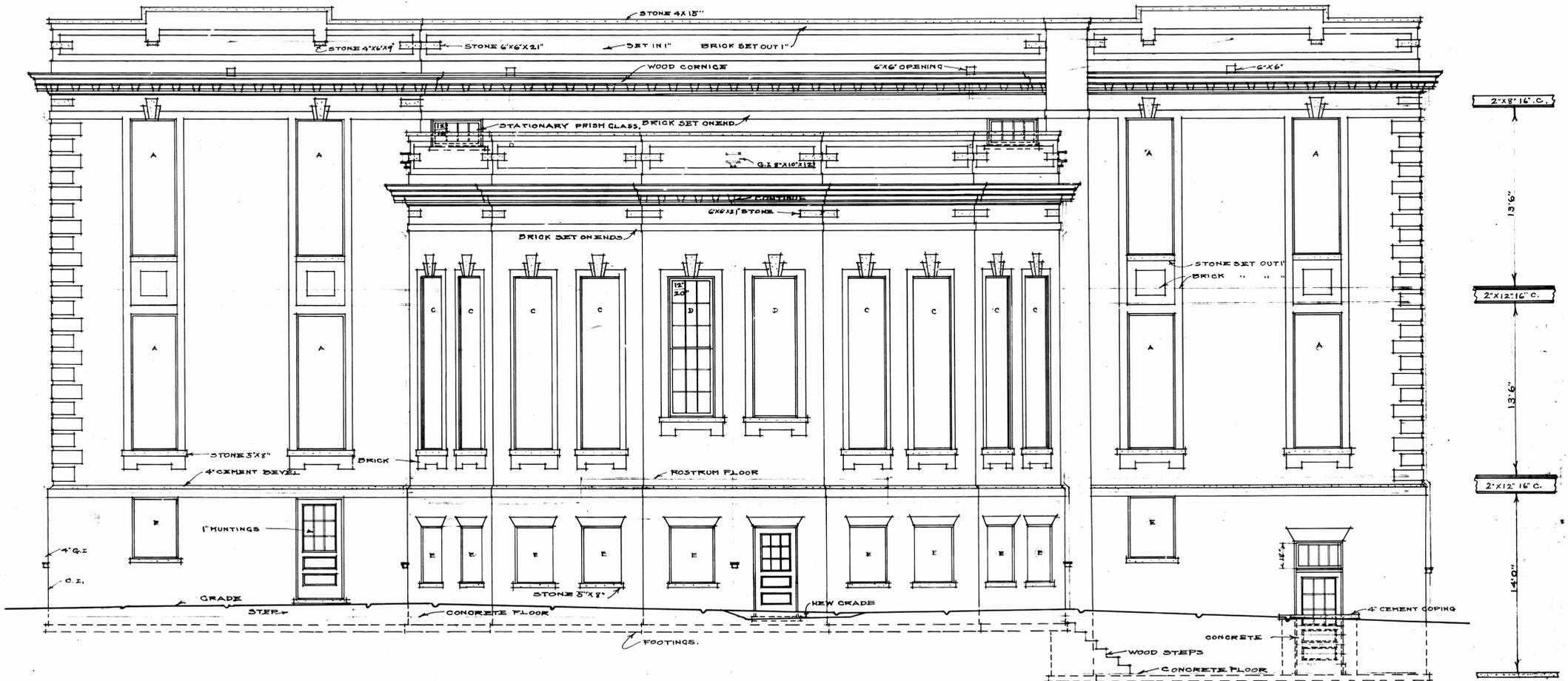
SCALE 1/4"=1'-0"
MARCH 1910.

MILLER PARK SCHOOL, LYNCHBURG, VA.

McLAUGHLIN PETTIT & JOHNSON,
ARCHITECTS,
LYNCHBURG & DANVILLE, VA.



TRUSS OVER AUDITORIUM
1/4" SCALE



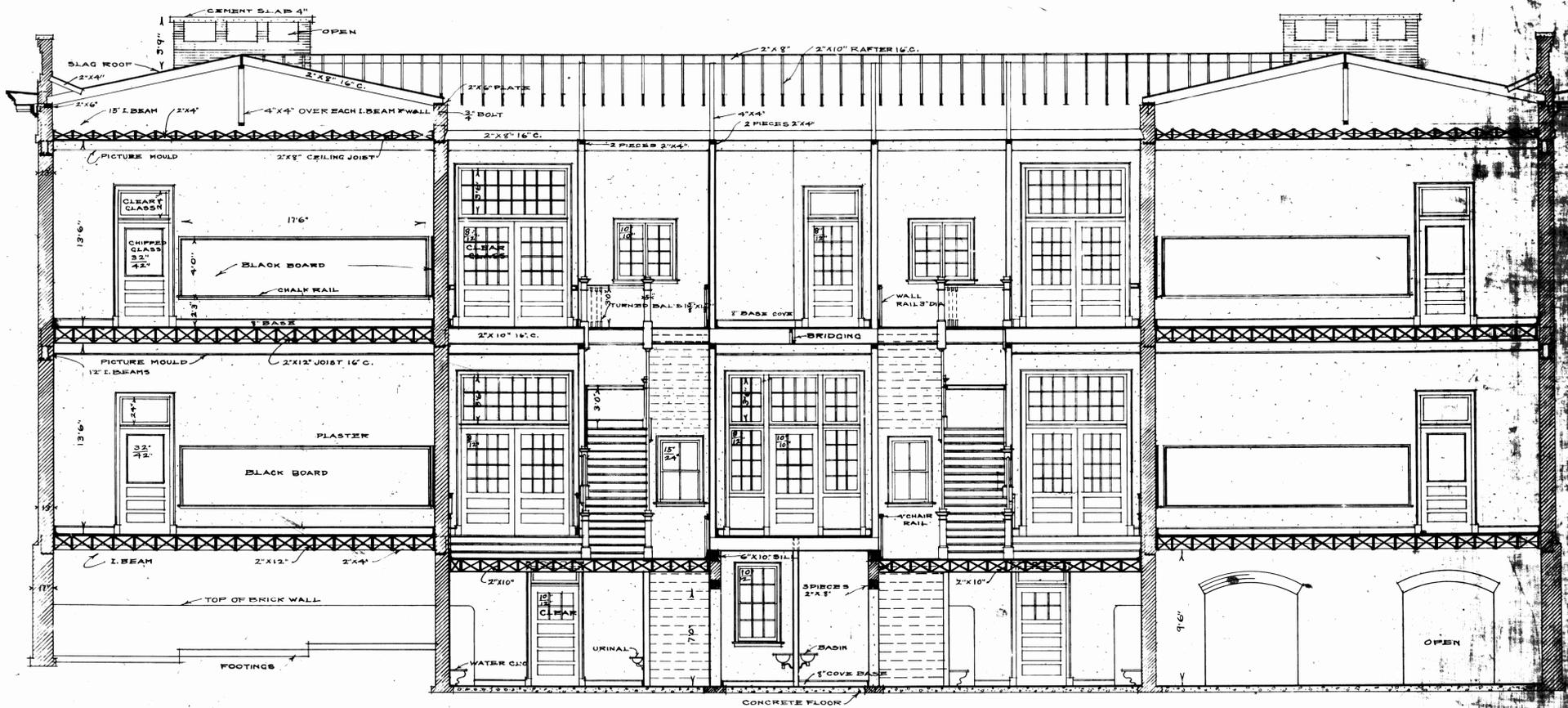
DEAD ELEVATION

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Jones Memorial Library, Lynchburg, Virginia.
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SCALE 1/4"=1'-0"
MARCH 1910.

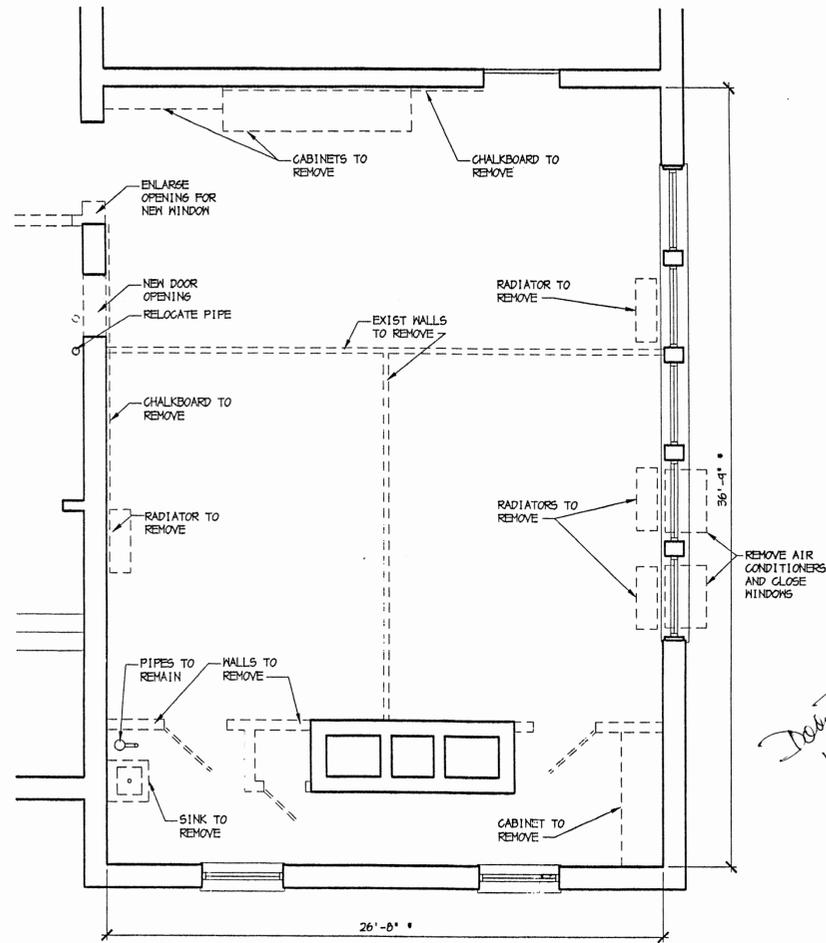
MILLED PARK SCHOOL LYNCHBURG, VA.

M. LAUGHLIN, PETTIT & CO.
ARCHITECTS
LYNCHBURG & DANVILLE, VA.



CROSS SECTION ON LINE A-A.

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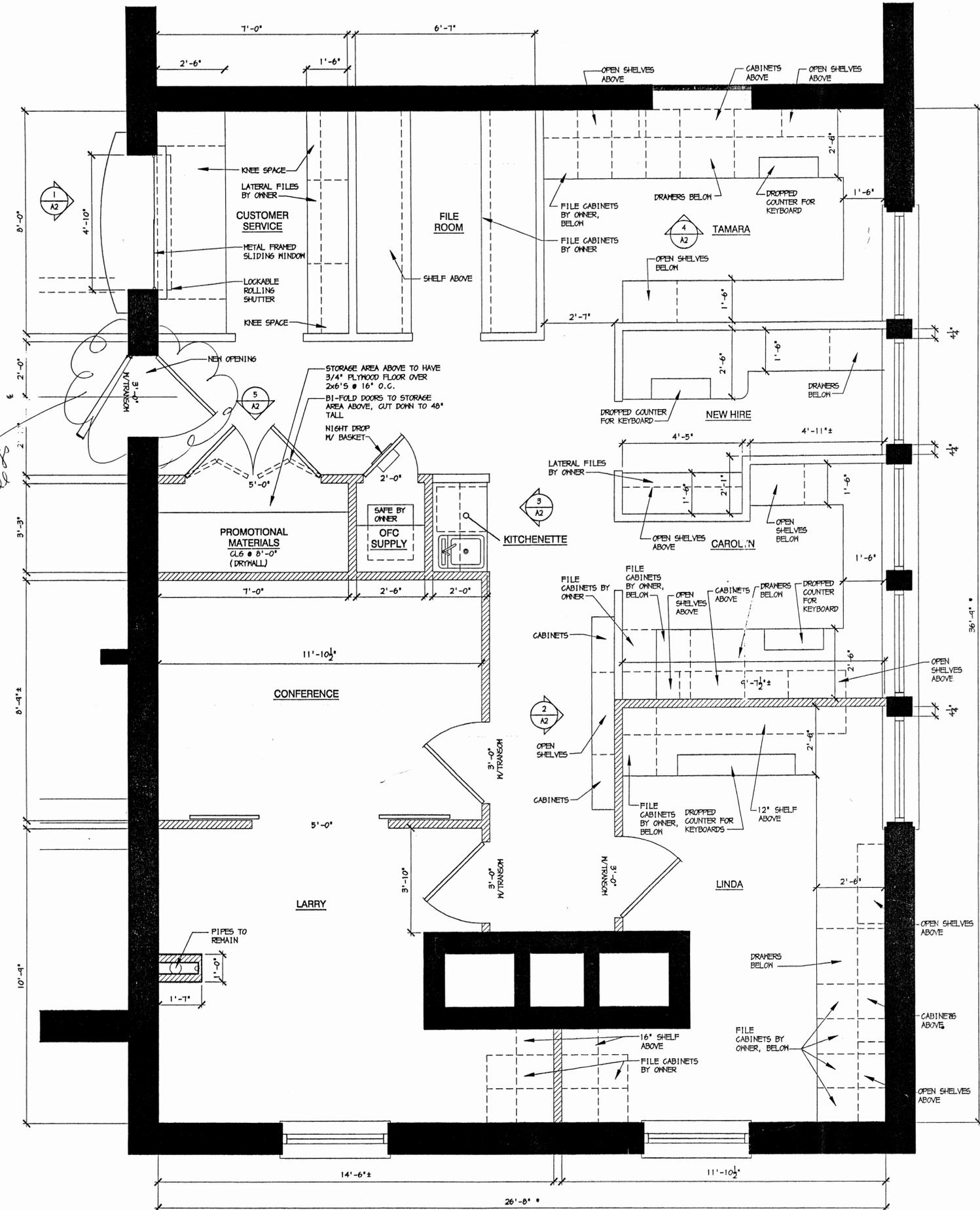
1 DEMOLITION FLOOR PLAN
1/4"=1'-0"

- EXISTING WALL
- 3 1/2" STUD WALL TO FULL CEILING HEIGHT
- 3 1/2" STUD WALL TO 7'-6" HEIGHT

GENERAL NOTE
ALL DOORS TO BE 7'-6" TALL

* DIMENSIONS OF EXISTING STRUCTURE ARE GIVEN FOR ESTIMATING PURPOSES ONLY. DIMENSIONS AFFECTING NEW WORK TO BE VERIFIED IN FIELD BEFORE COMMENCEMENT OF WORK.

Take Swamps into hall

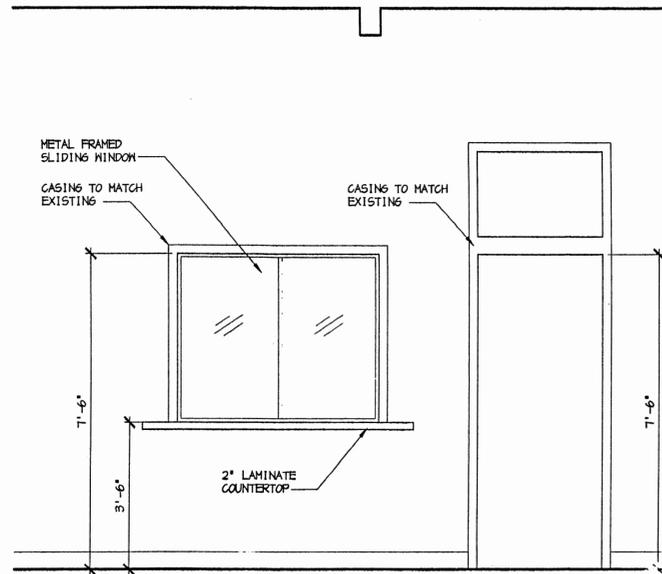


2 FLOOR PLAN
1/2"=1'-0"

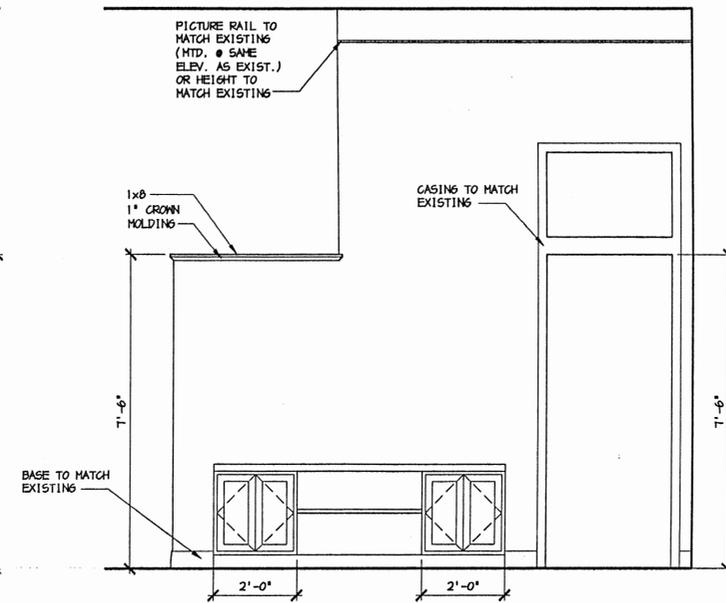


WRITTEN DIMENSIONS ON THESE DRAWINGS SHALL TAKE PRECEDENCE OVER SCALED DIMENSIONS. CONTRACTORS SHALL VERIFY AND BE RESPONSIBLE FOR ALL DIMENSIONS AND CONDITIONS ON THE JOB AND THIS OFFICE MUST BE NOTIFIED OF ANY VARIATION FROM THE DIMENSIONS AND CONDITIONS SHOWN BY THESE DRAWINGS.

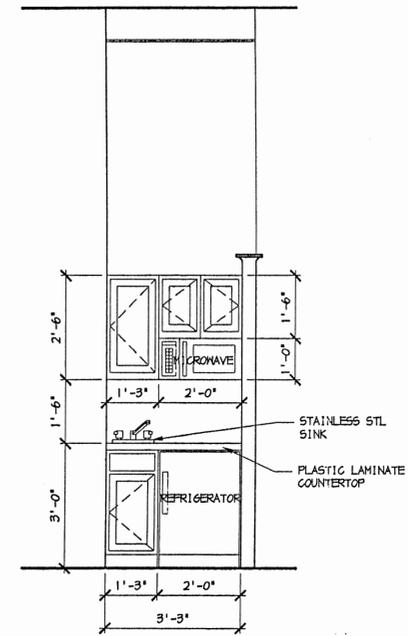
DESIGNED: MDD
DRAWN: TAW
CHECKED: MWS
DATE: 11-29-01
REVISIONS: 12-07-01



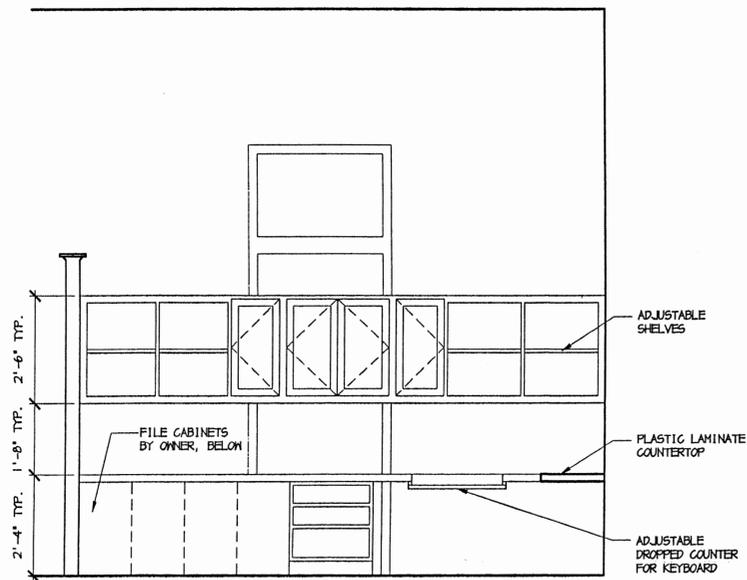
1 ELEVATION
A2 1/2"=1'-0"



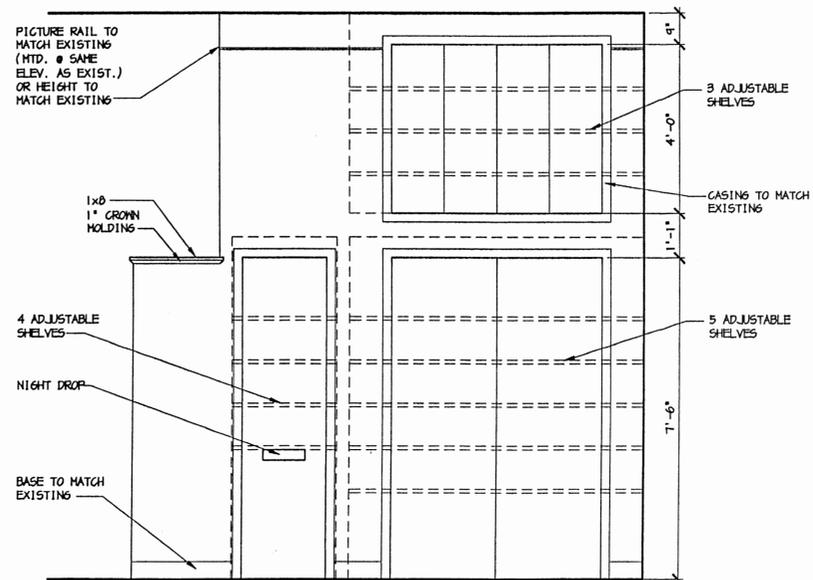
2 ELEVATION
A2 1/2"=1'-0"



3 ELEVATION
A2 1/2"=1'-0"



4 ELEVATION
A2 1/2"=1'-0"



5 ELEVATION
A2 1/2"=1'-0"

MECHANICAL SPECIFICATIONS

- 1.0 GENERAL
- 1.01 THE CONTRACT DOCUMENTS APPLY TO THESE SPECIFICATIONS.
- 1.02 PROVIDE ALL NECESSARY LABOR AND MATERIALS FOR THE WORK SHOWN ON THE DRAWINGS, WHICH INCLUDES INSTALLATION OF HVAC SYSTEMS AND ALL PLUMBING PIPING AND FIXTURES.
- 1.03 WORK SHALL MEET REQUIREMENTS OF LOCAL BUILDING CODES AND ORDINANCES, APPLICABLE REQUIREMENTS OF THE VUSBC AND NFPA. PLUMBING WORK SHALL ALSO MEET REQUIREMENTS OF LOCAL PLUMBING CODE.
- 1.04 SUBMIT SHOP DRAWINGS FOR THE FOLLOWING:
- A. PLUMBING FIXTURES & EQUIPMENT
 - B. GRILLES, REGISTERS & DIFFUSERS
 - C. HEATING AND AIR CONDITIONING EQUIPMENT
 - D. INSULATION
- 1.05 PLACING IN SERVICE:
- A. BEFORE BEING PLACED INTO OPERATION, ALL EQUIPMENT REQUIRING PREOPERATIONAL ATTENTION SHALL BE SERVICED IN ACCORDANCE WITH THE REQUIREMENTS OF THESE SPECIFICATIONS AND THE MANUFACTURER'S RECOMMENDATIONS.
 - B. THIS SERVICING SHALL INCLUDE LUBRICATION, CONTROL CALIBRATIONS AND ADJUSTMENTS, AND TESTING AND ADJUSTING OF OPERATING CONTROLS.
 - C. AT THE COMPLETION OF PERFORMANCE TEST AND FOLLOWING APPROVAL OF TEST RESULTS, THE CONTRACTOR SHALL RECHECK ALL EQUIPMENT AND VERIFY THAT EACH ITEM IS FUNCTIONING CORRECTLY.
 - D. FURNISH ALL NECESSARY EQUIPMENT AND ASSUME ALL COSTS INVOLVED TO PERFORM ALL TESTING, CLEANING, AND BALANCING OPERATIONS REQUIRED.
 - E. TEST, ADJUST AND BALANCE ALL SYSTEMS UNTIL DESIGN FUNCTION AND OPERATION ARE ACHIEVED. THE CONTRACTOR MAY ENGAGE THE SERVICES OF AN INDEPENDENT CONTRACTOR WHO SPECIALIZES IN THE PRACTICE OF TESTING, ADJUSTING, AND BALANCING MECHANICAL EQUIPMENT AND SYSTEMS.

- 2.0 PRODUCTS
- 2.01 DUCTWORK:
- A. DUCT SYSTEMS SHALL BE IN ACCORDANCE WITH SMACNA DUCT CONSTRUCTION STANDARDS, THE NATIONAL FIRE PROTECTION ASSOCIATION AND MANUFACTURER'S RECOMMENDATIONS WHERE APPLICABLE.
 - B. SYSTEMS AND MATERIALS: LOW VELOCITY A/C AND EXHAUST (GENERAL USE): GALVANIZED STEEL.
 - C. FITTINGS FOR ALL DUCT SYSTEMS SHALL BE OF THE SAME MATERIAL AS THE DUCT.
 - D. MATERIALS: GALVANIZED STEEL SHALL MEET REQUIREMENTS OF ASTM A-527, "STEEL SHEET, ZINC COATED BY THE HOT-DIP PROCESS, LOC-FORMING QUALITY". MANUAL DAMPER OPERATIONS SHALL BE LOCKING TYPE AS MANUFACTURED BY VENTFABRICS, INC. OR YOUNG REGULATOR COMPANY.
- 2.02 SUPPLY REGISTERS: SHALL BE METAL-AIRE MODEL V4004 DOUBLE DEFLECTION, ALL ALUMINUM CONSTRUCTION WITH OBD.
- 2.03 RETURN GRILLES: SHALL BE OF ALUMINUM CONSTRUCTION, METALARE SERIES RHED, SINGLE FIXED-DEFLECTION WITH OBD.
- 2.04 PIPE AND PIPE FITTINGS
- A. COPPER TUBE TYPE K, L: ANSI/ASTM B88.
 - B. PVC PIPE: SCH 40, GRADE PVC 2116: ASTM D1785 AND ASTM D2241.
 - C. STEEL PIPE: BLACK PIPE SHALL MEET THE DIMENSIONAL REQUIREMENTS OF ANSI B36.10 AND SHALL MEET THE MINIMUM REQUIREMENTS OF ANSI/ASTM A106, A53 TYPE E OR S, OR A120 AS SHOWN IN PIPING SCHEDULE UNLESS SPECIFICALLY NOTED OTHERWISE.
- 2.05 PIPING SYSTEMS SHALL BE SUPPORTED IN ACCORDANCE WITH ANSI B31.1 "POWER PIPING" SC AS TO MAINTAIN REQUIRED PITCH OF LINES, PREVENT VIBRATION AND PROVIDE FOR EXPANSION AND CONTRACTION MOVEMENT. REFER TO NFPA-13 FOR SPRINKLER PIPING REQUIREMENTS.

2.06 PIPING SCHEDULE

SERVICE	SIZE	PIPE TYPE	FITTING TYPE	VALVE TYPE	MFG & NO.
DOMESTIC HOT & COLD WATER SUPPLY	2 IN. & SMALLER	TYPE L COPPER HARD DRN	WRT. COPPER SOLDER	BALL	NIBCO 595-Y
STEAM	ALL SIZES	SCH 40 BK STL	125lb. CI THREADED	-	-

2.07 INSULATION SCHEDULE

SERVICE	TYPE INSUL	THKNS INCHES	FINISH IN CNCL AREAS	FINISH IN FINISH AREAS
(1) PIPING				
STEAM	GLASS FIBER	1.0	INTEGRAL FIRE RETARDANT JKT	PAINT TO MATCH EXISTING
DUCTWORK	DUCT LINER KNAUF RIGID PLENUM LINER	3/4"	-	-

3.0 EXECUTION

- 3.01 INSTALL HVAC SYSTEM IN ACCORDANCE WITH MFG RECOMMENDATIONS.

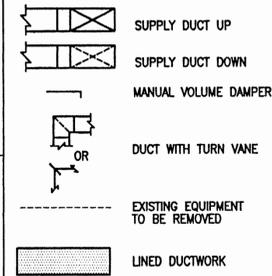
GENERAL NOTES

1. WHERE SPACE IS LIMITED, ROUTES AND CLEARANCES AND INSTALLATION PROCEDURES FOR DUCTWORK, PIPING, AND OTHER MECHANICAL EQUIPMENT SHALL BE VERIFIED AND COORDINATED WITH OTHER WORK BEFORE EQUIPMENT IS INSTALLED.
2. DUCT AND OTHER EQUIPMENT MOUNTING HEIGHTS WHERE SHOWN ON DRAWINGS ARE MEASURED FROM FINISHED FLOOR TO BOTTOM EDGE OF OPENING UNLESS OTHERWISE INDICATED.
3. MOUNT THERMOSTATS 5'-0" ABOVE FINISHED FLOOR.
4. ALL DUCTS SHOWN RUNNING SIDE-BY-SIDE ON THE PLANS SHALL BE INSTALLED WITH A MINIMUM CLEARANCE OF 6" BETWEEN THEM TO PROVIDE SPACE FOR LIGHTING SUSPENSION DEVICES.
5. SEE SPECIFICATIONS FOR DESCRIPTION OF DUCTWORK INSULATION.
6. OFFSET DUCTS AND PIPING WHERE NECESSARY TO CLEAR OTHER WORK SUCH AS BEAMS, PIPES, ELECT., ETC., COORDINATE DUCTWORK INSTALLATION WITH WORK OF OTHER TRADES TO AVOID SPACE CONFLICTS.
7. CERTIFIED AIR AND WATER BALANCE REPORT SHALL ACCOMPANY A SET OF AS-BUILT PLANS INDICATING EXACT TO-SCALE LOCATIONS AND FINAL BALANCE FLOW RATES. MAINTAIN A MINIMUM OF ONE INTACT SET OF PROJECT PLANS AND SPECIFICATIONS AT JOB SITE MARKED TO SHOW ALL DEVIATIONS PERMITTED DURING CONSTRUCTION AS THE WORK IS INSTALLED. ALL MARKS SHALL BE RED IN COLOR, COMPLETE, CLEAR AND LEGIBLE.
8. REMOVE EXISTING RADIATORS & PIPING - REMOVE PIPING BACK TO MAIN AND CAP AT TAKE-OFF.
9. KEEP ALL SUPPLY AND RETURN DUCTWORK AS HIGH AS POSSIBLE.
10. REWORK LAY-IN CEILING AS REQUIRED FOR NEW DUCTWORK.

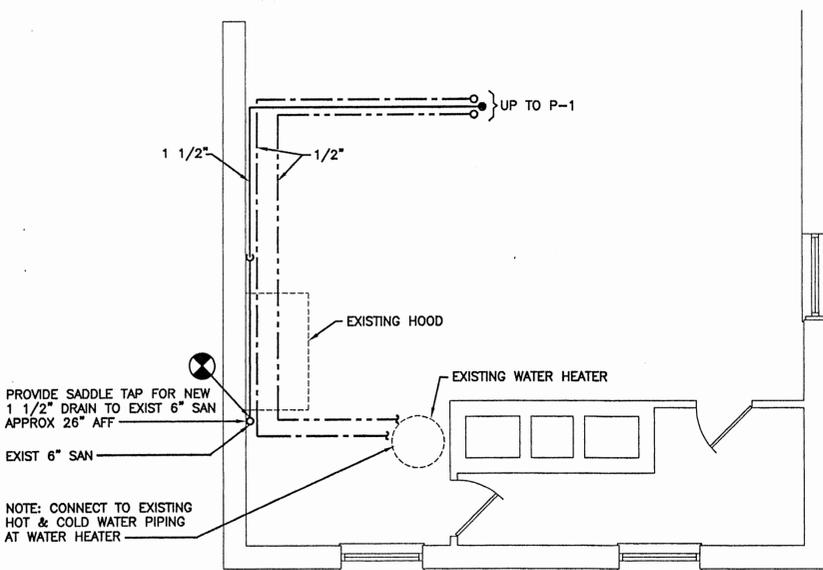
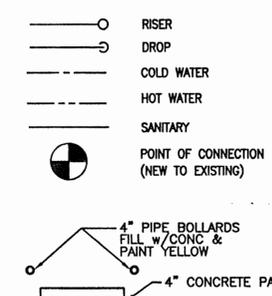
EQUIPMENT NOTES

- AC-1
AHU-1 TRANE MODEL TWE060C, 2000 CFM, EAT 76 Fdb, 63 Fwb, Tc 57220 BTUH, SEN 43600 BTUH, 3/4hp @ .50in S.P., 200-230 V-1φ, W/15.36KW HEATER, 240V, 3φ, EVAP DEFROST CONTROL KIT AY28x084
- HP-1 TRANE MODEL TWP060C 200-230-3φ THERMOSTAT TRANE TAY STAT 500C W/OUTDOOR SENSOR TAYSENS100A FURNISH WITH CLEAR PLASTIC LOCKING COVER.
- P-1 SINK - ELKAY MODEL LR 1722 WITH MOEN FAUCET MODEL 8948, 1 1/4"x1 1/2" 17GA P-TRAP
- DUCT SMOKE DETECTOR AIR DUCT IONIZATION DETECTOR: NOTIFIER CATALOG NUMBER DH400ACDC 4 WIRE HOUSING WITH IONIZATION SENSOR. AIR VELOCITY RATING FROM 300 TO 4000 FEET PER MINUTE 32F TO 140F 120 VOLT AC. ALARM INITIATING, ALARM AUXILIARY, AND SUPERVISORY CONTACTS.

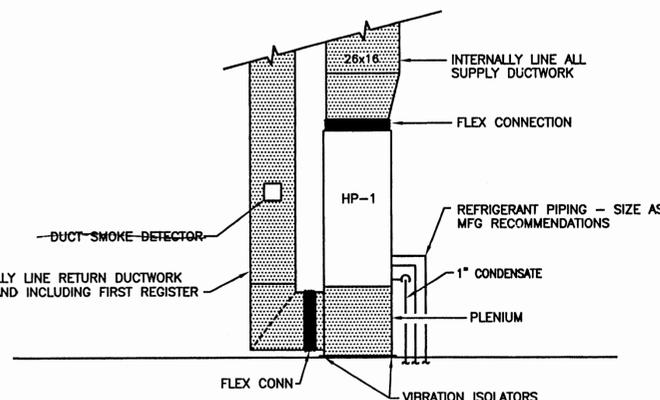
SHEET METAL



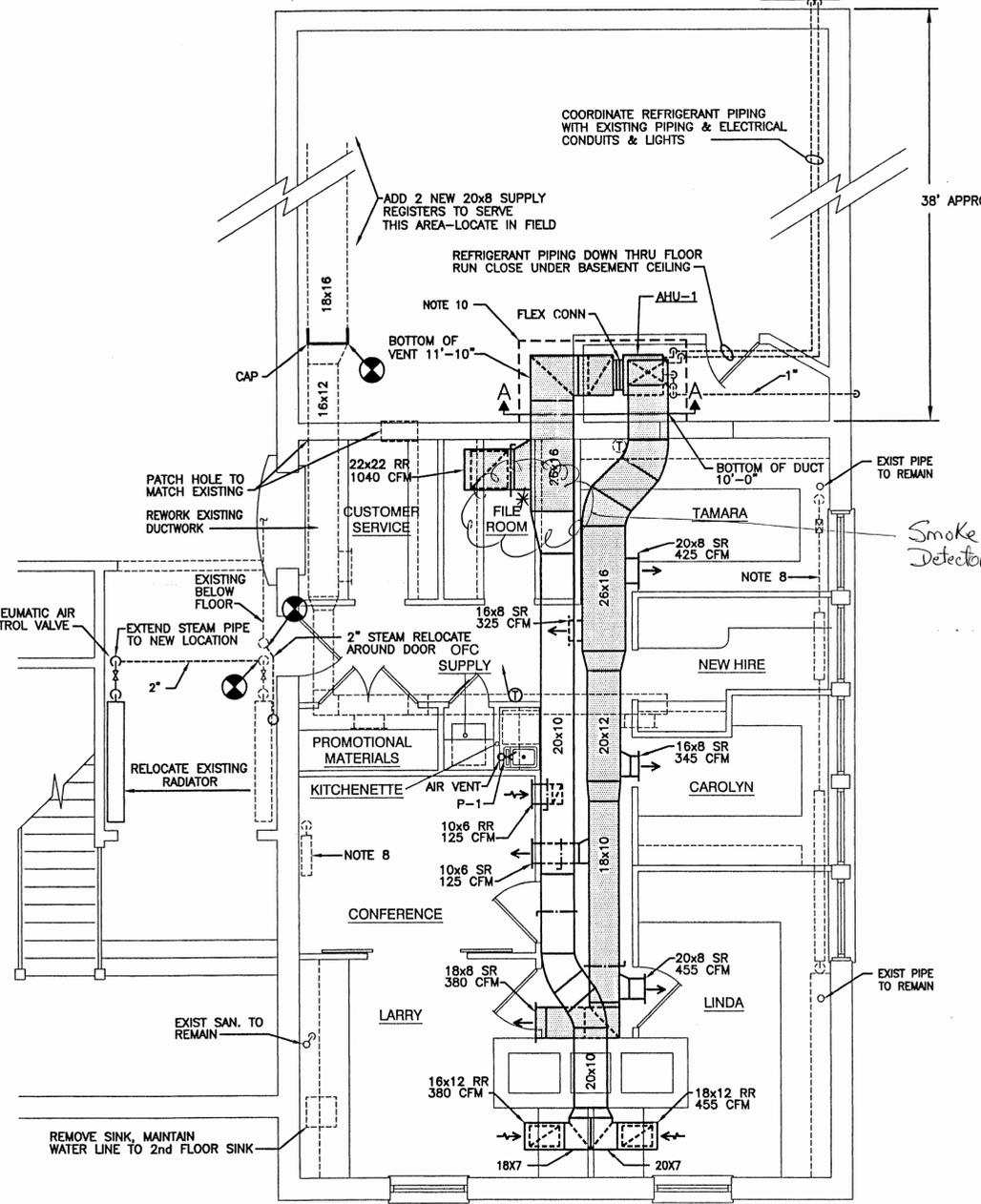
PIPING



PARTIAL BASEMENT PLAN
SCALE: 1/4" = 1'-0"



SECTION "A-A"
NTS



FLOOR PLAN - MECHANICAL
SCALE: 1/4" = 1'-0"

REVISIONS:



**Master
Engineers and Designers, P.C.**

2940 Fuller Street
Lynchburg, Virginia 24501
(804) 846-1360

**CITY OF LYNCHBURG
PARKS & RECREATION
GROVE STREET OFFICE RENOVATION**

LYNCHBURG, VIRGINIA PROJECT NO. 01160

DATE ISSUED: 12-10-01
SCALE: AS NOTED
JOB NO. 262-131
DESIGNED: DLC
DRAWN: ATE
CHECKED: DLC
APPROVED: DLC

DRAWING NO.
M1
SHEET OF
REVISION

ELECTRICAL LEGEND AND ABBREVIATIONS

- ▷ TELEPHONE OUTLET
- ▷_F TELEPHONE OUTLET, RECESSED FLOOR MOUNTED
- ▷ DATA OUTLET
- ▷_F DATA OUTLET, RECESSED FLOOR MOUNTED
- 12 NEMA 5-20, DUPLEX CONVENIENCE RECEPTACLE, NUMBER INDICATES CIRCUIT NUMBER
- 12 NEMA 5-20, DUPLEX CONVENIENCE RECEPTACLE, GROUND FAULT INTERRUPTING MOUNT AT COUNTER HEIGHT, NUMBER INDICATES CIRCUIT NUMBER
- S SWITCH, SINGLE POLE
- ⊙ JUNCTION BOX
- DISCONNECT SWITCH NON-FUSED
- DISCONNECT SWITCH, FUSIBLE, FUSE PER EQUIPMENT MANUFACTURER'S RECOMMENDATIONS (FMER)
- CONDUIT RUN CONCEALED BENEATH FLOOR OR GROUND
- CONDUIT RUN CONCEALED IN WALL OR CEILING
- CONDUIT RUN EXPOSED
- ← CIRCUIT HOME RUN. NUMBER OF ARROWS INDICATES NUMBER OF CIRCUITS

ELECTRICAL SPECIFICATIONS

PART 1-GENERAL

- 1.1 PROVIDE ALL NECESSARY ITEMS FOR THE COMPLETE INSTALLATION OF A PROPERLY OPERATING ELECTRICAL SYSTEM AS SPECIFIED HEREIN, BASED ON THESE DRAWINGS, ALL APPLICABLE CODES, STANDARDS AND THE INTENDED PURPOSE OF THE OWNER.
- 1.2 COMPLY WITH ALL APPLICABLE FEDERAL, STATE, AND LOCAL CODES AND ALL REQUIREMENTS OF THE CURRENT NATIONAL ELECTRICAL CODE.
- 1.3 FURNISH ALL LABOR, MATERIALS, EQUIPMENT AND SERVICES REQUIRED TO COMPLETE AND LEAVE READY FOR OPERATION ALL ELECTRICAL SYSTEMS AS SHOWN ON THESE DRAWINGS AND AS REQUIRED, INCLUDING THE COMPLETE COORDINATION OF ALL PORTIONS OF ELECTRICAL WORK WITH THAT OF OTHER TRADES.
- 1.4 FURNISH NEW UL LISTED, WHERE APPLICABLE, MATERIALS AND EQUIPMENT.
- 1.5 PROVIDE TESTING TO CONFIRM PROPER OPERATION OF ALL ELECTRICAL SYSTEMS, REPAIR OR REPLACE, AT NO EXPENSE TO OWNER, MATERIAL OR EQUIPMENT FAILING TESTS.
- 1.6 INSTRUCT THE OWNER'S REPRESENTATIVES IN THE PROPER OPERATION AND CONTROL OF ALL EQUIPMENT INSTALLED UNDER THIS CONTRACT.
- 1.7 GUARANTEE MATERIAL AND WORKMANSHIP AGAINST DEFECTS. REPLACE, AT NO EXPENSE TO OWNER, WORK OR MATERIAL THAT IS SHOWN TO BE DEFECTIVE WITHIN A PERIOD OF ONE (1) YEAR AFTER FINAL ACCEPTANCE OF WORK.
- 1.8 ARRANGE EQUIPMENT AS SHOWN ON THE DRAWINGS. MAKE DEVIATIONS ONLY WHERE NECESSARY TO AVOID INTERFERENCE. CHECK EQUIPMENT SIZE AGAINST AVAILABLE SPACE PRIOR TO SHIPMENT TO AVOID INTERFERENCE.
- 1.9 VISIT THE SITE TO BECOME KNOWLEDGEABLE ABOUT THE LOCATION, ACCESSIBILITY AND GENERAL CHARACTER OF THE SITE OR BUILDING, AND THE CHARACTER AND EXTENT OF EXISTING WORK WITHIN OR ADJACENT TO THE SITE. CLAIMS, AS A RESULT OF FAILURE TO DO SO, WILL NOT BE CONSIDERED BY THE OWNER.
- 1.10 SUBMIT SHOP DRAWINGS FOR THE FOLLOWING:
 - A. CIRCUIT BREAKERS
 - B. PANELBOARDS
 - C. LIGHTING FIXTURES AND LAMPS
 - D. RACEWAYS
- 1.11 SUBMISSION OF SHOP DRAWINGS DOES NOT RELIEVE THE CONTRACTOR OF PROVIDING ELECTRICAL EQUIPMENT AND MATERIALS WITH THE PROPER ELECTRICAL CHARACTERISTICS AND FEATURES AS SPECIFIED HEREIN AND ON THE DRAWINGS.
- 1.12 PROVIDE THREE (3) COPIES OF OPERATION AND MAINTENANCE MANUALS COVERING ITEMS AND EQUIPMENT INCLUDED IN THIS WORK.
- 1.13 MAKE INDICATED REVISIONS AND ADDITIONS TO EXISTING FACILITIES AND EQUIPMENT, INCLUDING ALL DEMOLITION AND REWORK OF EXISTING SYSTEMS. WHERE INDICATED, CHANGES TO NON-ELECTRICAL FACILITIES REQUIRE MINOR ASSOCIATED ELECTRICAL CHANGES MAKE THE NECESSARY CHANGES EVEN IF NOT SPECIFICALLY INDICATED.
- 1.14 COORDINATE ELECTRICAL OUTAGES WITH THE OWNER TO FACILITATE REWORKING OF EXISTING SYSTEM.

PART 2-PRODUCTS

- 2.1 FURNISH AND INSTALL ALL ELECTRICAL MATERIAL.
- 2.2 NAMEPLATES ON ALL PANELS, DISCONNECT SWITCHES, ETC., MADE OF BLACK LAMINATED PHENOLIC WITH WHITE LETTERS. FASTENERS SHALL BE SCREWS.
- 2.3 TYPED DIRECTORIES FOR ALL PANELS TO MATCH RECORD DRAWINGS.
- 2.4 RACEWAYS
 - A. CONCEALED AND UNFINISHED AREAS: EMT CONDUIT WITH STEEL CONNECTORS WITH COUPLINGS OR LOCKNUTS AND PLASTIC BUSHINGS (MINIMUM SIZE 3/4 INCH). EMT FITTINGS SHALL BE STEEL, COMPRESSION TYPE.
 - B. EXPOSED IN FINISHED AREAS: SURFACE RACEWAY BY WIREMOLD OR PANDUIT. RACEWAY COLOR SHALL MATCH THE ATTACHED SURFACE. SECURE RACEWAY WITH ADHESIVE AND SCREWS INTO SURFACE.
- 2.5 WIRING
 - A. CONDUCTOR
 - 1. MATERIAL: COPPER
 - 2. SIZES: #12 AWG MINIMUM FOR POWER, #14 AWG MINIMUM FOR CONTROL
 - B. INSULATION
 - 1. #8 AWG AND SMALLER, TYPE THHN/THWN
 - 2. LARGER THAN #8 AWG, TYPE XHHW OR THHN RATED FOR 90 DEG. C
 - 3. VOLTAGE RATING: 600 VOLTS
- 2.6 MECHANICAL FIRE STOP OR UL CLASSIFIED FOAM SEALANT FOR ALL CONDUIT PENETRATIONS OF FIRBATED WALLS AND FLOORS.
- 2.7 PANELBOARDS AND MOLDED CASE CIRCUIT BREAKERS (MCCB) SHALL HAVE RATINGS AS INDICATED. BUS BARS SHALL BE COPPER. MCCB'S SHALL BE BOLT ON. LOAD CENTERS ARE NOT PERMITTED. MANUFACTURER SHALL BE SQUARE D.
- 2.8 LIGHTING FIXTURES (COMPLETE WITH LAMPS) AS SCHEDULED ON DRAWINGS, INCLUDING ALL REQUIRED SUPPORTS, BACKING, BLOCKING, ETC.
- 2.9 GROUNDING SYSTEM PER THE DRAWINGS AND ARTICLE 250 OF THE NEC. GROUND ALL METAL RACEWAYS AND ENCLOSURES. PROVIDE EQUIPMENT GROUNDING CONDUCTORS IN ALL RACEWAYS.
- 2.10 HANGERS, BOLTS, CLAMPS, STEEL ITEMS, ANCHORS, SLEEVES, CHASES, SUPPORTS, FLASHING AND SIMILAR ITEMS REQUIRED FOR THE PROPER INSTALLATION OF ALL ELECTRICAL WORK.
- 2.11 SPECIFICATION GRADE WIRING DEVICES BY BRYANT OR HUBBLE
 - A. GENERAL USE SNAP SWITCHES: 20 AMP, 120/277 VOLT, QUIET TYPE.
 - B. DUPLEX CONVENIENCE RECEPTACLES: 20 AMP, 125 VOLT, GROUNDING TYPE, NEMA 5-20R UNLESS OTHERWISE INDICATED ON THE DRAWINGS.
 - C. GROUND FAULT INTERRUPTER, DUPLEX CONVENIENCE RECEPTACLES: 20 AMP, 125 VOLT, GROUNDING TYPE, NEMA 5-20R UNLESS OTHERWISE INDICATED ON THE DRAWINGS.
 - D. DEVICE AND COVER PLATE COLORS: IVORY
- 2.12 FLOOR MOUNTED WIRING DEVICES SHALL BE RECESSED AND FLUSH MOUNTED IN FLOOR WITH FIRE RATING.
- 2.13 NEMA 1 ENCLOSURES INDOORS AND NEMA 3R ENCLOSURES OUTDOORS UNLESS OTHERWISE INDICATED ON DRAWINGS.

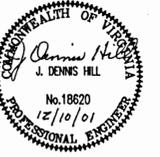
PART 3-EXECUTION

- 3.1 PROVIDE EQUIPMENT CONNECTIONS COMPLETE WITH SWITCHES, WIRING DEVICES, CONTROL DEVICES, PROTECTIVE DEVICES, CONDUIT, WIRE AND OTHER ACCESSORIES. ALL EQUIPMENT AND CONNECTIONS SHALL BE AS RECOMMENDED BY THE MANUFACTURER.
- 3.2 COORDINATE THE VOLTAGE REQUIREMENTS OF ALL EQUIPMENT TO BE INSTALLED, REGARDLESS OF THE SUPPLIER, WITH THE UTILIZATION AND/OR DISTRIBUTION VOLTAGES SHOWN ON THE ELECTRICAL DRAWINGS. REPAIR OR REPLACE, AT NO EXPENSE TO THE OWNER, EQUIPMENT SUSTAINING DAMAGE BECAUSE OF IMPROPER CONNECTIONS.
- 3.3 WHEN EQUIPMENT IS SUPPLIED WITH OTHER ELECTRICAL REQUIREMENTS AT VARIANCE WITH THOSE SPECIFIED OR SHOWN ON THE DRAWINGS, PROVIDE ASSOCIATED ELECTRICAL DEVICES AND CIRCUITRY OF THE CORRECT SIZES AND RATINGS.
- 3.4 INSTALL RACEWAYS IN ACCORDANCE WITH NEC.
- 3.5 LABEL AND IDENTIFY ALL CIRCUITS, PANELBOARDS, PULL BOXES, FEEDERS, AND SIMILAR ITEMS.
- 3.6 PROVIDE ALL CUTTING, DRILLING AND PATCHING OF THE BUILDING STRUCTURE AS REQUIRED FOR THE WORK AS INDICATED. PATCHING SHALL MATCH EXISTING SURROUNDING AREA.
- 3.7 MAINTAIN CONSTRUCTION RECORD DRAWINGS THAT REFLECT ALL ADJUSTMENTS MADE TO THESE DRAWINGS. PROVIDE CLEAR, CLEAN MARK-UPS OF THE RECORD CONDITIONS SO THAT THE ORIGINAL DRAWINGS CAN BE UPDATED.

NOTES (DRAWING NO. E-1)

1. ALL ELECTRICAL ITEMS ARE NEW UNLESS INDICATED OTHERWISE.
2. REMOVE ALL ELECTRICAL LIGHTS, RECEPTACLES, TELEPHONE OUTLETS, DATA OUTLETS, WIRING, AND RACEWAYS IN ROOM 102. REMOVE WIRING AND RACEWAYS BACK TO THEIR SOURCE OF ORIGINATION.
3. SERVICE, FEEDER, AND BRANCH CIRCUIT WIRING AND RACEWAYS HAVE NOT BEEN SHOWN IN DETAIL ON THE FLOOR PLANS.
4. THE CONTRACTOR SHALL INSTALL WIRING AND RACEWAYS CONCEALED IN WALLS, UNDER FLOORS, AND ABOVE CEILINGS WHERE PRACTICAL. SURFACE MOUNTED RACEWAYS AND WIRING DEVICES SHALL BE PROVIDED WHEN WIRING AND RACEWAYS CANNOT BE CONCEALED.
5. COMBINATION POWER AND TELECOM SURFACE MOUNTED RACEWAY SHALL BE USED WHERE APPLICABLE TO MINIMIZE THE AMOUNT OF SURFACE MOUNTED RACEWAY.
6. TELEPHONE AND DATA WORKSTATION JACKS, FACEPLATES, AND WIRING SHALL BE PROVIDED BY THE OWNER.

REVISIONS:



**Master
Engineers and Designers, P.C.**
2940 Fuiks Street
Lynchburg, Virginia 24501
P.O. Drawer 2239
24501
(804) 846-1350

**CITY OF LYNCHBURG
PARKS & RECREATION
GROVE STREET OFFICE RENOVATION**
LYNCHBURG, VIRGINIA PROJECT NO: 01160

DATE ISSUED: 12-10-01
SCALE: 1/4"=1'-0"
JOB NO. 262-131
DESIGNED: JDH
DRAWN: JHR
CHECKED: JDH
APPROVED: JDH
DRAWING NO. E-1
SHEET OF
REVISION

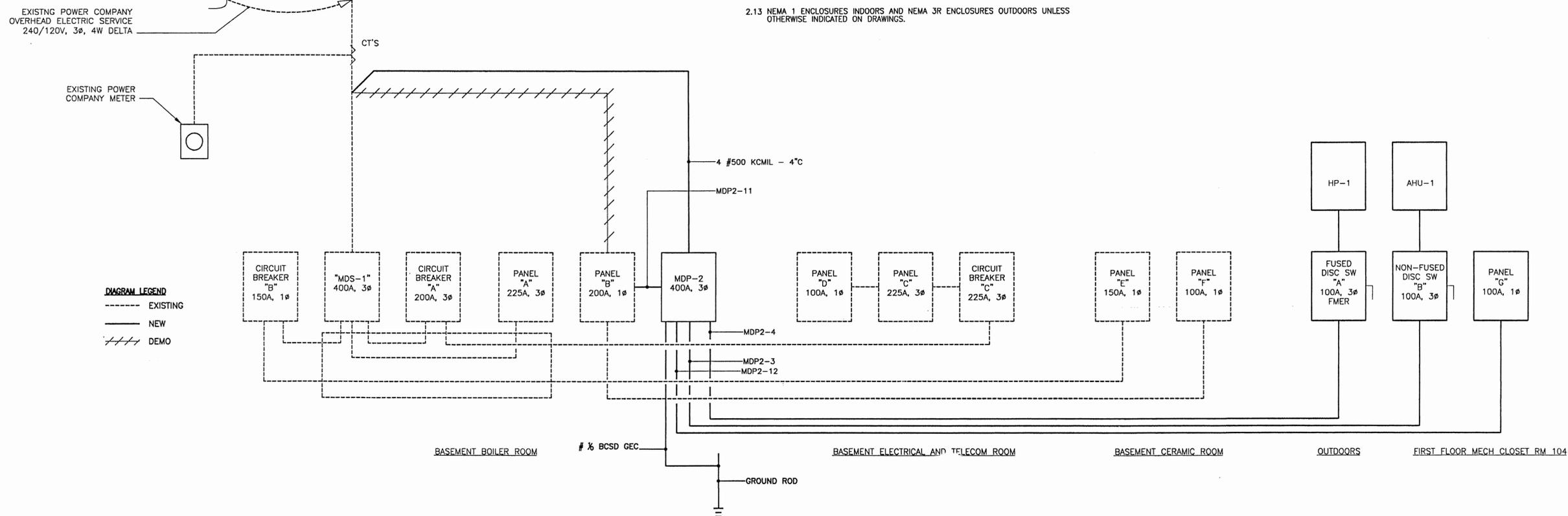
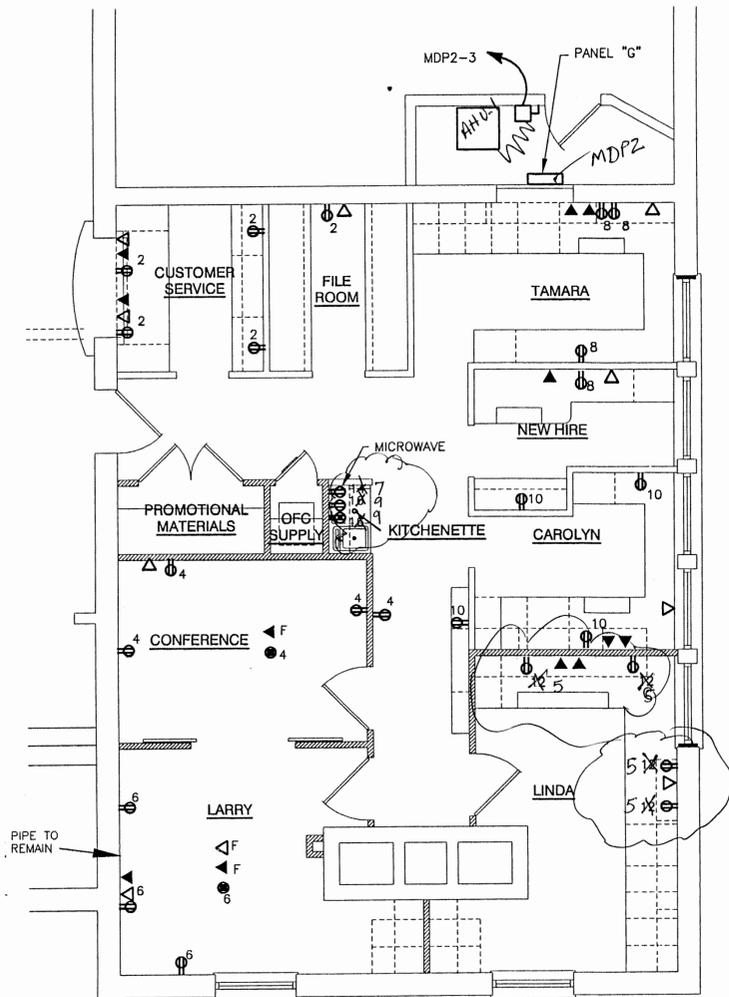


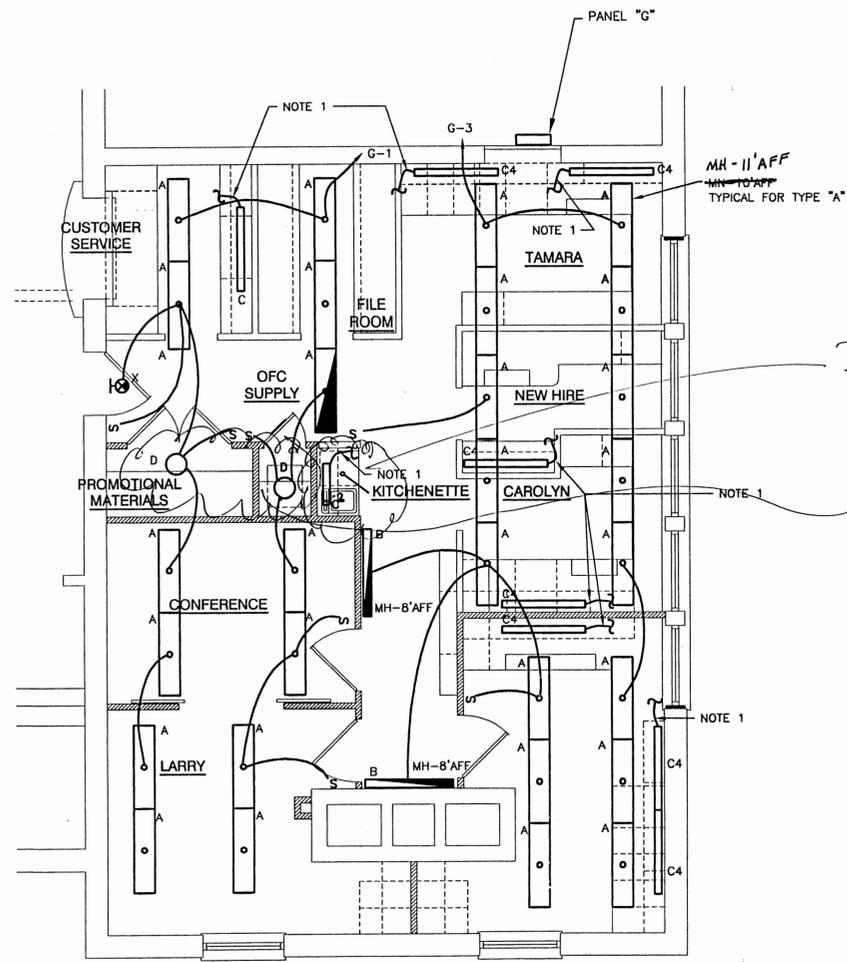
DIAGRAM LEGEND
--- EXISTING
— NEW
/// DEMO

ELECTRICAL MAINLINE DIAGRAM
SCALE: NOT TO SCALE

E1-862-131.dwg 12/10/01 JKH Master Engineers, John Rosser



ROOM 102 FLOOR PLAN - POWER
SCALE: 1/4" = 1'-0"



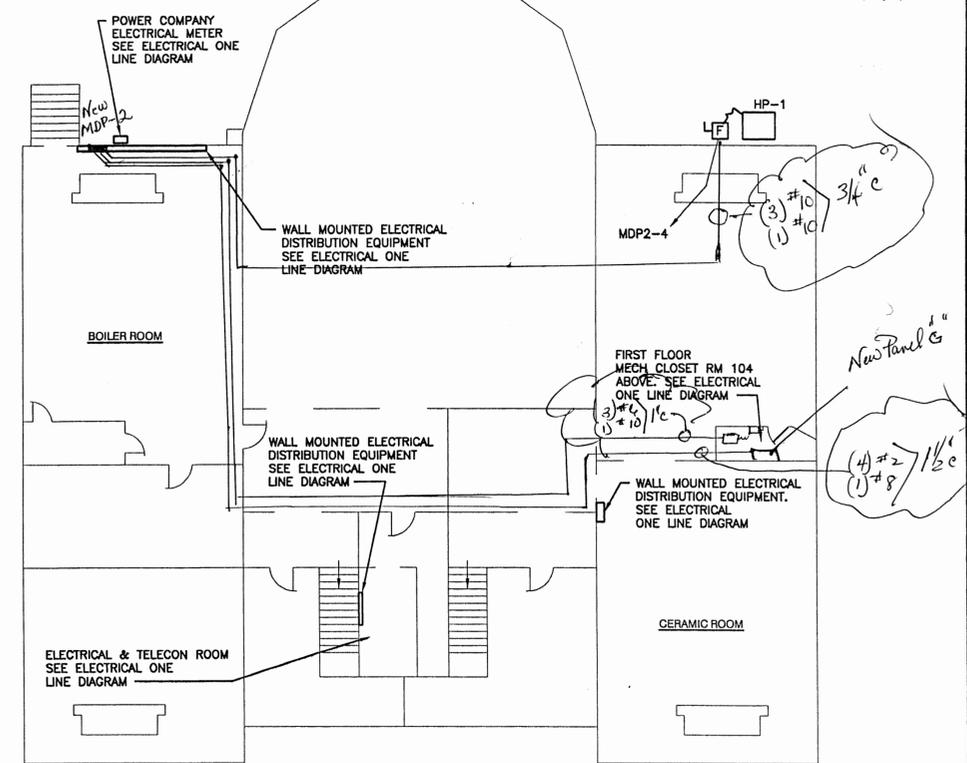
ROOM 102 FLOOR PLAN - LIGHTING
SCALE: 1/4" = 1'-0"

NOTES (DRAWING NO. E-2)

- CONNECT UNDER CABINET LIGHT FIXTURES TO NEAREST RECEPTACLE CIRCUIT.

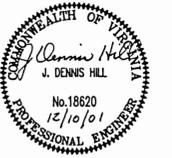
Delete light

Changed Storage Closet & Safe room to lights do fluorescent because of shelves.



BASEMENT FLOOR PLAN - POWER
SCALE: 3/32" = 1'-0"

REVISIONS:



Master Engineers and Designers, P.C.
2840 Fuiks Street
Lynchburg, Virginia 24501
(804) 848-1350

**CITY OF LYNCHBURG
PARKS & RECREATION
GROVE STREET OFFICE RENOVATION**
LYNCHBURG, VIRGINIA PROJECT NO: 01160

DATE ISSUED: 12-10-01
SCALE: AS NOTED
JOB. NO. 262-131
DESIGNED: JDH
DRAWN: JHR
CHECKED: JDH
APPROVED: JDH

DRAWING NO. **E-2**
SHEET OF
REVISION

PANEL "MDP2" SCHEDULE

PANELBOARD CHARACTERISTICS:
 VOLTS: 240/120 DELTA HIGH LEG
 PHASES: 3
 WIRES: 4
 SOLID NEUTRAL, GROUND BAR

MAIN BREAKER: 400A
 MINIMUM SHORT CIRCUIT RATING: 22,000 RMS SYM AMPS

LOCATION: BOILER ROOM
 SERVICE ENTRANCE RAED

CKT. NO.	POLE NO.	DESCRIPTION	CONN. KVA	CONN. AMPS			BREAKER			NO. & WIRE SIZE			CONDUIT SIZE	DEMAND KVA	DEMAND AMPS		
				A	B	C	P	AF	AT	PHASE	NEUT.	EGC			A	B	C
3	1	AHU-1 INDOOR UNIT	15.86	38.2	38.2		3	100	60	6	10	1"	15.86	38.2	38.2		
	3																
	5																
	7																
11	9	PANEL "B"					2	200	200	4/0	4/0	6	2 1/2"				
	11																
	13																
	15																
	17																
	19																
	21																
	23																
	25																
	27																
	29																
	31																
	33																
	35																
4	2	HP-1 OUTDOOR UNIT	7.97	19.2	19.2		3	100	40	10	10	3/4"	7.97	19.2	19.2		
	4																
	6																
	8																
12	10	PANEL "G"	13.35				2	100	100	2	2	8	1 1/2"	51.3	51.3		
	12																
	14			50.0													
	16																
	18																
	20																
	22																
	24																
	26																
	28																
	30																
	32																
	34																
	36																
38																	
40																	
42																	
TOTALS			37.18	107.4	57.4	108.7							37.18	107.4	57.4	108.7	

PANEL "G" SCHEDULE

PANELBOARD CHARACTERISTICS:
 VOLTS: 120/240
 PHASES: 1
 WIRES: 3
 SOLID NEUTRAL, GROUND BAR

MAIN LUGS: 100 AMP
 MINIMUM SHORT CIRCUIT RATING: 10,000 RMS SYM AMPS

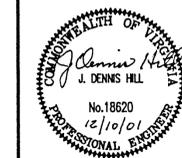
LOCATION: MECH CLOSET ROOM 104

CKT. NO.	POLE NO.	DESCRIPTION	CONN. KVA	CONN. AMPS		BREAKER			NO. & WIRE SIZE			CONDUIT SIZE	DEMAND KVA	DEMAND AMPS	
				L1	L2	P	AF	AT	PHASE	NEUT.	EGC			L1	L2
1	1	LIGHTS: ROOM 102	1.20	10.0		1	100	20	12	12	12	3/4"	1.20	10.0	
3	3	LIGHTS: ROOM 102	1.35		11.3	1	100	20	12	12	122	3/4"	1.35		11.3
5	5	SPACE ONLY		10		1	100	20	12	12	12	3/4"	1.2	10	
7	7	Recept Room 102 Liner		10		1	100	20	12	12	12	3/4"	1.2	10	
9	9	Recept Kitchen MW		10		1	100	20	12	12	12	3/4"	1.2	10	
11	11	Kitchen counter		10		1	100	20	12	12	12	3/4"	1.2	10	
13	13														
15	15														
17	17														
19	19														
21	21														
23	23														
25	25														
27	27														
29	29														
2	2	RECEPTACLES: ROOM 102	1.20	10.0		1	100	20	12	12	122	3/4"	1.20	10.0	
4	4	RECEPTACLES: ROOM 102	1.20		10.0	1	100	20	12	12	122	3/4"	1.20		10.0
6	6	RECEPTACLES: ROOM 102	1.20	10.0		1	100	20	12	12	122	3/4"	1.20	10.0	
8	8	RECEPTACLES: ROOM 102	1.20		10.0	1	100	20	12	12	122	3/4"	1.20		10.0
10	10	RECEPTACLES: ROOM 102	1.20	10.0		1	100	20	12	12	122	3/4"	1.20	10.0	
12	12	RECEPTACLES: ROOM 102	1.20		10.0	1	100	20	12	12	122	3/4"	1.20		10.0
14	14	RECEPTACLES: ROOM 102	1.20	10.0		1	100	20	12	12	122	3/4"	1.20	10.0	
16	16	RECEPTACLES: ROOM 102	1.20		10.0	1	100	20	12	12	122	3/4"	1.20		10.0
18	18	SPACE ONLY													
20	20														
22	22														
24	24														
26	26														
28	28														
30	30														
TOTALS			12.15	50.0	51.3								12.15	50.0	51.3

LIGHTING FIXTURE SCHEDULE

SYMBOL	TYPE	MANUFACTURER	CATALOG NUMBER	VOLTAGE	VOLT-AMPERES (MAXIMUM)	LAMPS		DESCRIPTION	REMARKS
						QTY	TYPE **		
	A	PEERLESS	PRM4-2-32-GE810	120	70	2	F32TB	9"X3"X4" FLUORESCENT INDIRECT/DIRECT PENDANT MOUNT, ELECTRONIC BALLAST	EMERGENCY BALLAST, SWITCHED
	B	LITHONIA	W-2-32-WH	120	70	2	F32TB	4' FLUORESCENT WALL BRACKET UP AND DOWN LIGHT, FUSED, WHITE TRIM	EMERGENCY BALLAST, SWITCHED
	C2	LITHONIA	N2S-17-SWR	120	20	1	F17TB	24" FLUORESCENT SOLID FRONT UNDERCABINET LIGHT WITH SWITCH	
	C2	LITHONIA	N2S-32-SWR	120	35	1	F32TB	48" FLUORESCENT SOLID FRONT UNDERCABINET LIGHT WITH SWITCH	
	D	NONE	NONE	120	35	1	F32TB	4' strip light	PORCELAIN LAMP HOLDER
	X	LITHONIA	LE-S-G-ELN	120	4	1	LED ARRAY	DIE CAST ALUMINUM BODY, LED ARRAY, NICKEL CADMIUM BATTERY.	

REVISIONS:



Master
 Engineers and Designers, P.C.

2940 Fuqua Street
 Lynchburg, Virginia 24501
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CITY OF LYNCHBURG
 PARKS & RECREATION
 GROVE STREET OFFICE RENOVATION

PROJECT NO. 01160
 LYNCHBURG, VIRGINIA

DATE ISSUED: 12-10-01
 SCALE: 1/4"=1'-0"
 JOB. NO. 262-131
 DESIGNED: JDH
 DRAWN: JHR
 CHECKED: JDH
 APPROVED: JDH

DRAWING NO.
 E-3
 SHEET OF
 REVISION

FLOOR PLAN

TAYLOR BROTHERS
INCORPORATED
Member AIA
LYNCHBURG, VIRGINIA

GROVE STREET OFFICE RENOVATION
LYNCHBURG PARKS & RECREATION
COLEMAN ADAMS-CONTRACTOR
CRADDOCK-CUNNINGHAM ARCHITECT

DRAWN BY
GC LARSON

CHECKED BY

DATE
3/8/02

SCALE
3/4"=1'-0"

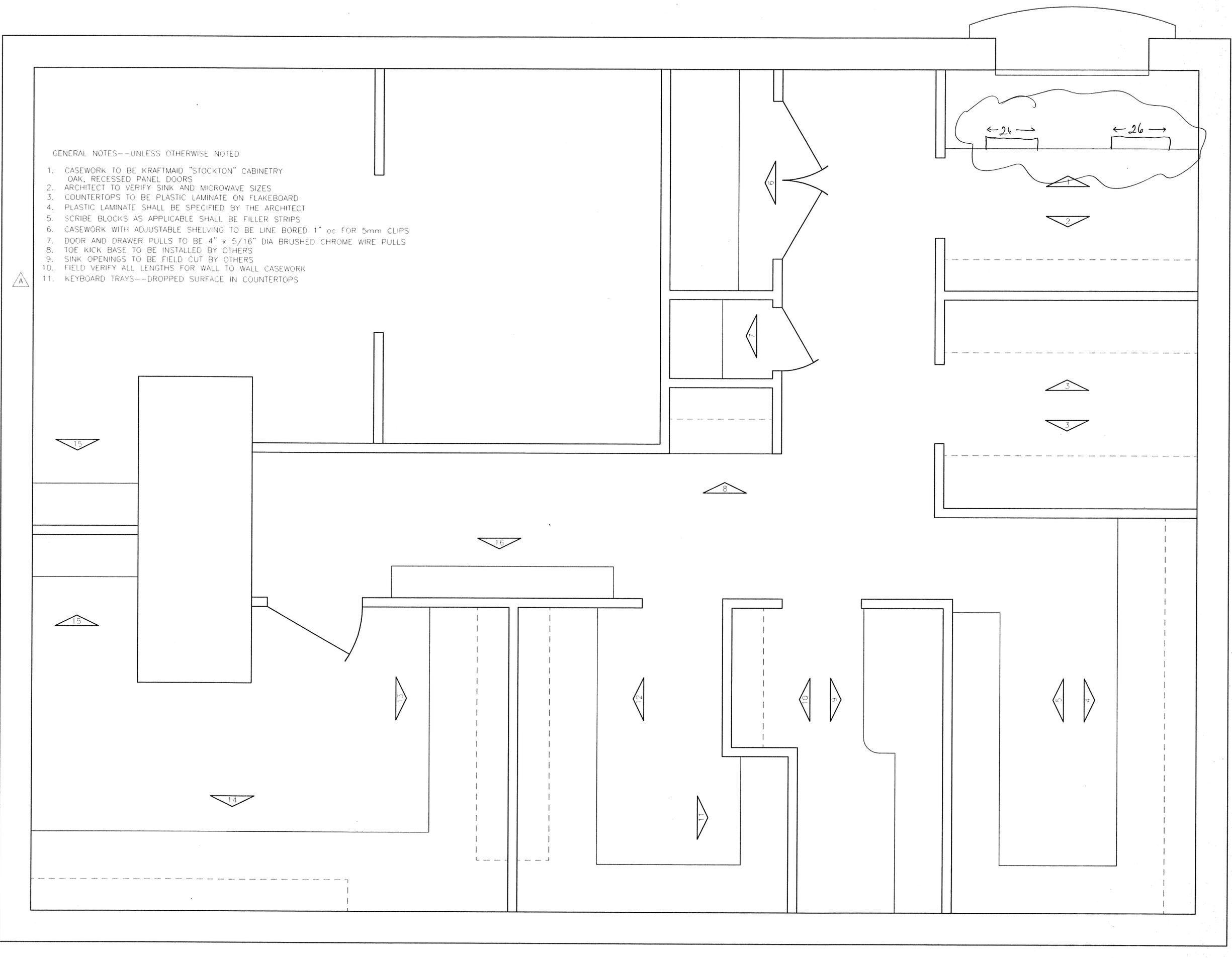
REVISION A

DRAWING NO.
GS-01

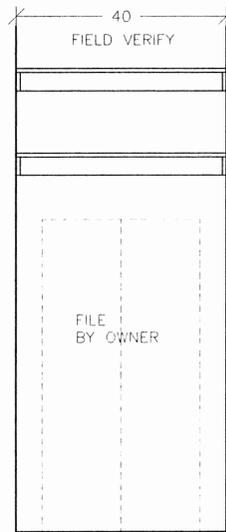
GENERAL NOTES--UNLESS OTHERWISE NOTED

1. CASEWORK TO BE KRAFTMAID "STOCKTON" CABINETY
OAK, RECESSED PANEL DOORS
2. ARCHITECT TO VERIFY SINK AND MICROWAVE SIZES
3. COUNTERTOPS TO BE PLASTIC LAMINATE ON FLAKEBOARD
4. PLASTIC LAMINATE SHALL BE SPECIFIED BY THE ARCHITECT
5. SCRIBE BLOCKS AS APPLICABLE SHALL BE FILLER STRIPS
6. CASEWORK WITH ADJUSTABLE SHELVING TO BE LINE BORED 1" oc FOR 5mm CLIPS
7. DOOR AND DRAWER PULLS TO BE 4" x 5/16" DIA BRUSHED CHROME WIRE PULLS
8. TOE KICK BASE TO BE INSTALLED BY OTHERS
9. SINK OPENINGS TO BE FIELD CUT BY OTHERS
10. FIELD VERIFY ALL LENGTHS FOR WALL TO WALL CASEWORK
11. KEYBOARD TRAYS--DROPPED SURFACE IN COUNTERTOPS

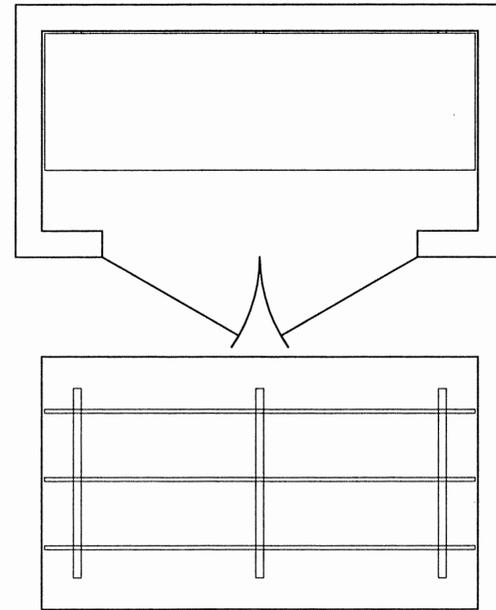
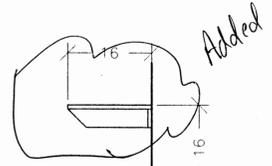
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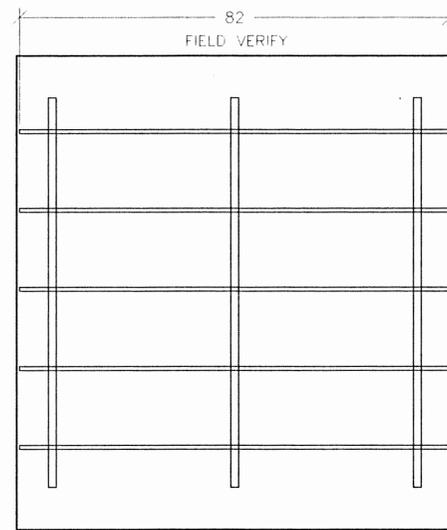
CA\CLL\GROVE STAGS-01



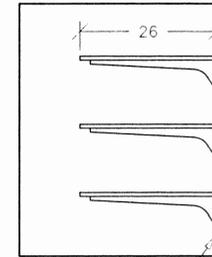
VIEW 15
2 REQUIRED
PAINT GRADE BIRCH PLYWOOD
w/EDGE BAND
ON 1x4 CLEATS



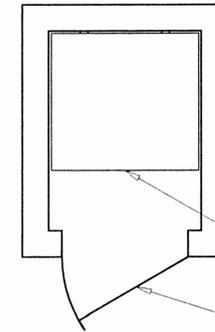
VIEW 6
PAINT GRADE BIRCH PLYWOOD
w/EDGE BAND
REF 5/A2



NOTE
KV STANDARDS AND BRACKETS ARE ADJUSTABLE

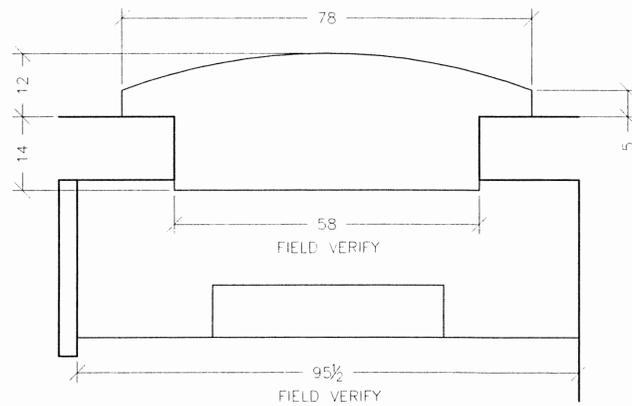


KV 87 ANO 36"
3 REQUIRED

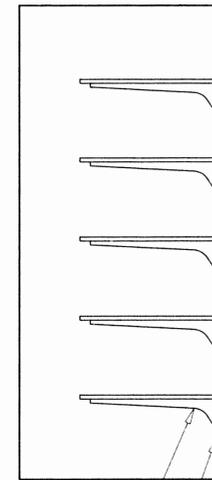
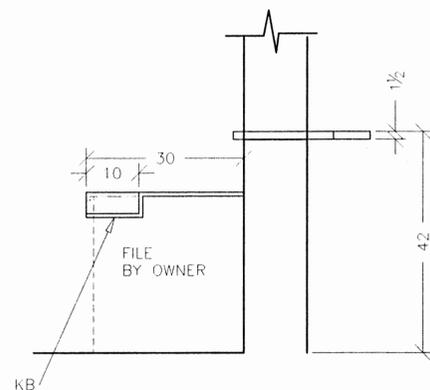


SHELF REF

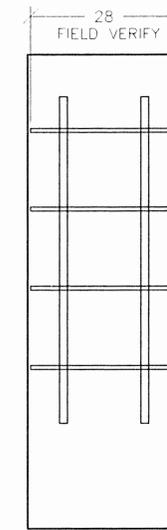
ACCESS FOR SAFE
BY OTHERS



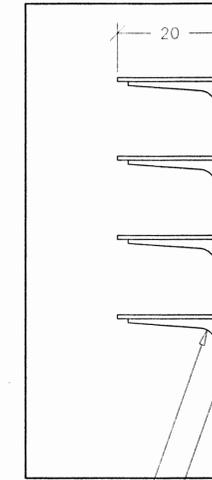
VIEW 1
CUSTOMER SERVICE
PLASTIC LAMINATE ALMOND
ALL EXPOSED SURFACES
REF 1/A2



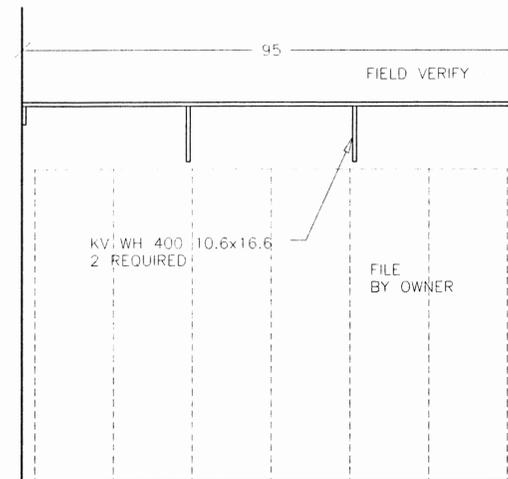
KV 187LL ANO 24"
24 REQUIRED
KV 87 ANO 72"
3 REQUIRED



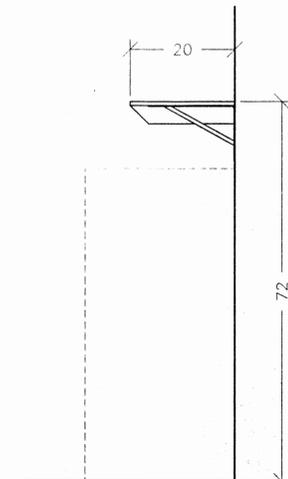
VIEW 3
2 REQUIRED
PAINT GRADE BIRCH PLYWOOD
w/EDGE BAND
ON 1x4 CLEATS



KV 187LL ANO 18"
8 REQUIRED
KV 87 ANO 60"
2 REQUIRED



VIEW 3
2 REQUIRED
PAINT GRADE BIRCH PLYWOOD
w/EDGE BAND
ON 1x4 CLEATS



SHELVES

TAYLOR BROTHERS
INCORPORATED
Member AIA

LYNCHBURG, VIRGINIA

GROVE STREET OFFICE RENOVATION
LYNCHBURG PARKS & RECREATION
COLEMAN ADAMS-CONTRACTOR
CRADDOCK-CUNNINGHAM ARCHITECT

DRAWN BY
GC LARSON

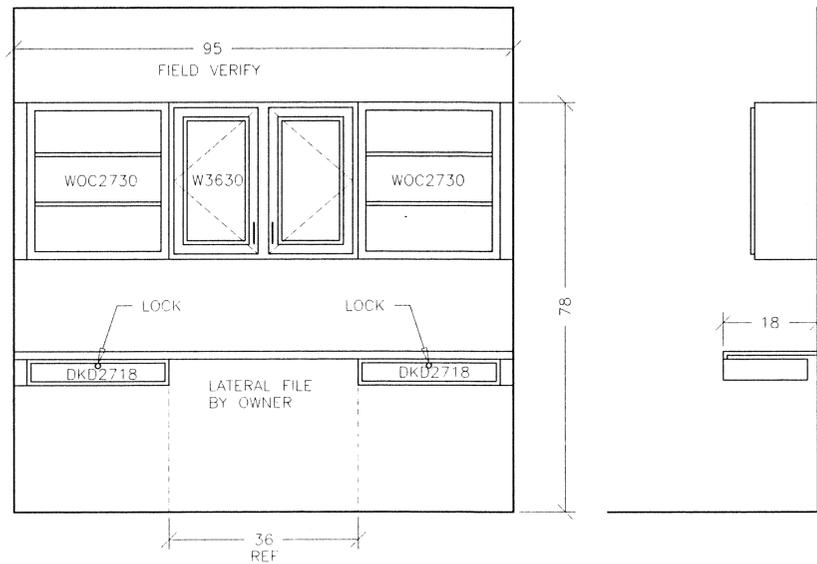
CHECKED BY

DATE
3/8/02

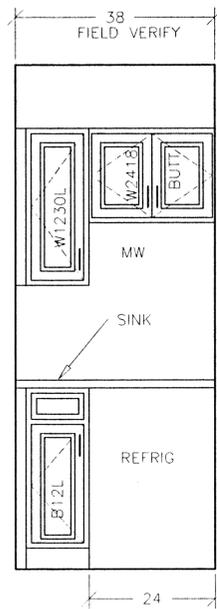
SCALE
3/4"=1'-0"

REVISION A

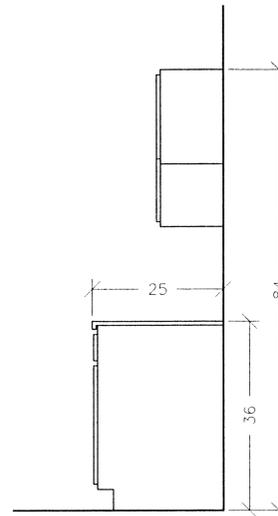
DRAWING NO.
GS-02



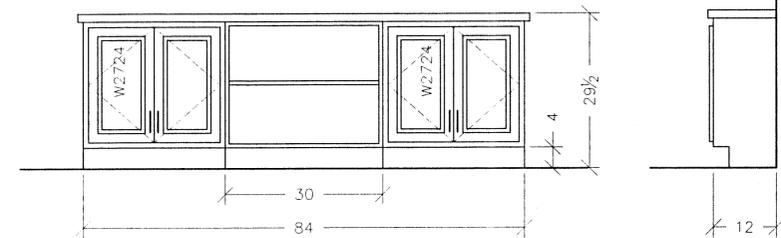
VIEW 2
CUSTOMER SERVICE



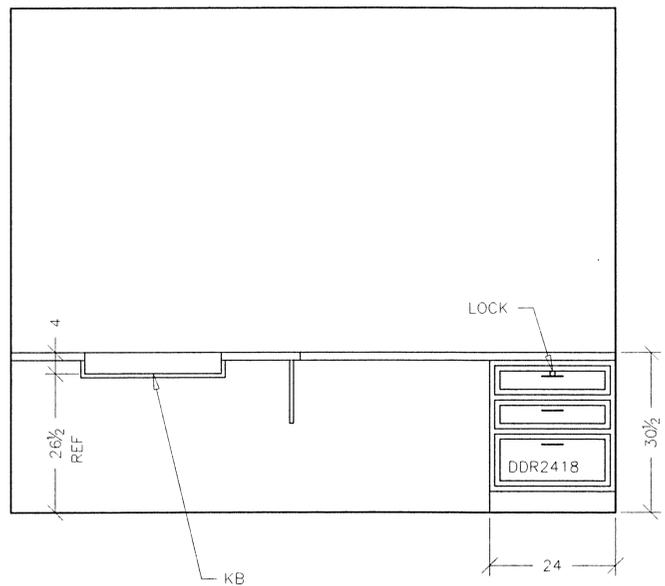
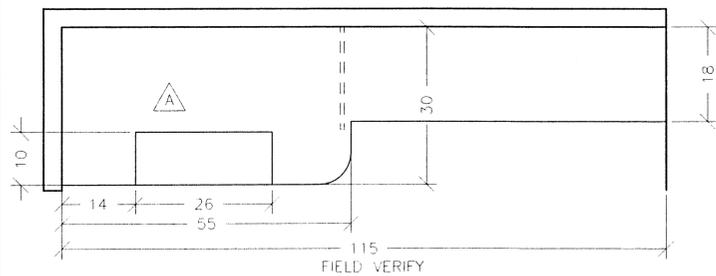
VIEW 8
KITCHENETTE



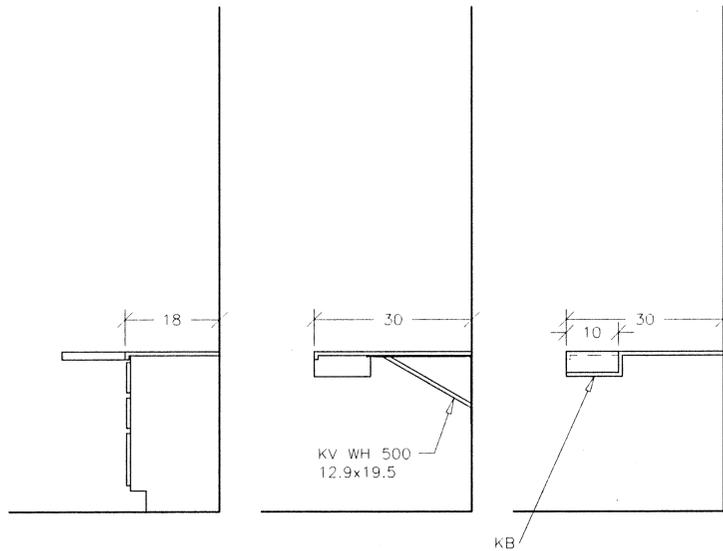
NOTE
OPEN SHELVES IN VIEWS 2, 10 & 16
ARE ADJUSTABLE AND REMOVABLE
FILLERS WILL BE PROVIDED BETWEEN CASEWORK AND WALLS
AS REQUIRED



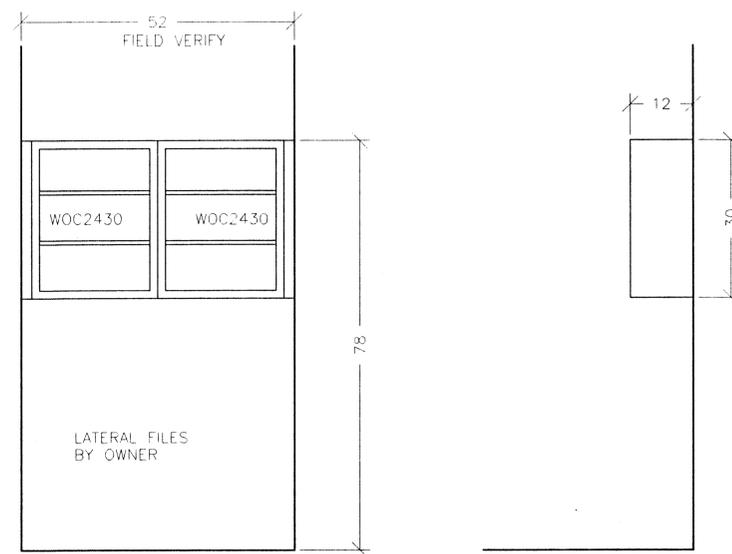
VIEW 16
HALL



VIEW 9
NEW HIRE



KB



VIEW 10
NEW HIRE

C:\CAL\GROVE-ST\GS-03A

CUBICLES

TAYLOR BROTHERS
INCORPORATED
Member AIA

LYNCHBURG, VIRGINIA

GROVE STREET OFFICE RENOVATION
LYNCHBURG PARKS & RECREATION
COLEMAN ADAMS - CONTRACTOR
CRADDOCK - CUNNINGHAM ARCHITECT

DRAWN BY
GC LARSON

CHECKED BY

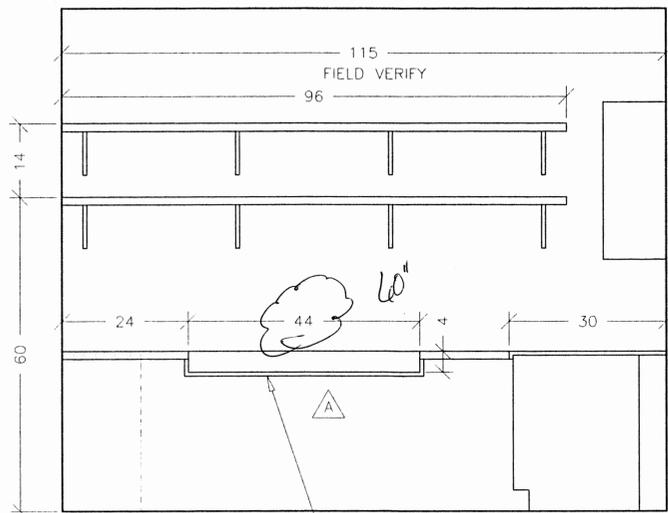
DATE
3/8/02

SCALE
3/4" = 1'-0"

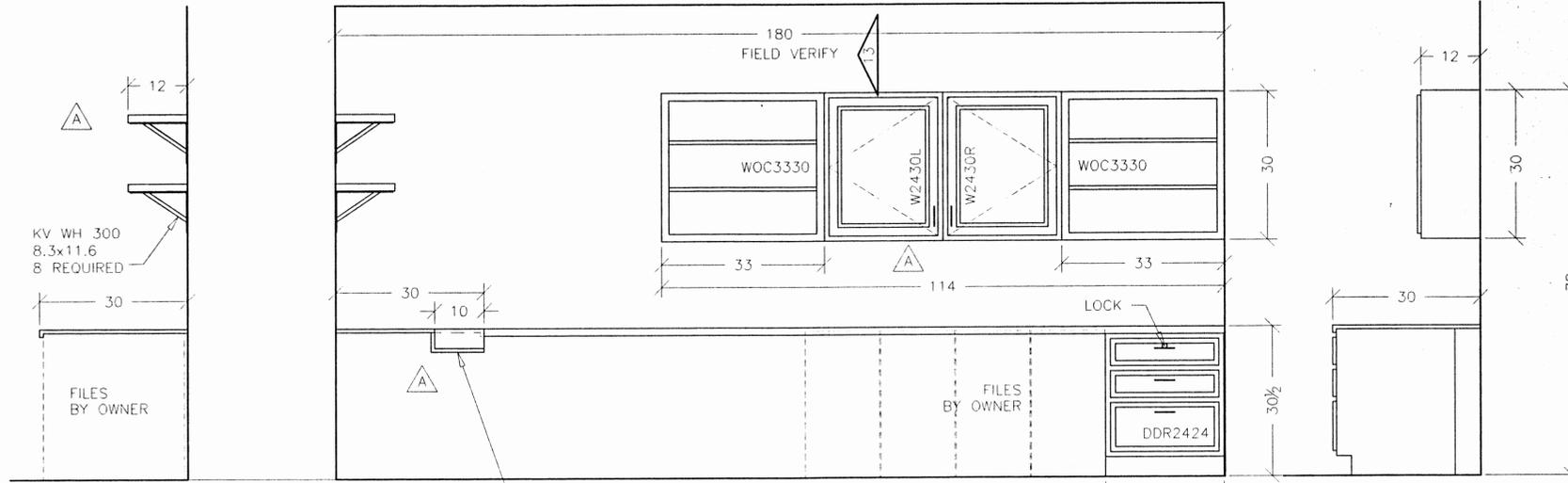
REVISION A

DRAWING NO.

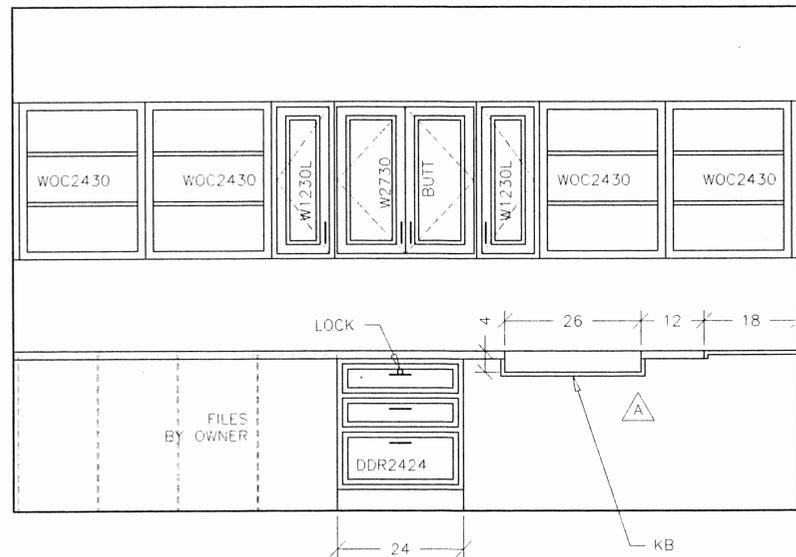
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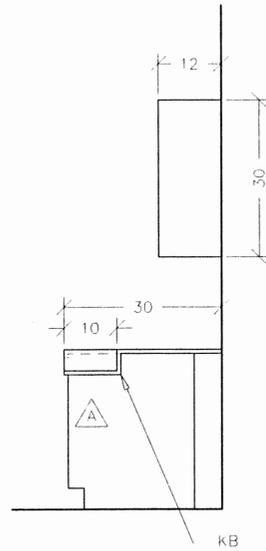
SECTION 13
LINDA



SECTION 14
LINDA

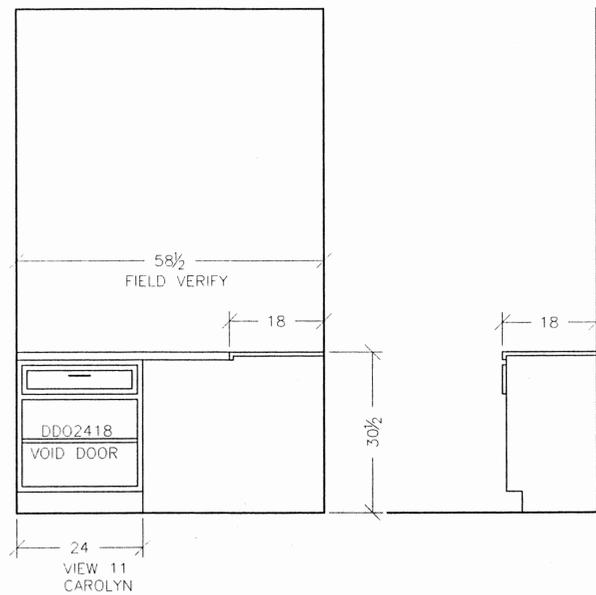


SECTION 4
TAMARA

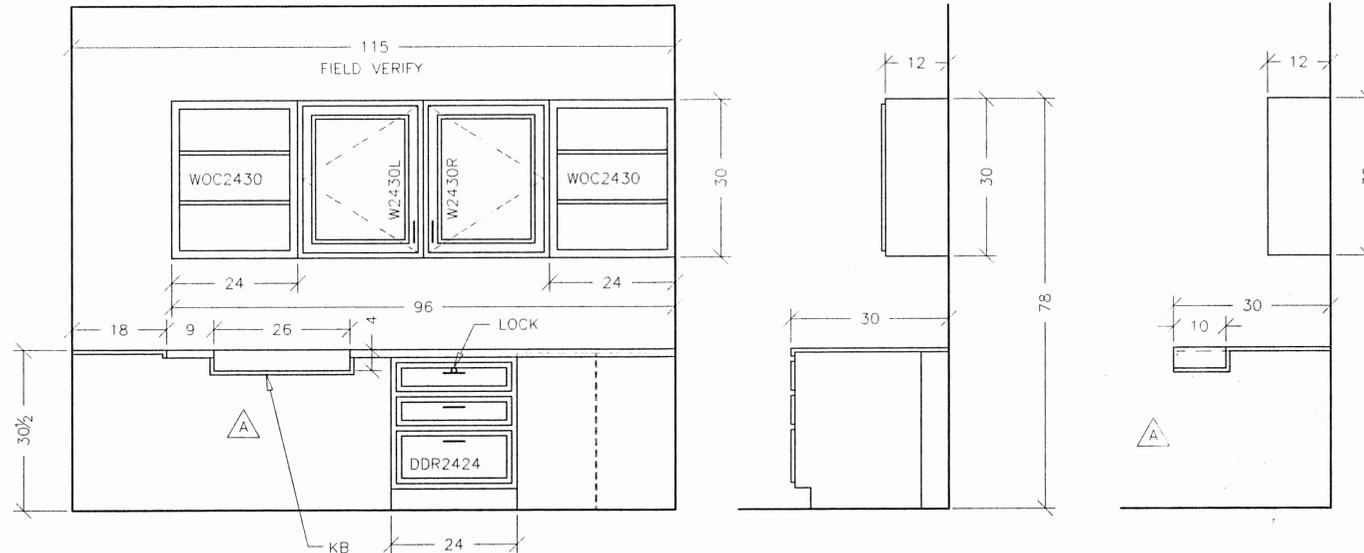


SECTION 5
TAMARA

NOTE
OPEN SHELVES IN VIEWS 4, 12 & 14
ARE ADJUSTABLE AND REMOVABLE
FILLERS WILL BE PROVIDED BETWEEN CASEWORK AND WALLS
AS REQUIRED



VIEW 11
CAROLYN



VIEW 12
CAROLYN

CUBICLES

TAYLOR BROTHERS

INCORPORATED

Member AIA

LYNCHBURG, VIRGINIA

GROVE STREET OFFICE RENOVATION
LYNCHBURG PARKS & RECREATION
COLEMAN ADAMS-CONTRACTOR
CRADDOCK-CUNNINGHAM ARCHITECT

DRAWN BY
GC LARSON

CHECKED BY

DATE
3/8/02

SCALE
3/4"=1'-0"

REVISION A

DRAWING NO.

GS-04

RENOVATIONS TO MILLER CENTER LYNCHBURG, VIRGINIA

CITY PROJECT # P0072

PROJECT MANUAL, PART III: TECHNICAL SPECIFICATIONS

**BID SET
FEBRUARY 13, 2013**

PREPARED FOR

**LYNCHBURG DEPT. OF PARKS & RECREATION
301 Grove Street
Lynchburg, Virginia**

Prepared by:

H&A

architects & engineers

HANKINS & ANDERSON



RENOVATIONS TO MILLER CENTER
Lynchburg, Virginia
City Project # P0072
H&A Project 008261.00:003

PART III: TECHNICAL SPECIFICATIONS

TABLE OF CONTENTS

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Section 012100	Allowances
Section 012200	Unit Prices
Section 012300	Alternates
Section 013100	Project Management and Coordination
Section 013200	Construction Progress Documentation
Section 013300	Submittal Procedures
Section 014000	Quality Requirements
Section 015000	Temporary Facilities and Controls
Section 016000	Product Requirements
Section 017329	Cutting and Patching
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SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Project information.
 - 2. Work covered by Contract Documents.
 - 3. Work by Owner.
 - 4. Work under separate contracts.
 - 5. Access to site.
 - 6. Coordination with occupants.
 - 7. Work restrictions.
 - 8. Specification and drawing conventions.
- B. Related Requirements include, but are not limited to:
 - 1. Division 01 Section "Allowances".
 - 2. Division 01 Section "Unit Prices".
 - 3. Division 01 Section "Alternates".
 - 4. Division 01 Section "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.3 PROJECT INFORMATION

- A. Project Identification:
 - 1. Project Title: Renovations to Miller Center
 - 2. Project Location: 301 Grove Street, Lynchburg, Virginia
 - 3. Project Number: P0072.
- B. Owner: City of Lynchburg Department of Parks and Recreation.
Owner's Representative: Kay Frazier, Director
Phone: 434-455-5868
Fax: 434-528-2794.
- C. Architect: H&A Architects & Engineers.
222 Central Park Avenue, Suite 1200
Virginia Beach, Virginia 23462
Phone: 757-222-2010
Fax: 757-222-2022
- D. Architect's Consultants: The Architect has retained the following design professionals who have prepared designated portions of the Contract Documents:
 - 1. Civil Engineer and Hazardous Materials Abatement Consultant: Hurt & Proffitt, Inc.
2524 Langhorne Road
Lynchburg, Virginia 2450`
Phone: 434-847-7796
Fax: 434-847-0047

2. Structural Engineer: Sinclair-Pratt-Cameron, P.C.
1630 Donna Drive
Virginia Beach, Virginia 23451
Phone: 757-417-0565
Fax: 757-417-0568
3. Kitchen Consultant: FoodService Solutions Design Consultants
605 JackRabbit Road, Suite B
Virginia Beach, Virginia 23451
Phone: 757-425-0055
Fax: 757-491-7006
4. Plumbing, Mechanical, Electrical Engineer: Hickman-Ambrose, Inc.
814-G Greenbrier Circle
Chesapeake, Virginia 23320
Phone: 757-420-3595
Fax: 757-424-1940
5. Theatrical Design Consultant: Auerback Pollack Friedlander
266 West 37th Street, 10th Floor
New York, New York 10018
Phone: 212-764-5630
Fax: 212-764-5632

1.4 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of Project is defined by the Contract Documents and generally consists of the following:
 1. Single three-story building addition of approximately 1,820 sf.
 2. Renovations to the approximately 24,500 sf existing building.
 3. Associated sitework.
- B. Type of Contract: Project will be constructed under a single prime contract.
- C. Record Drawings of Existing Building: The following record drawings indicating construction of the existing building at the time of bid are provided for reference purposes:
 1. Miller Park School
 - a. Architect: McLaughlin Pettit & Johnson
 - b. Date: March, 1910.
 - c. 8 sheets total
 2. Grove Street Office Renovation
 - a. Architect: Craddock-Cunningham Architectural Partners, P.C.
 - b. Date: December 7, 2001
 - c. 6 sheets of construction drawings and 4 sheets of shop drawings prepared by Taylor Brothers bound into a single set.

1.5 WORK BY OWNER

- A. General: Cooperate fully with Owner so work may be carried out smoothly, without interfering with or delaying work under this Contract or work by Owner. Coordinate the Work of this Contract with work performed by Owner.
- B. Concurrent Work: Owner will perform the following construction operations at Project site. Those operations will be conducted simultaneously with work under this Contract.
 1. Installation of site furnishings.

2. Selected landscaping work, to include:
 - a. Final selection of plant choices.
 - b. Plant spacing
 - c. Installation of plants.
- C. Subsequent Work: Owner will perform the following additional work at site after Substantial Completion. Completion of that work will depend on successful completion of preparatory work under this Contract.
 1. Installation of fixtures, furniture, and equipment (FF&E).

1.6 WORK UNDER SEPARATE CONTRACTS

- A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under separate contracts.
- B. Concurrent Work: Owner will award separate contract(s) for the following construction operations at Project site. Those operations will be conducted simultaneously with work under this Contract.
 1. Devices and wiring for building security system
 2. Devices and wiring for building data and telecommunications systems.

1.7 ACCESS TO SITE

- A. General: Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work or to retain other contractors on portions of Project.
- B. Use of Site: Limit use of Project site to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
- C. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.

1.8 COORDINATION WITH OCCUPANTS

- A. Owner Limited Occupancy of Completed Areas of Construction: Owner reserves the right to place and install equipment in completed portions of the Work, prior to Substantial Completion of the Work, provided such equipment installation does not interfere with completion of the Work. Such placement of equipment and limited occupancy shall not constitute acceptance of the total Work.
 1. Before limited Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of Work.

1.9 WORK RESTRICTIONS

- A. Work Restrictions, General: Comply with restrictions on construction operations.
 1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.
- B. On-Site Work Hours: Limit work to normal business working hours of 7:30 a.m. to 5:30 p.m., Monday through Friday, unless otherwise indicated.

1. Weekend Hours: Limit work on weekends to begin no sooner than 9:30 a.m. on Saturdays and Sundays.
 2. Early Morning Hours: Limit noisy work such as demolition to begin no sooner than 7:30 a.m. Monday through Friday and 9:30 a.m. Saturday and Sunday.
- C. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise, odors, or other disruption to adjoining properties with Owner.
1. Notify Owner not less than two days in advance of proposed disruptive operations.
- D. Nonsmoking Building: Smoking is not permitted within the building or within 25 feet of entrances, operable windows, or outdoor-air intakes.
- E. Controlled Substances: Use of tobacco products and other controlled substances within the existing building is not permitted.
- F. Employee Identification: Provide identification tags for Contractor personnel working on Project site. Require personnel to use identification tags at all times.

1.10 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
 2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
- C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
 2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and scheduled on Drawings.
 3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

(Not Used)

END OF SECTION 011000

SECTION 012100 - ALLOWANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements governing allowances.
 - 1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when direction will be provided to Contractor. If necessary, additional requirements will be issued by Change Order.
- B. Types of allowances include the following:
 - 1. Lump-sum allowances.
- C. Related Requirements include, but are not limited to:
 - 1. Division 01 Section "Unit Prices" for procedures for using unit prices.

1.3 SELECTION AND PURCHASE

- A. At the earliest practical date after award of the Contract, advise Architect of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.
- B. At Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.
- C. Purchase products and systems selected by Architect from the designated supplier.

1.4 ACTION SUBMITTALS

- A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.

1.5 INFORMATIONAL SUBMITTALS

- A. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.
- B. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.
- C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.6 COORDINATION

- A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

1.7 LUMP-SUM ALLOWANCES

- A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Architect under allowance and shall include freight and delivery to Project site.
- B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials selected by Architect under allowance shall be included as part of the Contract Sum and not part of the allowance.
- C. Unused Materials: Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.
 - 1. If requested by Architect, retain and prepare unused material for storage by Owner. Deliver unused material to Owner's storage space as directed.

1.8 ADJUSTMENT OF ALLOWANCES

- A. Allowance Adjustment: To adjust allowance amounts, prepare a Change Order proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.
 - 1. Include installation costs in purchase amount only where indicated as part of the allowance.
 - 2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other margins claimed.
 - 3. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.
- B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or Contractor's handling, labor, installation, overhead, and profit.
 - 1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of work has changed from what could have been foreseen from information in the Contract Documents.
 - 2. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

- A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 SCHEDULE OF ALLOWANCES

- A. The following allowances include material cost, receiving, handling, installation, and Contractor overhead and profit.
1. Allowance No. 1: Include the lump sum of \$5,000 (five thousand dollars exactly) for interior and exterior architectural signage.
 2. Allowance No. 2: Include the lump sum of \$5,000 (five thousand dollars exactly) for additional electrical and/or electronic hardware items not yet specified, for coordination and connection to the Owner's security and access control system.
 3. Allowance No. 3: Include the lump sum of \$3,000 (three thousand dollars exactly) for landscaping irrigation system.

END OF SECTION 012100

SECTION 012200 - UNIT PRICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for unit prices.
- B. Related Requirements include, but are not limited to:
 - 1. Division 02 Section "Asbestos Materials Hazard Control."
 - 2. Division 11 Section "Theatrical Lighting Fixtures and Accessories."
 - 3. Division 11 Section "Theatrical Audio Video Systems".

1.3 DEFINITIONS

- A. Unit price is an amount incorporated in the Agreement, applicable during the duration of the Work as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.
 - 1. Unit prices will be required of the successful bidder only, within 15 days after notification but prior to contract award.

1.4 PROCEDURES

- A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.
- B. Measurement and Payment: See individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.
- C. List of Unit Prices: A schedule of unit prices is included in Part 3. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES

- A. Unit Prices for removal and disposal of miscellaneous asbestos-containing materials discovered during renovation: Refer to Appendix, Section 028314. Provide unit prices listed.
- B. Unit Prices for Theatrical Lighting Fixtures and Accessories: Refer to Appendix A, Section 116173. Provide unit prices for all scheduled equipment.

- C. Unit Prices for Theatrical Audio-Visual Equipment: Refer to Appendix A, Section 116183. Provide unit prices for all scheduled equipment.

END OF SECTION 012200

SECTION 012300 - ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
 - 1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
 - 2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

- A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
 - 1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
- B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated revisions to alternates.
- C. Execute accepted alternates under the same conditions as other work of the Contract.
- D. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

- A. Alternate No. 1: Aviary Parking Lot Light Fixtures.
 - 1. Base Bid: Site lighting for the Aviary Parking Lot to consist of public electric utility fixtures (Type "FF") as indicated on Sheet E002.

2. Alternate No. 1: Site lighting for the Aviary Parking Lot to consist of Type "HH" fixtures in lieu of public electric utility fixtures as indicated on Sheet E002. Fixtures to be controlled by Lighting Contactor LC-1 in Electrical Room 109 and key switch in Hall 224 as indicated on Sheets E201 and E202.
- B. Alternate No. 2: Sound-Rated Auditorium Door Assemblies
1. Base Bid: At door openings 213.1 and 213.2 provide conventional wood doors, hollow metal frames, and finish hardware as indicated and specified.
 2. Alternate: At door openings 213.1 and 213.2 provide specialty sound-rated door and frame assemblies as specified in Section 083473.

END OF SECTION 012300

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. General coordination procedures.
 - 2. Coordination drawings.
 - 3. Requests for Information (RFIs).
 - 4. Project meetings.
- B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.
- C. Related Requirements include, but are not limited to, the following:
 - 1. Division 01 Section "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
 - 2. Division 01 Section "Closeout Procedures" for coordinating closeout of the Contract.

1.3 DEFINITIONS

- A. RFI: Request from Contractor seeking information required by, or clarifications of, the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
 - 1. Name, address, and telephone number of entity performing subcontract or supplying products.
 - 2. Number and title of related Specification Section(s) covered by subcontract.
 - 3. Drawing number and detail references, as appropriate, covered by subcontract.
- B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.
 - 1. Post copies of list in project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

1.5 GENERAL COORDINATION PROCEDURES

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate

construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

B. Coordination: Each contractor shall coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the Work. Each contractor shall coordinate its operations with operations, included in different Sections, that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components with other contractors to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

C. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

D. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's construction schedule.
2. Preparation of the schedule of values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.

E. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

1.6 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.

1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:

- a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
- b. Coordinate the addition of trade-specific information to the coordination drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
- c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
- d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
- e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
- f. Indicate required installation sequences.
- g. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

B. Coordination Drawing Organization: Organize coordination drawings as follows:

1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
6. Mechanical and Plumbing Work: Show the following:
 - a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
 - b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
 - c. Fire-rated enclosures around ductwork.
7. Electrical Work: Show the following:
 - a. Runs of vertical and horizontal conduit 1-1/4 inches in diameter and larger.
 - b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
 - c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
 - d. Location of pull boxes and junction boxes dimensioned from column center lines.
8. Fire-Protection System: Show locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.
9. Review: Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared

in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make changes as directed and resubmit.

10. Coordination Drawing Prints: Prepare coordination drawing prints according to requirements in Division 01 Section "Submittal Procedures."

1.7 REQUESTS FOR INFORMATION (RFIs)

- A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
 1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
 2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
 1. Project name.
 2. Project number.
 3. Date.
 4. Name of Contractor.
 5. Name of Architect.
 6. RFI number, numbered sequentially.
 7. RFI subject.
 8. Specification Section number and title and related paragraphs, as appropriate.
 9. Drawing number and detail references, as appropriate.
 10. Field dimensions and conditions, as appropriate.
 11. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 12. Contractor's signature.
 13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.
- C. RFI Forms: At the Contractor's option, use one of the following:
 1. AIA Document G716.;
 2. Software-generated form with substantially the same content as indicated above, acceptable to Architect.
 3. Attachments shall be electronic files in Adobe Acrobat PDF format.
- D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven (7) working days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.
 1. The following Contractor-generated RFIs will be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for approval of Contractor's means and methods.
 - d. Requests for coordination information already indicated in the Contract Documents.
 - e. Requests for adjustments in the Contract Time or the Contract Sum.
 - f. Requests for interpretation of Architect's actions on submittals.
 - g. Incomplete RFIs or inaccurately prepared RFIs.
 2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.

3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to the General Conditions
 - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within ten (10) days of receipt of the RFI response.
- E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Include the following:
 1. Project name.
 2. Name and address of Contractor.
 3. Name and address of Architect.
 4. RFI number including RFIs that were returned without action or withdrawn.
 5. RFI description.
 6. Date the RFI was submitted.
 7. Date Architect's response was received.
- F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within three (3) days if Contractor disagrees with response.
 1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
 2. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

1.8 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.
 1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
 2. Notification: Contractor shall notify the Owner's representative of all meetings with the Architect at any time, whether scheduled or not.
 3. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
 4. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three (3) days of the meeting.
- B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.
 1. Conduct the conference to review responsibilities and personnel assignments.
 2. Attendees: Authorized representatives of Owner Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 3. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Tentative construction schedule.
 - b. Critical work sequencing and long-lead items.
 - c. Designation of key personnel and their duties.
 - d. Lines of communications.
 - e. Procedures for processing field decisions and Change Orders.
 - f. Procedures for RFIs.
 - g. Procedures for testing and inspecting.
 - h. Procedures for processing Applications for Payment.

- i. Distribution of the Contract Documents.
 - j. Submittal procedures.
 - k. Preparation of record documents.
 - l. Use of the premises and existing building.
 - m. Work restrictions.
 - n. Working hours.
 - o. Responsibility for temporary facilities and controls.
 - p. Procedures for moisture and mold control.
 - q. Procedures for disruptions and shutdowns.
 - r. Construction waste management and recycling.
 - s. Parking availability.
 - t. Office, work, and storage areas.
 - u. Equipment deliveries and priorities.
 - v. First aid.
 - w. Security.
 - x. Progress cleaning.
4. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.
1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
 2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
 - a. Contract Documents.
 - b. Options.
 - c. Related RFIs.
 - d. Related Change Orders.
 - e. Purchases.
 - f. Deliveries.
 - g. Submittals.
 - h. Review of mockups.
 - i. Possible conflicts.
 - j. Compatibility requirements.
 - k. Time schedules.
 - l. Weather limitations.
 - m. Manufacturer's written instructions.
 - n. Warranty requirements.
 - o. Compatibility of materials.
 - p. Acceptability of substrates.
 - q. Temporary facilities and controls.
 - r. Space and access limitations.
 - s. Regulations of authorities having jurisdiction.
 - t. Testing and inspecting requirements.
 - u. Installation procedures.
 - v. Coordination with other work.
 - w. Required performance results.
 - x. Protection of adjacent work.
 - y. Protection of construction and personnel.
 3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
 4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.

5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- D. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 60 days prior to the scheduled date of Substantial Completion.
1. Conduct the conference to review requirements and responsibilities related to Project closeout.
 2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
 - a. Preparation of record documents.
 - b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
 - c. Submittal of written warranties.
 - d. Requirements for preparing operations and maintenance data.
 - e. Requirements for delivery of material samples, attic stock, and spare parts.
 - f. Requirements for demonstration and training.
 - g. Preparation of Contractor's punch list.
 - h. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
 - i. Submittal procedures.
 - j. Coordination of separate contracts.
 - k. Owner's partial occupancy requirements.
 - l. Installation of Owner's furniture, fixtures, and equipment.
 - m. Responsibility for removing temporary facilities and controls.
 4. Minutes: Entity conducting meeting will record and distribute meeting minutes.
- E. Semi-Monthly Progress and Coordination Meetings: Conduct progress and coordination meetings at 2-week intervals.
1. Coordinate dates of meetings with preparation of payment requests.
 2. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - 1) Review schedule for next period.
 - b. Review present and future needs of each entity present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Status of submittals.
 - 4) Deliveries.
 - 5) Off-site fabrication.

- 6) Access.
 - 7) Site utilization.
 - 8) Temporary facilities and controls.
 - 9) Progress cleaning.
 - 10) Quality and work standards.
 - 11) Hazards and risks.
 - 12) Status of correction of deficient items.
 - 13) Field observations.
 - 14) Status of RFIs.
 - 15) Status of proposal requests.
 - 16) Pending changes.
 - 17) Status of Change Orders.
 - 18) Pending claims and disputes.
 - 19) Documentation of information for payment requests.
4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
- a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.
- F. Weekly Owner Meetings: Conduct progress meetings at weekly intervals:
1. Attendees: Representatives of Owner and Contractor. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress.
 - a. Include topics for discussion as appropriate to status of Project.
 - b. Review 2-week "Look Ahead" Schedule.

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

(Not Used)

END OF SECTION 013100

SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
 - 1. Startup construction schedule.
 - 2. Contractor's construction schedule.
 - 3. Construction schedule updating reports.
 - 4. Daily construction reports.
 - 5. Site condition reports.
 - 6. Special reports.
- B. Related Requirements include, but are not limited to, the following:
 - 1. Division 01 Section "Submittal Procedures" for submitting schedules and reports.
 - 2. Division 01 Section "Quality Requirements" for submitting a schedule of tests and inspections.
 - 3. Division 11 Section "Theatrical Audio Video Systems" for sequence and scheduling requirements related to AV system equipment.

1.3 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
 - 1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
 - 2. Predecessor Activity: An activity that precedes another activity in the network.
 - 3. Successor Activity: An activity that follows another activity in the network.
- B. Cost Loading: The allocation of the schedule of values for the completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum unless otherwise approved by Architect.
- C. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.
- D. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- E. Event: The starting or ending point of an activity.
- F. Float: The measure of leeway in starting and completing an activity.
 - 1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
 - 2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.

3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.
- G. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.

1.4 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals in the following format:
1. Working electronic copy of schedule file, where indicated.
 2. PDF electronic file.
 3. Two (2) paper copies.
- B. Startup construction schedule. Approval of cost-loaded, startup construction schedule will not constitute approval of schedule of values for cost-loaded activities.
- C. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.
- D. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
1. Submit a working electronic copy of schedule, using software indicated, and labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label.
- E. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.
1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
 2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
 3. Total Float Report: List of all activities sorted in ascending order of total float.
- F. Construction Schedule Updating Reports: Submit with Applications for Payment.
- G. Daily Construction Reports: Submit at bi-weekly intervals.
- H. Site Condition Reports: Submit at time of discovery of differing conditions.
- I. Special Reports: Submit at time of unusual event.
- J. Qualification Data: For scheduling consultant.

1.5 QUALITY ASSURANCE

- A. Scheduling Consultant Qualifications: An experienced specialist in CPM scheduling and reporting, with capability of producing CPM reports and diagrams within 24 hours of Architect's request.
- B. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to the preliminary construction schedule and Contractor's construction schedule, including, but not limited to, the following:

1. Review software limitations and content and format for reports.
2. Verify availability of qualified personnel needed to develop and update schedule.
3. Discuss constraints, including phasing, work stages, area separations, interim milestones, and partial Owner occupancy.
4. Review delivery dates for Owner-furnished products.
5. Review schedule for work of Owner's separate contracts.
6. Review submittal requirements and procedures.
7. Review time required for review of submittals and resubmittals.
8. Review requirements for tests and inspections by independent testing and inspecting agencies.
9. Review time required for Project closeout and Owner startup procedures.
10. Review and finalize list of construction activities to be included in schedule.
11. Review procedures for updating schedule.

1.6 COORDINATION

- A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.
- B. Coordinate Contractor's construction schedule with the schedule of values, list of subcontractors, submittal schedule, progress reports, payment requests, and other required schedules and reports.
 1. Secure time commitments for performing critical elements of the Work from entities involved.
 2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.
 3. Refer to Division 11 Section "Theatrical Audio Video Systems" for required sequence and schedule coordination for AV systems equipment.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Time Frame: Extend schedule from date established for commencement of the Work to date of final completion.
 1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
- B. Activities: Treat each story or separate area as a separate numbered activity for each main element of the Work. Comply with the following:
 1. Activity Duration: Define activities so no activity is longer than 30 days, unless specifically allowed by Architect.
 2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
 3. Submittal Review Time: Include review and resubmittal times indicated in Division 01 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
 4. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
 5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
 6. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.

- C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
1. Work under More Than One Contract: Include a separate activity for each contract.
 2. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
 3. Products Ordered in Advance: Include a separate activity for each product.
 4. Owner-Furnished Products: Include a separate activity for each product.
 5. Work Restrictions: Show the effect of the following items on the schedule:
 - a. Coordination with existing construction.
 - b. Limitations of continued occupancies.
 - c. Uninterruptible services.
 - d. Partial occupancy before Substantial Completion.
 - e. Use of premises restrictions.
 - f. Provisions for future construction.
 - g. Seasonal variations.
 - h. Environmental control.
 6. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
 - a. Subcontract awards.
 - b. Submittals.
 - c. Purchases.
 - d. Mockups.
 - e. Fabrication.
 - f. Sample testing.
 - g. Deliveries.
 - h. Installation.
 - i. Tests and inspections.
 - j. Adjusting.
 - k. Curing.
 - l. Startup and placement into final use and operation.
 7. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
 - a. Structural completion.
 - b. Temporary enclosure and space conditioning.
 - c. Permanent space enclosure.
 - d. Completion of mechanical installation.
 - e. Completion of electrical installation.
 - f. Substantial Completion.
- D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion.
- E. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
1. Unresolved issues.
 2. Unanswered Requests for Information.
 3. Rejected or unreturned submittals.
 4. Notations on returned submittals.
 5. Pending modifications affecting the Work and Contract Time.
- F. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.

- G. Computer Scheduling Software: Prepare schedules using current version of one of the following programs that has been developed specifically to manage construction schedules.
 - 1. Microsoft Project.
 - 2. Primavera, Meridian.
 - 3. Prolog.

2.2 STARTUP CONSTRUCTION SCHEDULE

- A. Bar-Chart Schedule: Submit startup, horizontal, bar-chart-type construction schedule within seven days of date established for commencement of the Work.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for first 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

2.3 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

- A. General: Prepare network diagrams using AON (activity-on-node) format.
- B. Startup Network Diagram: Submit diagram within 14 days of date established for commencement of the Work. Outline significant construction activities for the first 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.
- C. CPM Schedule: Prepare Contractor's construction schedule using a time-scaled CPM network analysis diagram for the Work.
 - 1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 60 days after date established for commencement of the Work.
 - a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Architect's approval of the schedule.
 - 2. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
 - 3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
 - 4. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule in order to coordinate with the Contract Time.
- D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.
 - 1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
 - a. Preparation and processing of submittals.
 - b. Mobilization and demobilization.
 - c. Purchase of materials.
 - d. Delivery.
 - e. Fabrication.
 - f. Utility interruptions.
 - g. Installation.
 - h. Work by Owner that may affect or be affected by Contractor's activities.
 - i. Testing.
 - j. Punch list and final completion.

- k. Activities occurring following final completion.
 - 2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
 - 3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
 - 4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.
 - a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.
- E. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall project schedule.
- F. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:
 - 1. Contractor or subcontractor and the Work or activity.
 - 2. Description of activity.
 - 3. Main events of activity.
 - 4. Immediate preceding and succeeding activities.
 - 5. Early and late start dates.
 - 6. Early and late finish dates.
 - 7. Activity duration in workdays.
 - 8. Total float or slack time.
 - 9. Average size of workforce.
- G. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:
 - 1. Identification of activities that have changed.
 - 2. Changes in early and late start dates.
 - 3. Changes in early and late finish dates.
 - 4. Changes in activity durations in workdays.
 - 5. Changes in the critical path.
 - 6. Changes in total float or slack time.
 - 7. Changes in the Contract Time.

2.4 REPORTS

- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
 - 1. List of subcontractors at Project site.
 - 2. List of separate contractors at Project site.
 - 3. Approximate count of personnel at Project site.
 - 4. Equipment at Project site.
 - 5. Material deliveries.
 - 6. High and low temperatures and general weather conditions, including presence of rain or snow.
 - 7. Accidents.
 - 8. Meetings and significant decisions.
 - 9. Unusual events (see special reports).
 - 10. Stoppages, delays, shortages, and losses.
 - 11. Meter readings and similar recordings.
 - 12. Emergency procedures.

13. Orders and requests of authorities having jurisdiction.
14. Change Orders received and implemented.
15. Construction Change Directives received and implemented.
16. Services connected and disconnected.
17. Equipment or system tests and startups.
18. Partial completions and occupancies.
19. Substantial Completions authorized.

- B. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

2.5 SPECIAL REPORTS

- A. General: Submit special reports directly to Owner within two (2) days of an occurrence. Distribute copies of report to parties affected by the occurrence.
- B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Scheduling Consultant: Engage a consultant to provide planning, evaluation, and reporting using CPM scheduling.
1. In-House Option: Owner may waive the requirement to retain a consultant if Contractor employs skilled personnel with experience in CPM scheduling and reporting techniques. Submit qualifications.
 2. Meetings: Scheduling consultant shall attend all meetings related to Project progress, alleged delays, and time impact.
- B. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule at least one week before regularly scheduled progress meetings on monthly intervals.
1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
 2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
 3. As the Work progresses, indicate final completion percentage for each activity.
- C. Distribution: Distribute copies of approved schedule to Architect Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
1. Post copies in Project meeting rooms and temporary field offices.
 2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 013200

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.
- B. Related Requirements include, but are not limited to, the following:
 - 1. Division 01 Section "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
 - 2. Division 01 Section "Closeout Procedures" for submitting operation and maintenance manuals, record Drawings, record Specifications, and record Product Data; and for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.3 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."
- B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."
- C. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.
- D. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.4 ACTION SUBMITTALS

- A. Submittal Register: Submit a list of submittals, arranged in numerical order by specification section and coordinated with dates required by construction schedule for time-critical submittals. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates for time-critical submittals. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.
 - 1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
 - 2. Initial Submittal: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required

to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.

3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.
 - a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.
4. Format: Arrange the following information in a tabular format:
 - a. Scheduled date for first submittal.
 - b. Specification Section number and title.
 - c. Submittal category: Action; informational.
 - d. Name of subcontractor.
 - e. Description of the Work covered.
 - f. Scheduled date for Architect's final release or approval.
 - g. Scheduled date of fabrication.
 - h. Scheduled dates for purchasing.
 - i. Scheduled dates for installation.
 - j. Activity or event number.

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Architect's Digital Data Files: Electronic digital data files of portions of the Contract Drawings will be provided by Architect for Contractor's use in preparing submittals.
 1. Architect will furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing Shop Drawings.
 - a. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
 - b. Contractor shall execute a data licensing agreement in a form acceptable to Architect.
 - c. Only the following digital data files will be furnished for each appropriate discipline:
 - 1) Floor plans.
 - 2) Reflected ceiling plans.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
 3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
 4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
 5. Concurrent Review by Owner and Architect: Using the accepted Submittal Register, the Architect will designate specific submittals for concurrent review by both the Owner and the Architect. For submittals so designated, submit copies to both the Owner and Architect for simultaneous review.
- C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
 2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
 3. Resubmittal Review: Allow 10 days for review of each resubmittal.
 4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.
 5. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 15 days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.
- D. Paper Submittals: Place a permanent label or title block on each submittal item for identification.
1. Indicate name of firm or entity that prepared each submittal on label or title block.
 2. Provide a space approximately 6 by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
 3. Include the following information for processing and recording action taken:
 - a. Project name.
 - b. Date.
 - c. Name of Architect.
 - d. Name of Contractor.
 - e. Name of subcontractor.
 - f. Name of supplier.
 - g. Name of manufacturer.
 - h. Submittal number or other unique identifier, including revision identifier.
 - i. Number and title of appropriate Specification Section.
 - j. Drawing number and detail references, as appropriate.
 - k. Location(s) where product is to be installed, as appropriate.
 - l. Other necessary identification.
 4. Additional Paper Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.
 - a. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect.
 5. Transmittal for Paper Submittals: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will return without review submittals received from sources other than Contractor.
 - a. Transmittal Form for Paper Submittals: At the Contractor's option, use one of the following:
 - 1) AIA Document G810.
 - 2) CSI Form 12.1A.
 - 3) Other standardized form acceptable to Architect.
 - b. Provide locations on form for the following information:
 - 1) Project name.
 - 2) Date.
 - 3) Destination (To:).
 - 4) Source (From:).
 - 5) Name and address of Architect.
 - 6) Name of Contractor.
 - 7) Name of firm or entity that prepared submittal.
 - 8) Names of subcontractor, manufacturer, and supplier.
 - 9) Category and type of submittal.
 - 10) Submittal purpose and description.
 - 11) Specification Section number and title.

- 12) Specification paragraph number or drawing designation and generic name for each of multiple items.
- 13) Drawing number and detail references, as appropriate.
- 14) Indication of full or partial submittal.
- 15) Transmittal number.
- 16) Submittal and transmittal distribution record.
- 17) Remarks.
- 18) Signature of transmitter.

E. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:

1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
2. Name file with submittal number or other unique identifier, including revision identifier.
3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
4. Transmittal Form for Electronic Submittals: Use software-generated form from electronic project management software or electronic form acceptable to Owner, containing the following information:
 - a. Project name.
 - b. Date.
 - c. Name and address of Architect.
 - d. Name of Contractor.
 - e. Name of firm or entity that prepared submittal.
 - f. Names of subcontractor, manufacturer, and supplier.
 - g. Category and type of submittal.
 - h. Submittal purpose and description.
 - i. Specification Section number and title.
 - j. Specification paragraph number or drawing designation and generic name for each of multiple items.
 - k. Drawing number and detail references, as appropriate.
 - l. Location(s) where product is to be installed, as appropriate.
 - m. Related physical samples submitted directly.
 - n. Indication of full or partial submittal.
 - o. Transmittal number, numbered consecutively.
 - p. Submittal and transmittal distribution record.
 - q. Other necessary identification.
 - r. Remarks.
5. Metadata: Include the following information as keywords in the electronic submittal file metadata:
 - a. Project name.
 - b. Number and title of appropriate Specification Section.
 - c. Manufacturer name.
 - d. Product name.

F. Options: Identify options requiring selection by Architect.

G. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

H. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.

2. Note date and content of revision in label or title block and clearly indicate extent of revision.
 3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.
- I. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
 - J. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

- A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
 1. Submit electronic submittals via email as PDF electronic files.
 - a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
 2. Action Submittals: Submit four (4) paper copies of each submittal unless otherwise indicated. Architect will return two (2) copies.
 3. Informational Submittals: Submit Two (2) paper copies of each submittal unless otherwise indicated. Architect will not return copies.
 4. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
 - a. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.
 - b. Provide a notarized statement on original paper copy certificates and certifications where indicated.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
 1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
 2. Mark each copy of each submittal to show which products and options are applicable.
 3. Include the following information, as applicable:
 - a. Manufacturer's catalog cuts.
 - b. Manufacturer's product specifications.
 - c. Standard color charts.
 - d. Statement of compliance with specified referenced standards.
 - e. Testing by recognized testing agency.
 - f. Application of testing agency labels and seals.
 - g. Notation of coordination requirements.
 - h. Availability and delivery time information.
 4. For equipment, include the following in addition to the above, as applicable:
 - a. Wiring diagrams showing factory-installed wiring.
 - b. Printed performance curves.
 - c. Operational range diagrams.
 - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
 5. Submit Product Data before or concurrent with Samples.

6. Submit Product Data in one of the following formats:
 - a. PDF electronic file.
 - b. Four (4) paper copies of Product Data unless otherwise indicated. Architect will return two (2) copies.

- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data, unless submittal based on Architect's digital data drawing files is otherwise permitted.
 1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Identification of products.
 - b. Schedules.
 - c. Compliance with specified standards.
 - d. Notation of coordination requirements.
 - e. Notation of dimensions established by field measurement.
 - f. Relationship and attachment to adjoining construction clearly indicated.
 - g. Seal and signature of professional engineer if specified.
 2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches , but no larger than 30 by 42 inches.
 3. Submit Shop Drawings in one of the following formats:
 - a. PDF electronic file.
 - b. Four (4) opaque copies of each submittal. Architect will retain two (2) copies; remainder will be returned.

- D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
 1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
 2. Identification: Attach label on unexposed side of Samples that includes the following:
 - a. Generic description of Sample.
 - b. Product name and name of manufacturer.
 - c. Sample source.
 - d. Number and title of applicable Specification Section.
 - e. Specification paragraph number and generic name of each item.
 3. For projects where electronic submittals are permitted, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
 4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
 - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
 - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
 5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
 - a. Number of Samples: Submit two (2) full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will identify options selected.
 6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or

containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

- a. Number of Samples: Submit four (4) sets of Samples. Architect will retain two (2) Sample sets; remainder will be returned.
 - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
 - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three (3) sets of paired units that show approximate limits of variations.
- E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
 1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
 2. Manufacturer and product name, and model number if applicable.
 3. Number and name of room or space.
 4. Location within room or space.
 5. Submit product schedule in one of the following formats:
 - a. PDF electronic file.
 - b. Four (4) paper copies of product schedule or list unless otherwise indicated. Architect will return two (2) copies.
- F. Coordination Drawing Submittals: Comply with requirements specified in Division 01 Section "Project Management and Coordination."
- G. Contractor's Construction Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation."
- H. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Division 01 Section "Quality Requirements."
- I. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Division 01 Section "Closeout Procedures."
- J. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- K. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.
- L. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
- M. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

- N. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- O. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- P. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
- Q. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- R. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
 - 1. Name of evaluation organization.
 - 2. Date of evaluation.
 - 3. Time period when report is in effect.
 - 4. Product and manufacturers' names.
 - 5. Description of product.
 - 6. Test procedures and results.
 - 7. Limitations of use.
- S. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
- T. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
- U. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
- V. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.2 DELEGATED-DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 - 1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit three (3) paper copies of certificate, signed and sealed by the

responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

- A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Project Closeout and Maintenance Material Submittals: See requirements in Division 01 Section "Closeout Procedures."
- C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

- A. Action Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.
- B. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.
- C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.
- D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- E. Submittals not required by the Contract Documents may be returned by the Architect without action.

END OF SECTION 013300

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
 - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
 - 3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

1.3 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.
- C. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.
 - 1. Laboratory Mockups: Full-size physical assemblies constructed at testing facility to verify performance characteristics.
 - 2. Integrated Exterior Mockups: Mockups of the exterior envelope erected separately from the building but on Project site, consisting of multiple products, assemblies, and subassemblies.
 - 3. Room Mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes, doors, windows, millwork, casework, specialties, furnishings and equipment, and lighting.

- D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.
- E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- F. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.
- G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
 - 1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).
- J. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five (5) previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4 CONFLICTING REQUIREMENTS

- A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.5 ACTION SUBMITTALS

- A. Shop Drawings: For integrated exterior mockups, provide plans, sections, and elevations, indicating materials and size of mockup construction.
 - 1. Indicate manufacturer and model number of individual components.
 - 2. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

1.6 INFORMATIONAL SUBMITTALS

- A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.

- B. Qualification Data: For Contractor's quality-control personnel.
- C. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems:
 1. Seismic-force-resisting system, designated seismic system, or component listed in the designated seismic system quality-assurance plan prepared by Architect.
 2. Main wind-force-resisting system or a wind-resisting component listed in the wind-force-resisting system quality-assurance plan prepared by Architect.
- D. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- E. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
 1. Specification Section number and title.
 2. Entity responsible for performing tests and inspections.
 3. Description of test and inspection.
 4. Identification of applicable standards.
 5. Identification of test and inspection methods.
 6. Number of tests and inspections required.
 7. Time schedule or time span for tests and inspections.
 8. Requirements for obtaining samples.
 9. Unique characteristics of each quality-control service.

1.7 CONTRACTOR'S QUALITY-CONTROL PLAN

- A. Quality-Control Plan, General: Submit quality-control plan within (15) fifteen days of Notice of Award, and not less than five (5) days prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities. Coordinate with Contractor's construction schedule.
- B. Quality-Control Personnel Qualifications: Engage qualified full-time personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.
- C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.
- D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:
 1. Contractor-performed tests and inspections including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections.
 2. Special inspections required by authorities having jurisdiction and indicated on the "Statement of Special Inspections."
 3. Owner-performed tests and inspections indicated in the Contract Documents.
- E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements and approved mockups.

- F. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results. Include work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.8 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
 - 1. Date of issue.
 - 2. Project title and number.
 - 3. Name, address, and telephone number of testing agency.
 - 4. Dates and locations of samples and tests or inspections.
 - 5. Names of individuals making tests and inspections.
 - 6. Description of the Work and test and inspection method.
 - 7. Identification of product and Specification Section.
 - 8. Complete test or inspection data.
 - 9. Test and inspection results and an interpretation of test results.
 - 10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
 - 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 - 12. Name and signature of laboratory inspector.
 - 13. Recommendations on retesting and reinspecting.
- B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
 - 1. Name, address, and telephone number of technical representative making report.
 - 2. Statement on condition of substrates and their acceptability for installation of product.
 - 3. Statement that products at Project site comply with requirements.
 - 4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
 - 5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 - 6. Statement whether conditions, products, and installation will affect warranty.
 - 7. Other required items indicated in individual Specification Sections.
- C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
 - 1. Name, address, and telephone number of factory-authorized service representative making report.
 - 2. Statement that equipment complies with requirements.
 - 3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 - 4. Statement whether conditions, products, and installation will affect warranty.
 - 5. Other required items indicated in individual Specification Sections.
- D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.9 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that is similar in material, design, and extent to those indicated for this Project.
- F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
 - 1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.
- G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
 - 1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
 - 2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
- H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
 - 1. Contractor responsibilities include the following:
 - a. Provide test specimens representative of proposed products and construction.
 - b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.

- c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
 - d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
 - e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
 - f. When testing is complete, remove test specimens, assemblies, and mockups; do not reuse products on Project.
 - 2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
- K. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
- 1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
 - 2. Notify Architect at least five (5) days in advance of dates and times when mockups will be constructed.
 - 3. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed during the construction at Project.
 - 4. Demonstrate the proposed range of aesthetic effects and workmanship.
 - 5. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
 - a. Allow five (5) days for initial review and each re-review of each mockup.
 - 6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 - 7. Demolish and remove mockups when directed unless otherwise indicated.
- L. Integrated Exterior Mockups: Construct integrated exterior mockup according to approved Shop Drawings. Coordinate installation of exterior envelope materials and products for which mockups are required in individual Specification Sections, along with supporting materials.
- M. Laboratory Mockups: Comply with requirements of preconstruction testing and those specified in individual Specification Sections.

1.10 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
- 1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
 - 2. Payment for these services will be made from testing and inspecting allowances, as authorized by Change Orders.
 - 3. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.
- B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.
- 1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.

2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
 - a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
 3. Notify testing agencies at least 48 hours in advance of time when Work that requires testing or inspecting will be performed.
 4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
 6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. **Manufacturer's Field Services:** Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 01 Section "Submittal Procedures."
- D. **Manufacturer's Technical Services:** Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.
- E. **Retesting/Reinspecting:** Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- F. **Testing Agency Responsibilities:** Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
 1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
 3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
 4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
 5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
 6. Do not perform any duties of Contractor.
- G. **Associated Services:** Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
 1. Access to the Work.
 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
 4. Facilities for storage and field curing of test samples.
 5. Delivery of samples to testing agencies.
 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 7. Security and protection for samples and for testing and inspecting equipment at Project site.

- H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
 - 1. Schedule times for tests, inspections, obtaining samples, and similar activities.
- I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents as a component of Contractor's quality-control plan. Coordinate and submit concurrently with Contractor's construction schedule. Update as the Work progresses.
 - 1. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.11 SPECIAL TESTS AND INSPECTIONS

- A. Special Tests and Inspections: Owner will engage a qualified special inspector to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, as indicated in Statement of Special Inspections attached to this Section, and as follows:
 - 1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviews the completeness and adequacy of those procedures to perform the Work.
 - 2. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
 - 3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.
 - 4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
 - 5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
 - 6. Retesting and reinspecting corrected work.

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

- A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
 - 1. Date test or inspection was conducted.
 - 2. Description of the Work tested or inspected.
 - 3. Date test or inspection results were transmitted to Architect.
 - 4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
 - 1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching.

- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

SCHEDULE OF SPECIAL INSPECTIONS for Miller Center Renovations

MATERIAL/ACTIVITY	TYPE OF INSPECTION	APPLICABLE TO THIS PROJECT			
		Y/N/P/N	EXTENT/REFERENCE	AGENT	COMPLETED
GENERAL					
Pre-Construction conference	Meeting with parties listed in Section 6 of the HRRSIGP to discuss Special Inspection procedures	Y	Scheduled by SI with the Contractor prior to commencement of work.	1 & 2	
EARTHWORK					
Site preparation (building)	Field testing & inspection	Y	Field review, IBC 1704.7	2	
Fill material (building)	Review submittals, field testing and inspection	Y	Field review, IBC 1704.7	2	
Fill compaction (building)	In-place density tests	Y	Field review, IBC 1704.7	2	
Foundation sub-grade	Field inspection of foundation subgrade prior to placement of concrete	Y	Field review, IBC 1704.7	2	
DEEP FOUNDATION ELEMENTS					
Materials	Review product, sizes and lengths	N	IBC 1704.8, .9 OR .10		
Test Piles	Monitor driving of test piles	N	IBC 1704.8, .9 OR .10		
Installation	Monitor drilling, placement, driving of piles, including cut off and tip elevation	N	IBC 1704.8, .9 OR .10		
Pile load test	Monitor pile load test	N	IBC 1704.8, .9 OR .10		
CONCRETE					
Materials	Review product supplied versus certificates of compliance and mix design	Y	Submittal & Field Review, IBC 1704.4.1, ACI 318: Ch. 4 and 5; IBC 1904.2.2, 1913.2, 1913.3	1	
Installation of reinforcing steel, including prestressed tendons and anchor bolts as well as welding	Field inspection of placement	Y	Field Review; ACI 318:3.5, 3.5.2 & Ch. 7, AWS D1.4; IBC 1704.4, 1911.5, 1913.4	1	
Formwork installation	Field inspection	N	Field Review, ACI 318:6.1.1; IBC 1704.4		
Concreting operations & placement	Field inspection of placement/sampling	Y	Field Review ACI 318:5.6, 5.8, 5.9-10, ASTM C 172, C 31; IBC 1704.4, 1913.6, 1913.7, 1913.8,	2	
Concrete curing	Field inspection of curing process	Y	Field Review ACI 318:5.11-13, IBC 1704.4, 1913.9	2	
Concrete strength	Evaluation of concrete strength	Y	Laboratory Testing ACI 318:6.2, IBC 1704.4	2	
Application of forces for prestressed concrete	Field inspection	N	Field Review, ACI 318: 18.20		
Grouting of precast tendons	Field inspection	N	Field Review, ACI 318: 18.18.4		

Special Inspection Guidelines and Procedures

MATERIAL/ACTIVITY	TYPE OF INSPECTION	APPLICABLE TO THIS PROJECT			
		Y/N/P/N	EXTENT/REFERENCE	AGENT	COMPLETED
PRECAST CONCRETE					
Verify fabrication/quality control procedures	In-plant inspection of fabrication/quality control procedure	N	IBC 1704.2		
Erection and installation	Review submittals and as-built assemblies; Field inspection of in-place precast	N	ACI 318; Ch. 16; IBC Table 1704.4		
MASONRY (Level ___; Based on Occupancy Category ___)					
Materials	Review of products supplied versus certificate of compliance and material submitted	Y	Submittal & Field Review; ACI 530.1; ASCE 6; TMS 602; IBC 1704.5, 1708	1	
Strength	Testing/review of strength	Y	Submittal & Field Review; ACI 530.1; ASCE 6; TMS 602; IBC 1704.5, 2105.2.2, 2105.3	1	
Mortar and grout	Inspection of proportioning and mixing. Placement of mortar only.	N	Field Review; ACI 530.1; ASCE 6; TMS 602		
Grout placement, including prestressing grout	Verification to ensure compliance	N	Field Review; ACI 530.1; ASCE 6; TMS 602		
Grout space	Verification to ensure compliance	P	Field Review; ACI 530.1; ASCE 6; TMS 602	1	
Mortar, grout and prism specimens	Observe preparation	Y	Field Review; ACI 530.1; ASCE 6; TMS 602	2	
Reinforcement, prestressing tendons, and connections	Inspect condition, size, location, and spacing	P	Field Review; IBC 1704.5; ACI 530.1; ASCE 5; ASCE 6; TMS 402, 602	1	
Welding of reinforcing bars	Inspection and testing of welds	N	Field Review; IBC 1704.5; ACI 530.1; ASCE 5; TMS 402		
Prestressing force	Verify application and measurement	N	Field Review; IBC 1704.5; ACI 530.1; ASCE 5; ASCE 6; TMS 602		
Protection	Inspect procedures for protection during cold and hot weather	N	Field Review; IBC 1704.5; 2104.3, 2104.4, ACI 530.1; ASCE 6; TMS 602		
Anchorage	Inspection of anchorages	P	Field Review; ACI 530.1; ASCE 5, ASCE 6; TMS 402, TMS 602, IBC 1704.5	1	
Masonry installation	Inspection of placement of masonry and joints	N	Field Review; ACI 530.1; ASCE 6; TMS 602, IBC 1704.5		
STRUCTURAL STEEL					
Verify fabrication/quality control procedures**	In-plant inspection of fabrication/quality control procedures**	N	IBC 1704.2		
Bolts, nuts, washers, materials	Material Identification markings. Review of certificate of compliance	N	Submittal & Field Review; IBC 1704.3; ASTM; AISC 360 Section A3.3		
Bolts, nuts, washers-installation	Inspection of in-place high-strength bolts, snug-tight joints, pre-tensioned and bearing type, and slip critical connections	Y	Submittal & Field Review IBC 1704.3.3, AISC 360 Sec. M2.5	2	

Special Inspection Guidelines and Procedures

MATERIAL/ACTIVITY	TYPE OF INSPECTION	APPLICABLE TO THIS PROJECT			
		Y/N/P/N	EXTENT/REFERENCE	AGENT	COMPLETED
Structural Steel-materials	Material Identification markings and review of certificate of compliance	N	Submittal & Field Review IBC 1704.3, 1708.4, ASTM A6, A568		
Structural Steel details installation	Inspection of member locations, structural details for bracing, connections, stiffening	Y	Submittal & Field Review; IBC 1704.3.2	1	
Weld filler materials & welder certification	Review of identification markings, certificate of compliance, and welder certifications	N	Submittal & Field Review; AISC A3.5, A3.5		
Welds	Inspection and testing of welds (FIELD WELDS)	Y	Field Review, IBC 1704.3.1, AWS, D1.1, D1.3	2	
Cold-formed steel trusses spanning 60' or greater	Inspection of temporary and permanent restrains/bracing	N	Field Review, IBC 1704.3.4		
WOOD					
Verify fabrication/quality control procedures	In-plant inspection of fabrication/quality control procedures**	N	IBC 1704.2, 1704.6		
Metal plate connected wood/metal trusses spanning 60' or more	Approved bracing with submittal	N	IBC 1704.6.2		
High-Load Diaphragms-Installation	Review submittal and as-built assemblies; Inspection of sheathing, framing size, nail and staple diameter and length, number of fastener lines, and fastener spacing.	Y	IBC 1704.1, 1704.6.1	1	
SPRAYED CEMENTITIOUS AND MINERAL FIBER FIRE RESISTIVE MATERIALS					
Structural member surface conditions	Field Review of surface conditions prior to application	N	AWCI 12-B; IBC 1704.12		
Application/Thickness	Field review of application operations and thickness	N	ASTM E605, AWCI 12-B, IBC 1704.12		
Mastic & Intumescent Fire Resistant Coating	Field review of application operations and thickness	N	AWCI 12-B; IBC 1704.13		
EXTERIOR INSULATION AND FINISH SYSTEMS					
Application	Field review of application/installation	N	ASTM E2570, IBC 1704.14		
SPECIAL CASES					
Alternative Materials & Systems	As requested by Bldg Official, review system & installation	N	IBC 1704.15		

Special Inspection Guidelines and Procedures

MATERIAL/ACTIVITY	TYPE OF INSPECTION	APPLICABLE TO THIS PROJECT		
		Y/N/P/N	EXTENT/REFERENCE	AGENT
MAIN WIND FORCE RESISTING SYSTEM				
Wind Requirements	Review of the system components and installation	N	IBC 1609.1.2, 1705.4, 1705.4.1, 1705.4.2, 1710	
SEISMIC FORCE RESISTING SYSTEMS				
Seismic Requirements	Review of the designated seismic systems and seismic force resistance systems	N	IBC 1613, 1705.3, 1705.3.1, 1707, 1708, 1710.2; ASCE 7	
SMOKE CONTROL				
Special inspection of smoke control systems	Leakage testing and recording of device location, pressure difference testing, flow measurement and detection and control verification	N	IBC 1704.16, 1704.16.1, 1704.16.2	
INSPECTION AGENTS				
1. Special Inspector	To Be Determined		ADDRESS	PHONE
2. Materials Testing Laboratory	To Be Determined			
3. Special Inspector Smoke Control System				
4. (Additional Agents)				

Notes: * The qualifications of the Special Inspector and Testing Laboratories are subject to the approval of the Building Official.

** Inspection of quality control procedures required only if fabricator is not regularly inspected by an independent inspection agency.

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.
- B. Related Requirements: Refer to Division 01 Section "Summary" for work restrictions and limitations on utility interruptions.

1.3 USE CHARGES

- A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, testing agencies, and authorities having jurisdiction.
- B. Sewer Service: Pay sewer-service use charges for sewer usage by all entities for construction operations.
- C. Water Service: Pay water-service use charges for water used by all entities for construction operations.
- D. Electric Power Service: Pay electric-power-service use charges for electricity used by all entities for construction operations.

1.4 INFORMATIONAL SUBMITTALS

- A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.
- B. Erosion- and Sedimentation-Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.
- C. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.
- D. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage.
 - 1. Describe delivery, handling, and storage provisions for materials subject to water absorption or water damage.
 - 2. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.
 - 3. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these

operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.

1.5 QUALITY ASSURANCE

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.6 PROJECT CONDITIONS

- A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Chain-Link Fencing: Minimum 2-inch, 0.148-inch- thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts, with 1-5/8-inch- OD top rails.
- B. Portable Chain-Link Fencing: Minimum 2-inch, 0.148-inch- thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts, with 1-5/8-inch- OD top and bottom rails. Provide concrete bases for supporting posts.
- C. Wood Enclosure Fence: Plywood, 8 feet high, framed with four 2-by-4-inch rails, with preservative-treated wood posts spaced not more than 8 feet apart.
- D. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil minimum thickness, with flame-spread rating of 15 or less per ASTM E 84 and passing NFPA 701 Test Method 2.

2.2 TEMPORARY FACILITIES

- A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
- B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:
 - 1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
 - 2. Conference room of sufficient size to accommodate meetings of ten (10) individuals. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and 4-foot- square tack and marker boards.
 - 3. Drinking water and private toilet.
 - 4. Coffee machine and supplies.
 - 5. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F.

6. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.

- C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
1. Store combustible materials apart from building.

2.3 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
 2. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
 3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return-air grille in system and remove at end of construction and clean HVAC system as required in Division 01 Section "Closeout Procedures"
- C. Air-Filtration Units: Primary and secondary HEPA-filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
1. Locate facilities to limit site disturbance as specified in Division 01 Section "Summary."
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.
1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.
1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.
- C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.
- D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

- E. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
- F. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
 - 1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.
- G. Electric Power Service: Provide temporary electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
 - 1. Install temporary electric power service overhead unless otherwise indicated.
- H. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
 - 1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
- I. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install minimum two (2) telephone lines for each field office.
 - 1. Provide additional telephone lines for each facsimile machine in each field office.
 - 2. At each telephone, post a list of important telephone numbers.
 - a. Police and fire departments.
 - b. Ambulance service.
 - c. Contractor's home office.
 - d. Contractor's emergency after-hours telephone number.
 - e. Architect's office.
 - f. Engineers' offices.
 - g. Owner's office.
 - h. Principal subcontractors' field and home offices.
 - 3. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.
- J. Electronic Communication Service: Provide a desktop computer in the primary field office adequate for use by Architect and Owner to access Project electronic documents and maintain electronic communications. Equip computer with not less than the following:
 - 1. Printer: "All-in-one" unit equipped with printer server, combining color printing, photocopying, scanning, and faxing, or separate units for each of these three functions.
 - 2. Internet Service: Broadband modem, router and ISP, equipped with hardware firewall.
 - 3. Internet Security: Integrated software, providing software firewall, virus, spyware, phishing, and spam protection in a combined application.
 - 4. Backup: External hard drive, minimum 40 gigabyte, with automated backup software providing daily backups.

3.3 SUPPORT FACILITIES INSTALLATION

- A. General: Comply with the following:
 - 1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
 - 2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial

Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

- B. Temporary Use of Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.
 - 1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
 - 2. Prepare subgrade and install subbase and base for temporary roads and paved areas according to Division 31 Section "Earthwork."
 - 3. Recondition base after temporary use, including removing contaminated material, regrading, proofrolling, compacting, and testing.
 - 4. Delay installation of final course of permanent hot-mix asphalt pavement until immediately before Substantial Completion. Repair hot-mix asphalt base-course pavement before installation of final course.
- C. Traffic Controls: Comply with requirements of authorities having jurisdiction.
 - 1. Protect existing site improvements to remain including curbs, pavement, and utilities.
 - 2. Maintain access for fire-fighting equipment and access to fire hydrants.
- D. Parking: Provide temporary parking areas for construction personnel.
- E. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
 - 1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
 - 2. Remove snow and ice as required to minimize accumulations.
- F. Project Signs: At the Contractor's option, up to two (2) project identification signs may be erected to identify the project design and construction team. Design layout, materials, information and location(s) for such signs shall be submitted for Owner approval. Unauthorized signs are not permitted.
 - 1. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
 - a. Provide temporary, directional signs for construction personnel and visitors.
 - 2. Maintain and touchup signs so they are legible at all times.
 - 3. Owner reserves the right to install its own signs for the purpose of project identification, to be mounted on construction fencing. Cooperate with Owner forces for mounting and maintenance of such signs.
- G. Waste Disposal Facilities: Comply with requirements specified in Division 01 Section "Construction Waste Management."
- H. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction.
- I. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
 - 1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.
- J. Temporary Elevator Use: See Division 14 Section "Hydraulic Elevator" for temporary use of new elevators.

- K. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.
- L. Existing Stair Usage: Use of Owner's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.
 - 1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If stairs become damaged, restore damaged areas so no evidence remains of correction work.
- M. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
- B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
 - 1. Comply with work restrictions specified in Division 01 Section "Summary."
- C. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of 2003 EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.
 - 1. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant- protection zones.
 - 2. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
 - 3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during the course of Project.
 - 4. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.
- D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.
- E. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.
- F. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.
- G. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.

1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
 2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one (1) set of keys to Owner.
- H. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.
- I. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- J. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.
- K. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.
1. Prohibit smoking in construction areas.
 2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
 3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
 4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.5 MOISTURE AND MOLD CONTROL

- A. Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.
- B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:
1. Protect porous materials from water damage.
 2. Protect stored and installed material from flowing or standing water.
 3. Keep porous and organic materials from coming into prolonged contact with concrete.
 4. Remove standing water from decks.
 5. Keep deck openings covered or dammed.
- C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
 2. Keep interior spaces reasonably clean and protected from water damage.
 3. Periodically collect and remove waste containing cellulose or other organic matter.
 4. Discard or replace water-damaged material.
 5. Do not install material that is wet.
 6. Discard, replace, or clean stored or installed material that begins to grow mold.
 7. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.

- D. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
 - 1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
 - 2. Use permanent HVAC system to control humidity.
 - 3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.
 - a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective.
 - b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
 - c. Remove materials that can not be completely restored to their manufactured moisture level within 48 hours.

3.6 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
 - 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
- C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
 - 1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
 - 2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
 - 3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Division 01 Section "Closeout Procedures."

END OF SECTION 015000

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.
- B. Related Requirements include, but are not limited to:
 - 1. Division 01 Section "Allowances" for products selected under an allowance.
 - 2. Division 01 Section "Alternates" for products selected under an alternate.

1.3 DEFINITIONS

- A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
 - 2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
 - 3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.4 ACTION SUBMITTALS

- A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
 - 2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

- a. Form of Approval: As specified in Division 01 Section "Submittal Procedures."
 - b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.
- B. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 01 Section "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.
- 1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
 - 2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
- 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
 - 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 - 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 - 4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.
- C. Storage:
- 1. Store products to allow for inspection and measurement of quantity or counting of units.
 - 2. Store materials in a manner that will not endanger Project structure.
 - 3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
 - 4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
 - 5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
 - 6. Protect stored products from damage and liquids from freezing.
 - 7. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.7 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. **Manufacturer's Warranty:** Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
 2. **Special Warranty:** Written warranty required by the Contract Documents to provide specific rights for Owner.
- B. **Special Warranties:** Prepare a written document that contains appropriate terms and identification, ready for execution.
1. **Manufacturer's Standard Form:** Modified to include Project-specific information and properly executed.
 2. **Specified Form:** When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
 3. See other Sections for specific content requirements and particular requirements for submitting special warranties.
- C. **Submittal Time:** Comply with requirements in Division 01 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

- A. **General Product Requirements:** Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
 2. **Standard Products:** If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
 4. Where products are accompanied by the term "as selected," Architect will make selection.
 5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
 6. **Or Equal:** For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.
- B. **Product Selection Procedures:**
1. **Product:** Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 2. **Manufacturer/Source:** Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 3. **Products:**
 - a. **Restricted List:** Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
 - b. **Nonrestricted List:** Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.

4. Manufacturers:
 - a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
 - b. Nonrestricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.
 5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.
- C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
- D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

- A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
 2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 3. Evidence that proposed product provides specified warranty.
 4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
 5. Samples, if requested.

PART 3 - EXECUTION

(Not Used)

END OF SECTION 016000

SECTION 017329 – CUTTING AND PATCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes, but is not limited to, cutting and patching of existing construction.
- B. Related Requirements include, but are not limited to:
 - 1. Division 01 Section "Summary" for limits on use of Project site.
 - 2. Division 01 Section "Closeout Procedures" for final cleaning.
 - 3. Division 02 Section "Selective Demolition" for demolition and removal of selected portions of the building.
 - 4. Division 07 Section "Penetration Firestopping" for patching penetrations in fire-rated construction.

1.3 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.
- B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.4 INFORMATIONAL SUBMITTALS

- A. Cutting and Patching Plan: Submit plan describing procedures at least ten (10) days prior to the time cutting and patching will be performed. Include the following information:
 - 1. Extent: Describe reason for and extent of each occurrence of cutting and patching.
 - 2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
 - 3. Products: List products to be used for patching and firms or entities that will perform patching work.
 - 4. Dates: Indicate when cutting and patching will be performed.
 - 5. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.
 - a. Include description of provisions for temporary services and systems during interruption of permanent services and systems.

1.5 QUALITY ASSURANCE

- A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
 - 1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut

- and patch structural elements in a manner that could change their load-carrying capacity or increase deflection
2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include the following:
 - a. Primary operational systems and equipment.
 - b. Fire separation assemblies.
 - c. Air or smoke barriers.
 - d. Fire-suppression systems.
 - e. Mechanical systems piping and ducts.
 - f. Control systems.
 - g. Communication systems.
 - h. Fire-detection and -alarm systems.
 - i. Conveying systems.
 - j. Electrical wiring systems.
 3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:
 - a. Water, moisture, or vapor barriers.
 - b. Membranes and flashings.
 - c. Sprayed fire-resistive material.
 - d. Equipment supports.
 - e. Piping, ductwork, vessels, and equipment.
 - f. Noise- and vibration-control elements and systems.
 4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
- B. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections.
- B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.
 - 1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
 - 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

3.2 CUTTING AND PATCHING

- A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.
- C. Temporary Support: Provide temporary support of work to be cut.
- D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Division 01 Section "Summary."
- F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.
- G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
 - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 - 3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 - 4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
 - 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 - 6. Proceed with patching after construction operations requiring cutting are complete.
- H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as

practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
 - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
 - b. Restore damaged pipe covering to its original condition.
 3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
 4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
 5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.
- I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

END OF SECTION 017329

SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
 1. Salvaging nonhazardous demolition and construction waste.
 2. Recycling nonhazardous demolition and construction waste.
 3. Disposing of nonhazardous demolition and construction waste.
- B. Related Requirements include, but are not limited to:
 1. Division 02 Section "Selective Demolition" for disposition of waste resulting from partial demolition of buildings, structures, and site improvements.
 2. Division 02 Section "Asbestos Materials Hazard Control."
 3. Division 02 Section "Lead-Based Paint Hazard Control."
 4. Division 04 Section "Unit Masonry" for disposal requirements for masonry waste.

1.3 DEFINITIONS

- A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.
- C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
- D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
- E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
- F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.4 PERFORMANCE REQUIREMENTS

- A. General: Achieve end-of-Project rates for salvage/recycling of 50 percent by weight of total non-hazardous solid waste generated by the Work. Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials.

1.5 ACTION SUBMITTALS

- A. Waste Management Plan: Submit plan within 30 days of date established for commencement of the Work.

1.6 INFORMATIONAL SUBMITTALS

- A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Include the following information:
 - 1. Material category.
 - 2. Generation point of waste.
 - 3. Total quantity of waste in tons or cubic yards.
 - 4. Quantity of waste salvaged, both estimated and actual in tons or cubic yards.
 - 5. Quantity of waste recycled, both estimated and actual in tons or cubic yards.
 - 6. Total quantity of waste recovered (salvaged plus recycled) in tons or cubic yards.
 - 7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.
- B. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.
- C. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.
- D. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.
- E. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- F. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- G. Qualification Data: For waste management coordinator and refrigerant recovery technician.
- H. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.7 QUALITY ASSURANCE

- A. Waste Management Coordinator Qualifications: Experienced firm, with a record of successful waste management coordination of projects with similar requirements, that employs a LEED-Accredited Professional, certified by the USGBC, as waste management coordinator.
- B. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.
- C. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.
- D. Waste Management Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:
 - 1. Review and discuss waste management plan including responsibilities of waste management coordinator.

2. Review requirements for documenting quantities of each type of waste and its disposition.
3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
5. Review waste management requirements for each trade.

1.8 WASTE MANAGEMENT PLAN

- A. General: Develop a waste management plan according to ASTM E 1609 and requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Distinguish between demolition and construction waste. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.
- B. Waste Identification: Indicate anticipated types and quantities of demolition and construction waste generated by the Work. Use. Include estimated quantities and assumptions for estimates.
- C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
 1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
 2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
 3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
 4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
 5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
 6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.
- D. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there was no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Include the following:
 1. Total quantity of waste.
 2. Estimated cost of disposal (cost per unit). Include hauling and tipping fees and cost of collection containers for each type of waste.
 3. Total cost of disposal (with no waste management).
 4. Revenue from salvaged materials.
 5. Revenue from recycled materials.
 6. Savings in hauling and tipping fees by donating materials.
 7. Savings in hauling and tipping fees that are avoided.
 8. Handling and transportation costs. Include cost of collection containers for each type of waste.
 9. Net additional cost or net savings from waste management plan.

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

- A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
 - 1. Comply with operation, termination, and removal requirements in Division 01 Section "Temporary Facilities and Controls."
- B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan.
- C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.
 - 1. Distribute waste management plan to everyone concerned within three days of submittal return.
 - 2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.
- D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 - 1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
 - 2. Comply with Division 01 Section "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 SALVAGING DEMOLITION WASTE

- A. Salvaged Items for Reuse in the Work: Salvage items for reuse and handle as follows:
 - 1. Clean salvaged items.
 - 2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
 - 3. Store items in a secure area until installation.
 - 4. Protect items from damage during transport and storage.
 - 5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.
- B. Salvaged Items for Sale and Donation: Not Permitted on Project site.
- C. Salvaged Items for Owner's Use: Salvage items for Owner's use and handle as follows:
 - 1. Clean salvaged items.
 - 2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
 - 3. Store items in a secure area until delivery to Owner.
 - 4. Transport items to Owner's storage area designated by Owner.
 - 5. Protect items from damage during transport and storage.

- D. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.
- E. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.
- F. Plumbing Fixtures: Separate by type and size.
- G. Lighting Fixtures: Separate lamps by type and protect from breakage.
- H. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.

3.3 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

- A. General: Recycle paper and beverage containers used by on-site workers.
- B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor.
- C. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.
- D. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.
 1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
 - a. Inspect containers and bins for contamination and remove contaminated materials if found.
 2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
 4. Store components off the ground and protect from the weather.
 5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor.

3.4 RECYCLING DEMOLITION WASTE

- A. Asphalt Paving: Break up and transport paving to asphalt-recycling facility.
- B. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.
 1. Pulverize concrete to maximum 4-inch size.
- C. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.
 1. Pulverize masonry to maximum 4-inch size.
 2. Clean and stack undamaged, whole masonry units on wood pallets.
- D. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.

- E. Metals: Separate metals by type.
 1. Structural Steel: Stack members according to size, type of member, and length.
 2. Remove and dispose of bolts, nuts, washers, and other rough hardware.
- F. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.
- G. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.
- H. Metal Suspension System: Separate metal members including trim, and other metals from acoustical panels and tile and sort with other metals.
- I. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.
- J. Conduit: Reduce conduit to straight lengths and store by type and size.

3.5 RECYCLING CONSTRUCTION WASTE

- A. Packaging:
 1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
 2. Polystyrene Packaging: Separate and bag materials.
 3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
 4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.
- B. Wood Materials:
 1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
 2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.
 - a. Comply with requirements in Division 32 Section "Turf and Grasses" for use of clean sawdust as organic mulch.
- C. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.
 1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.
 - a. Comply with requirements in Division 32 Section "Turf and Grasses" for use of clean ground gypsum board as inorganic soil amendment.

3.6 DISPOSAL OF WASTE

- A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
 1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn waste materials on site.

C. Disposal: Remove waste materials from Owner's property and legally dispose of them.

END OF SECTION 017419

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 1. Substantial Completion procedures.
 2. Final completion procedures.
 3. Warranties.
 4. Final cleaning.
 5. Repair of the Work.

1.3 ACTION SUBMITTALS

- A. Product Data: For cleaning agents.
- B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.4 CLOSEOUT SUBMITTALS

- A. Certificates of Release: From authorities having jurisdiction.
- B. Certificate of Insurance: For continuing coverage.
- C. Field Report: For pest control inspection.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.6 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of ten (10) days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction

- photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Owner. Label with manufacturer's name and model number where applicable.
 - a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Owner's signature for receipt of submittals.
 5. Submit test/adjust/balance records.
 6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
- C. Procedures Prior to Substantial Completion: Complete the following a minimum of ten (10) days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
1. Advise Owner of pending insurance changeover requirements.
 2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 3. Complete startup and testing of systems and equipment.
 4. Perform preventive maintenance on equipment used prior to Substantial Completion.
 5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings as applicable.
 6. Advise Owner of changeover in heat and other utilities.
 7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
 8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
 9. Complete final cleaning requirements, including touchup painting.
 10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of ten (10) days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
 2. Results of completed inspection will form the basis of requirements for final completion.

1.7 FINAL COMPLETION PROCEDURES

- A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:
1. Submit a final Application for Payment.
 2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.

3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
 4. Submit pest-control final inspection report.
- B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.8 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
 2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
 3. Include the following information at the top of each page:
 - a. Project name.
 - b. Date.
 - c. Name of Architect.
 - d. Name of Contractor.
 - e. Page number.
 4. Submit list of incomplete items in one of the following formats:
 - a. MS Excel electronic file. Architect will return annotated file.
 - b. PDF electronic file. Architect will return annotated file.
 - c. Three (3) paper copies. Architect will return two (2) copies.

1.9 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
 3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
 4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling

navigation to each item. Provide bookmarked table of contents at beginning of document.

- D. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.
 - 1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
 - 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
 - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
 - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - e. Remove snow and ice to provide safe access to building.
 - f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - h. Sweep concrete floors broom clean in unoccupied spaces.
 - i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
 - j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
 - k. Remove labels that are not permanent.
 - l. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.

- m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 - n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 - o. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
 - p. Clean HVAC system in compliance with NADCA Standard 1992-01. Provide written report on completion of cleaning.
 - q. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
 - r. Leave Project clean and ready for occupancy.
- C. Pest Control: Comply with pest control requirements in Division 01 Section "Temporary Facilities and Controls." Prepare written report.
- D. Construction Waste Disposal: Comply with waste disposal requirements in Division 01 Section "Construction Waste Management."

3.2 REPAIR OF THE WORK

- A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.
- B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
- 1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
 - 2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that already show evidence of repair or restoration.
 - a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
 - 3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
 - 4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 017700

SECTION 024119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes but is not limited to:
 - 1. Demolition and removal of selected portions of building or structure.
 - 2. Demolition and removal of selected site elements.
 - 3. Disconnecting, capping or sealing, and removing or abandoning-in-place site utilities.
 - 4. Salvage of existing items to be reused or recycled.
- B. Related Requirements include, but are not limited to:
 - 1. Division 01 Section "Summary" for restrictions on the use of the premises.
 - 2. Division 01 Section "Cutting and Patching."
 - 3. Division 01 Section "Construction Waste Management."
 - 4. Division 02 Section "Asbestos Materials Hazard Control."
 - 5. Division 02 Section "Lead Based Paint Hazard Control."

1.3 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse.
- C. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.
- D. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 MATERIALS OWNERSHIP

- A. Owner's Right of First Refusal: Existing items, materials, and equipment such as motors or breakers located in altered areas of the project that will be permanently removed and that can be salvaged and used by the Owner remain the property of the Owner unless indicated otherwise on the Contract Drawings or in other sections of the specifications. Such items that are removed and the Owner elects not to retain will then become the property of Contractor for disposal.
- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
 - 1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.5 PREINSTALLATION MEETINGS

- A. Predemolition Conference: Conduct conference at Project site.
 - 1. Inspect and discuss condition of construction to be selectively demolished.
 - 2. Review structural load limitations of existing structure.
 - 3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
 - 5. Review areas where existing construction is to remain and requires protection.
 - 6. Review items to be salvaged and reused or returned to Owner.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For refrigerant recovery technician.
- B. Proposed Protection Measures: Submit report, including drawings, that indicates the measures proposed for protecting individuals and property and for environmental protection. Indicate proposed locations and construction of barriers.
- C. Schedule of Selective Demolition Activities: Indicate the following:
 - 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity.
 - 2. Interruption of utility services. Indicate how long utility services will be interrupted.
 - 3. Coordination for shutoff, capping, and continuation of utility services.
 - 4. Use of elevator and stairs.
- D. Inventory: Submit a list of items to be removed and salvaged and deliver to Owner prior to start of demolition.
- E. Predemolition Photographs or Video: Submit before Work begins.
- F. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.7 CLOSEOUT SUBMITTALS

- A. Inventory: Submit a list of items that have been removed and salvaged.
- B. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.8 QUALITY ASSURANCE

- A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.
- B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with handling and disposal regulations of authorities having jurisdiction.
- C. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

1.9 FIELD CONDITIONS

- A. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- B. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- C. Hazardous Materials: Hazardous materials are present in building to be selectively demolished. A report on the presence of hazardous materials is available for review and use. Examine report to become aware of locations where hazardous materials are present.
 - 1. Hazardous material remediation is specified elsewhere in the Contract Documents.
 - 2. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.
- D. Historic Areas: Demolition and hauling equipment and other materials shall be of sizes that clear surfaces within historic spaces, areas, rooms, and openings, including temporary protection, by 12 inches or more.
- E. Storage or sale of removed items or materials on-site is not permitted.
- F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

PART 2 - PRODUCTS

2.1 SOIL MATERIAL

- A. Satisfactory Soils: Comply with requirements in Division 31 Section "Earthwork".

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Review project record documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in project record documents.
- C. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.
- E. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs and preconstruction videotapes.
 - 1. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.
 - 2. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
 - 1. Comply with requirements for existing services/systems interruptions specified in Division 01 Section "Summary."

- B. Existing Utilities: Demolish existing utilities and below-grade utility structures that are within 5 feet outside footprint indicated for new construction. Abandon utilities outside this area.
 - 1. Fill abandoned utility structures with satisfactory soil materials or recycled pulverized concrete according to backfill requirements in Division 31 Section "Earthwork".
 - 2. Piping: Disconnect piping at unions, flanges, valves, or fittings.
 - 3. Wiring Ducts: Disassemble into unit lengths and remove plug-in and disconnecting devices.

- C. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
 - 1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
 - 2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 - 3. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated to be removed.
 - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
 - c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
 - f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
 - g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.

- D. Refrigerant: Remove refrigerant from mechanical equipment to be selectively demolished according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 PREPARATION

- A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 - 1. Comply with requirements for access and protection specified in Division 01 Section "Temporary Facilities and Controls."

- B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 - 1. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
 - 2. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.

3. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Division 01 Section "Temporary Facilities and Controls."

C. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of selective demolition.

3.4 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
5. Maintain adequate ventilation when using cutting torches.
6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
9. Dispose of demolished items and materials promptly. Comply with requirements in Division 01 Section "Construction Waste Management."

B. Removed and Salvaged Items:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Protect items from damage during transport and storage.

C. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition, cleaned and reinstalled in their original locations after selective demolition operations are complete.

- E. Explosives: Use of explosives is not permitted.

3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.
- B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.
- C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.
- D. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings."
- E. Roofing: Remove no more existing roofing than what can be covered in one day by new roofing and so that building interior remains watertight and weathertight. See Division 07 Section "EPDM Roofing" for new roofing requirements.
 - 1. Remove existing roof membrane, flashings, copings, and roof accessories.
 - 2. Remove existing roofing system down to substrate.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
 - 1. Do not allow demolished materials to accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 - 3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
 - 4. Comply with requirements specified in Division 01 Section "Construction Waste Management."
- B. Burning: Do not burn demolished materials.
- C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.7 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.
 - 1. Clean roadways of debris caused by debris transport.

END OF SECTION 024119

SECTION 028313 – LEAD BASED PAINT HAZARD CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Reference: Lead-based Paint and Lead-containing Materials Investigation Report, Miller Center, 301 Grove Street, Lynchburg, VA; Hurt & Proffitt, August 2012.
- C. Code of Federal Regulations:
 - 1. 40 CFR Part 745, Subpart L- Lead; Renovation, Repair and Painting Program
 - 2. 29 CFR 1926.62-Lead in Construction
 - 3. 40 CFR Part 260, 261, 262 et. al.-Hazardous Waste Manifests
- D. Virginia Department of Professional and Occupational Regulation
 - 1. 18VAC-30 et. Seq.-Lead-Based Paint Activities Regulations

1.2 SUMMARY

- A. Section includes, but is not limited to, procedures for disturbing surfaces coated with lead-based paint (LBP) and controls needed to limit occupational and environmental exposure to lead hazards.
- B. Related Sections include, but are not limited to:
 - 1. Division 01 Section "Construction Waste Management."
 - 2. Division 02 Section "Selective Demolition."

1.3 ACTION SUBMITTALS

- A. Contractor performing renovations to submit documentary proof of the following Certifications:
 - 1. The Contractor's business organization (firm) possesses a current certification by the U.S. Environmental Protection Agency (US EPA) to perform renovations in child-occupied facilities.
 - 2. Contractor's supervisory personnel who will be assigned to the Miller Center project possess current certification by the US EPA as Certified Renovator(s).
 - 3. Contractor's work force has been (or will be) trained in the Lead-safe work practices described in 40 CFR Part 745-Lead, Renovation, Repair and Painting Program.
- B. Contractor's plan to conduct Industrial Hygiene monitoring of employee Lead exposure to comply with the exposure monitoring requirements specified in 29 CFR 1926.62.

1.4 CLOSEOUT SUBMITTALS

- A. Copies of records produced by Contractor that documents compliance with the requirements of 40 CFR Part 745.85, including documentation that a certified renovator was assigned to the project, that the certified renovator provided on-the job training for the workers used on the project, that the certified renovator performed all of the tasks described in Part 745.85(a), and that the certified renovator performed the post-renovation cleaning verification described in Part 745.85(b).

- B. Copies of employee Industrial Hygiene monitoring for Lead exposure purged of any personal identifying information.

1.5 DEFINITIONS

- A. All terms not defined herein shall have the meaning given in the publications, regulations and specifications applicable to work with Lead-containing materials in building construction and/or demolition.
 1. Child-occupied facility means a building, or portion of a building, constructed prior to 1978, visited regularly by the same child, six years of age or under, on at least two different days, within any week (Sunday through Saturday period); provided that each day's visit lasts at least three hours and the combined weekly visit lasts six hours, and the combined annual visits last at least 60 hours. Child-occupied facilities may be located in target housing or in public or commercial buildings.
 2. Cleaning verification card means a card developed and distributed, or otherwise approved, by US EPA for the purpose of determining, through comparison of wet or dry disposable cleaning cloths with the card, whether post-renovation cleaning has been properly completed.
 3. Component or building component means specific design or structural elements or fixtures of a building that are distinguished from each other by form, function, and location
 4. Dry disposable cleaning cloth means a commercially available dry, electrostatically charged, white disposable cloth designed to be used for cleaning hard surfaces such as uncarpeted floors or counter tops.
 5. Firm means a company, partnership, corporation, sole proprietorship or individual doing business, association, or other business entity; a federal, State, tribal, or local government agency; or a non-profit organization.
 6. HEPA vacuum means a vacuum cleaner which has been designed with a high-efficiency particulate air (HEPA) filter as the last filtration stage. A HEPA filter is a filter that is capable of capturing particles of 0.3 microns with 99.97% efficiency. The vacuum cleaner must be designed so that all air drawn into the machine is expelled through the HEPA filter with none of the air leaking past it.
 7. Lead-based Paint (LBP) means any surface coating containing a concentration of Lead equal to or greater than 1.0 milligrams Lead per square centimeter of surface area or 0.5% Lead by weight.
 8. Minor repair and maintenance activities are activities, including minor heating, ventilation or air conditioning work, electrical work, and plumbing; that disrupt 6 square feet or less of painted surface per room for interior activities or 20 square feet or less of painted for exterior activities; where none of the work practices prohibited or restricted by 40 CFR Part 745.85(a)(3) are used and where the work does not involve window replacement or demolition of painted surface areas. When removing painted components, or portions of painted components, the entire surface area removed is the amount of painted surface disturbed.
 9. Pamphlet means an original or complete copy of the EPA pamphlet titled "Renovate Right: Important Lead Hazard Information for Families, Child Care Providers and Schools".
 10. Recognized test kit means a commercially available kit recognized by US EPA under 40 CFR Part 745.88 as being capable of allowing the user to determine the presence of Lead at levels equal to or in excess of 1.0 milligrams per square centimeter, or more than 0.5% Lead by weight, in a paint chip, paint powder, or painted surface.
 11. Renovation means the modification of any existing structure, or portion thereof, that results in the disturbance of painted surfaces. The term renovation does not include minor repair and maintenance activities.
 12. Renovator means an individual who either performs or directs workers who perform renovations. A certified renovator is a renovator who has successfully completed a renovator course accredited by US EPA or an US EPA authorized State or tribal program.

13. Wet disposable cleaning cloth means a commercially available, pre-moistened white disposable cloth designed to be used for cleaning hard surfaces such as uncarpeted floors or counter tops.
14. Wet mopping system means a device with the following characteristics: a long handle, a mop head designed to be used with disposable absorbent cleaning pads, a reservoir for cleaning solution, and a built-in mechanism for distributing or spraying the cleaning solution onto a floor, or a method of equivalent efficiency.
15. Work area means the area that the certified renovator establishes to contain the dust and debris generated by a renovation.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Test Kits: EPA recognized test kits for the detection of Lead in surface coatings.
- B. Polyethylene: Clean sheeting of 6-mil minimum thickness utilized in sufficient widths to minimize the frequency of joints.
- C. Tape: High quality tape (duct tape, masking tape) capable of sealing joints between adjacent sheets of polyethylene and attaching polyethylene sheets to finished or unfinished surfaces. Tape must be capable of maintaining adhesion under both wet and dry conditions.
- D. Adhesives: High quality spray-on adhesives capable of sealing joints between adjacent sheets of polyethylene and attaching polyethylene sheet to finished or unfinished surfaces. Adhesives must be able to maintain adhesion under both dry and wet conditions, including exposure to amended water.
- E. Impermeable Containers: A container that is suitable to receive and retain any Lead-containing or contaminated materials until disposal to an approved site. The containers shall be labeled in accordance with EPA, OSHA and US DOT Regulations. Containers must be both air and watertight and must be resistant to damage and rupture. Containers such as dumpsters, 55 gallon drums, etc. must be capable of retaining all debris, dust, and paint chips while onsite and during transport to the disposal facility. Large and/or bulky items may be contained in 6-mil polyethylene sheeting that is sealed at all joints and properly labeled.
- F. Warning Labels and Signs: Lead warning signs for posting at the perimeter of a work area, as required by OSHA and EPA.
- G. Cleaning Verification Cards: US EPA developed or approved cards.
- H. Wet and dry disposable cleaning cloths and wet mopping system.
- I. Other Materials: Provide all other materials including, but not limited to, lumber, plywood, nails and hardware that may be required to properly construct the work area containments required by this project; and all materials required to accomplish the post-renovation cleaning procedures detailed in 40 CFR Part 475.

PART 3 - EXECUTION

3.1 LEAD SAFE RENOVATION OPERATIONS

- A. Conduct all renovation operations under the presumption that the Miller Center building has been and will become a child-occupied facility.

- B. Establish a Lead hazard communication program that provides the US EPA pamphlet, supplemented by written notices, verbal briefings, posted signs, etc.; to the Building Owner, site visitors and tradespersons working on the Miller Center site. Activities of the hazard communication program are to be documented.
- C. Prior to initiating any paint-disturbing activity:
 - 1. Test any surface coatings not previously tested or assume surface coating is LBP.
 - 2. Where LBP is present or assumed, establish a containment system to prevent the migration of dust and debris from the work area; and post signage warning individuals not involved in the work to avoid the work area.
 - 3. Document the work area set up procedures.
- D. Prior to initiating paint-disturbing activity on the interior of the building where LBP is present or assumed, prepare work area as specified in 40 CFR Part 745.85(a)(2)(i), including:
 - 1. Remove all objects from the work area, or cover objects remaining in the work area and seal all joints in the covering.
 - 2. Cover and seal all HVAC duct openings in the work area.
 - 3. Close windows and doors in the work area except for ingress/egress doorway(s) which are to be equipped with polyethylene flaps.
 - 4. Cover the floor to the extent needed to contain all dust and debris.
 - 5. Monitor the movement of personnel, material, equipment and contained waste from the containment to prevent migration of dust and debris.
 - 6. Supervised and documented by a certified renovator.
- E. Prior to initiating paint-disturbing activity on the exterior of the building where LBP is present or assumed, prepare the work area as specified in 40 CFR Part 745.85(a)(2)(ii), including:
 - 1. Close all doors within 20 feet of the work area, and all doors and windows of floors below the work area to the same 20 feet extent.
 - 2. Equip access/egress doorways to/from the work area with polyethylene flaps.
 - 3. Cover the ground to the extent necessary to capture all dust and debris generated by the work.
 - 4. Supervised and documented by a certified renovator.
- F. Where LBP is present or assumed, the following work practices are prohibited or restricted:
 - 1. Open-flame burning or torching is prohibited.
 - 2. High-speed mechanical removal of paint without use of HEPA-filtered exhaust is prohibited.
 - 3. Heat gun operation above 1100 degrees Fahrenheit is prohibited.
- G. Waste generated from renovations is to be:
 - 1. Cleaned-up and contained daily.
 - 2. To the extent practical, separately contained for Lead-contaminated and non-Lead contaminated wastes.
 - 3. Sealed in containers for transport from the work area containment; and for off-site disposal.
- H. Post-renovation clean-up interior and exterior work areas is to be performed precisely as specified in 40 CFR Part 745.85(a)(5)(i)and(ii);supervised and documented by a certified renovator, including:
 - 1. Picking up all paint chips and debris.
 - 2. Misting protective sheeting, folding it dirty side inward, and taping the edges for removal.
 - 3. Cleaning the work area surfaces and objects using a HEPA vacuum and/or wet and dry cloths.

- I. Post-renovation cleaning verification is to be performed precisely as specified in 40 CFR Part 745(b)(1) for interior work areas and Part 745(b)(2) for exterior work areas; supervised and documented by a certified renovator.

3.2 WASTE CHARACTERIZATION AND DISPOSAL

- A. Waste from renovation activities in commercial and public buildings that is known or presumed to contain Lead must be characterized as hazardous or non-hazardous prior to transport to an off-site disposal facility. Employ a competent person as defined in 29 CFR 1926.62(b) to collect a composite sample of this waste stream and submit the sample to an independent laboratory licensed by the Commonwealth of Virginia to perform the Toxicity Characteristic Leaching Procedure (TCLP) analysis for Lead. TCLP results equal to or greater than 5 parts per million (ppm) indicate that the waste must be disposed as hazardous. The container(s) for this waste must be properly sealed, labeled and manifested prior to shipment off-site to an approved disposal facility. Waste with a TCLP analysis results less than 5 ppm can be disposed as demolition debris.

END OF SECTION 028313

SECTION 028314 – ASBESTOS MATERIALS HAZARD CONTROL

PART 1- GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions and Division 01 Specification Sections, apply to this Section.
- B. References:
 - 1. Asbestos-Containing Materials Survey Report, Miller Center, 301 Grove Street, Lynchburg, VA; Hurt & Proffitt, September 11, 2012.
 - 2. Analysis Report, Miller Center Roof; SanAir Technologies Laboratory, February 13, 2013
- C. Code of Federal Regulations
 - 1. OSHA 29 CFR Part 1910.134-Respiratory Protection
 - 2. OSHA 29 CFR Part 1910.145-Accident Prevention
 - 3. OSHA 29 CFR Part 1926.1101-Asbestos Contractor
 - 4. OSHA 29 CFR Part 1910.1200-Hazard Communications
 - 5. USEPA 40 CFR Part 61-Asbestos National Emission Standards For Hazardous Air Pollutants
 - 6. USEPA 40 CFR Part 763-Asbestos Abatement Projects Rule
- D. Virginia Administrative Codes and Regulations:
 - 1. VSWMR 9 VAC 20-80-640-Disposal of Special Waste
 - 2. VA DOLI-Title 40.1-Chapter 1-Department of Labor and Industry (40.1 thru 40.1-11.1)
 - 3. VA DOLI-Title 40.1-Chapter 3-Protection of Employees (40.1-22 thru 40.1-51.4:5)
 - 4. VA DOLI-Title 40.1-Chapter 3.2-Asbestos Notification (40.1-51.20 thru 40.1-51.22)
 - 5. VA DOLI-Title 40.1-Chapter 3.3-Virginia NESHAP Act (40.1-51.23 thru 40.1-51.41)
 - 6. Virginia Solid Waste Management Regulations (VSWMR)- 9-VAC-20-80-200
 - 7. VSWMR-9 VAC 20-80-640
 - 8. Department of Professional and Occupational Regulation- Virginia Asbestos Regulation Part 18VAC15 20-10-880

1.2 SUMMARY

- A. Section includes, but is not limited to, procedures for removal of asbestos-containing materials (ACM) and controls needed to limit occupational and environmental exposure to asbestos hazards. The following materials are to be removed from the Miller Center building:
 - 1. Friable Asbestos-Containing Pipe Insulation - 10 Linear Feet
 - 2. Non-Friable Asbestos-Containing Interior Window Caulk - 50 Square Feet
 - 3. Non-Friable Presumed Asbestos-Containing Fire Doors <10 Doors
 - 4. Non-Friable Asbestos-Containing Roofing Materials - Complete
- B. Related Sections include, but are not limited to:
 - 1. Division 01 Section "Unit Prices."
 - 2. Division 01 Section "Construction Waste Management."
 - 3. Division 02 Section "Selective Demolition."

1.3 UNIT PRICES

- A. Prior to contract award, provide unit prices for removal of miscellaneous asbestos-containing materials discovered during the process of the work in accordance with Division 01 Section "Unit Prices." Refer to Appendix at the end of this Section.

1.4 ACTION SUBMITTALS

- A. Contractor performing renovations to submit documentary proof of the following Certifications:
 - 1. The Contractor's business organization (firm) possesses both Virginia contractor's license and asbestos abatement contractor's license.
 - 2. Copies of Virginia Waste Transporter Permits and the location of the landfill where the asbestos waste will be transported to.
 - 3. Copy of local wastewater discharge permit. If no permit is to be used, a statement indicating how wastewater will be disposed of on this project will be required.
 - 4. Material Safety Data Sheets (MSDS) for all chemicals and/or solvents to be utilized on-site.
 - 5. Manufacturers certifications for all equipment to be used on the project, ie: HEPA filtration units and HEPA vacuums.
 - 6. Copy of the Contractor's Hazard Communication Program, Medical Surveillance Program and Respiratory Protection Program and Site Emergency Response Plan.
 - 7. Copy of notification letters to the local fire and rescue squads, that asbestos abatement work will be conducted at the site.
 - 8. Copies of emergency phone numbers that will be posted on the personal decontamination unit and/or staging area.
 - 9. Copies of the following workers certifications:
 - a. Virginia DPOR licenses for all personnel,
 - b. Certificates of training for all personnel,
 - c. Medical evaluation forms and show suitability to wear respiratory protection for all personnel.
 - d. Respiratory fit test forms to show respirator suitability and fit.

1.5 CLOSEOUT SUBMITTALS

- A. Copies of OSHA personal air samples. Note: City of Lynchburg and its environmental consultant are not responsible for the interpretation of the results; the intent is to prove that the abatement Contractor is taking these required samples only.
- B. A daily list of the personnel on-site accompanied with their Virginia DPOR licenses.
- C. The supervisor's daily log book that documents the checking of critical barriers and the cleaning of the decontamination unit(s) at the beginning and end of each shift, as required by 29 CFR 1926.1101.
- D. An account of any asbestos handling air samples that were greater than 0.01 f/cc according to Phase Contrast Microscopy (PCM) and the measures taken to clean the proximate area (if necessary).
- E. Copies of waste manifests and/or bill of lading for every waste shipment from the site project.
- F. Any other submittal that the City of Lynchburg and/or the environmental consultant requests.

1.6 DEFINITIONS

- A. All terms not defined herein shall have the meaning given in the publications, regulations and specifications applicable to work with Lead-containing materials in building construction and/or demolition.
 - 1. ACM: Asbestos-Containing Material(s).
 - 2. AGGRESSIVE SAMPLING: High-activity level air sampling which results in settled asbestos remaining airborne and uniformly distributed through the use of special

entrainment and mixing techniques. This makes any settled asbestos fibers accessible to the sampling filters for subsequent detection.

3. AMENDED WATER: Water containing a wetting agent or surfactant.
4. ANSI: American National Standards Institute.
5. ASBESTOS: The term asbestos includes Chrysotile, Amosite, Crocidolite, Tremolite, and Actinolite.
6. AREA MONITORING: Sampling of asbestos fiber concentrations within the asbestos control area which is representative of the airborne concentrations of asbestos fibers which may reach the breathing zone.
7. CLEAN ROOM: An uncontaminated room having facilities for the storage of employees' street clothing and uncontaminated materials and equipment.
8. CONTRACTOR: Refers to the person, firm, or corporation providing the goods and services for this contract - "Asbestos Removal Project Design."
9. DECONTAMINATED AREA: An enclosed area adjacent and connected to the regulated area and consisting of an equipment room, shower area, and a clean room which is used for the decontamination of workers, materials and equipment contaminated with asbestos.
10. D.O.T.: Department of Transportation.
11. ENCAPSULATION: The coating of asbestos-containing materials with a bonding or sealing agent to prevent the release of airborne fibers.
12. EPA: United States Environmental Protection Agency
13. EQUIPMENT ROOM (CHANGE ROOM): A contaminated room located within the decontaminated area that is supplied with impermeable bags or containers for the disposal of contaminated protective clothing and equipment.
14. FRIABLE ASBESTOS MATERIAL: Material that contains more than 1% asbestos by weight and that can be crumbled, pulverized or reduced to powder by hand pressure when dry.
15. HEPA FILTER EQUIPMENT: High efficiency particulate air filtered vacuuming equipment and negative air machines with a filter system capable of collecting and retaining asbestos fibers. Filters shall be 99.97 percent efficient for retaining particles and fibers with a minimum dimension of 0.3 micrometers or larger.
16. NIOSH: National Institute for Occupational Safety and Health.
17. OSHA: United States Occupational Safety and Health Administration and the Virginia Occupational Safety and Health Division of the Department of Labor and Industry.
18. OWNER: The agent with the authority to execute the contract for the city agency.
19. PERMISSIBLE EXPOSURE LIMIT (PEL): An airborne concentration of asbestos in excess of 0.1 fibers per cubic centimeter of air as an eight (8) hour time-weighted average (TWA), using the OSHA mandatory analytical procedure specified in 29 CFR 1926.1101, Appendix A.
20. PROJECT MONITOR: Means the individual(s) representing the "owner" to make inspections, conduct monitoring, observe progress, approve schedules, and accept services under the terms of the contract.

1.7 NOTIFICATIONS

- A. Contractor may make all required notifications to the Virginia Department of Labor and Industry (DOLI) within 20 calendar days prior to project start. A copy of the notification must be posted on the project work site throughout abatement activities.
- B. Contractor must notify both the Virginia DOLI and the US Environmental Protection Agency 10 calendar days prior to ANY demolition of load barrier walls from within this project if applicable.

PART 2– PRODUCTS

2.1 MATERIALS

- A. Polyethylene; Clean sheeting of 6-mil minimum thickness utilized in sufficient widths to minimize the frequency of joints.

- B. Tape: High quality tape (duct tape, masking tape) capable of sealing joints between adjacent sheets of polyethylene and attaching polyethylene sheets to finished or unfinished surfaces. Tape must be capable of maintaining adhesion under both wet and dry conditions.
- C. Adhesives: High quality spray-on adhesives capable of sealing joints between adjacent sheets of polyethylene and attaching polyethylene sheet to finished or unfinished surfaces. Adhesives must be able to maintain adhesion under both dry and wet conditions, including exposure to amended water.
- D. Impermeable Containers: A container that is suitable to receive and retain any asbestos-containing or contaminated materials until disposal to an approved site. The containers shall be labeled in accordance with EPA, OSHA and US DOT Regulations. Containers must be both air and watertight and must be resistant to damage and rupture. Containers such as dumpsters, 55 gallon drums, etc. must be capable of retaining all debris, dust, and water while onsite and during transport to the disposal facility. Large and/or bulky items may be contained in 6-mil polyethylene sheeting that is sealed at all joints and properly labeled.
- E. Warning Labels and Signs: Asbestos warning signs for posting at the perimeter of a work area, as required by OSHA and EPA.
- F. Other Materials: Provide all other materials including, but not limited to, lumber, plywood, nails and hardware that may be required to properly construct the work area containments required by this project.

PART 3 – EXECUTION

3.1 ASBESTOS ABATEMENT PROCEDURES

- A. Personal Protection
 1. Air purifying respirators equipped with NIOSH approved HEPA filters shall be used for the duration of the removal project, unless a change has been approved by the project designer and/or engineer.
 2. Workers shall wear properly fitted respirators in the work area. Long side-burns, beards, etc., which interfere with proper fit are unacceptable.
 3. Workers shall wear disposable, full body coveralls, gloves, disposable head covers, and disposable footwear in the work area.
 4. Respirators shall be sanitized daily by the contractor or between shifts if employees share usage.
 5. Eating, drinking, smoking, and chewing of gum or tobacco shall not be permitted in the work area, equipment room or shower area.
 6. All individuals, without exception, shall wear an approved respirator, disposable coveralls, gloves, head cover, and footwear to enter the work area. Personal clothing worn into the containment area will not be transferred out until it is properly sealed within two separate six (6) mil asbestos disposal bags.
- B. Establishing the Decontamination Unit (if required by size and scope of project)
 1. The contractor shall establish a decontamination unit to include an equipment room, clean room, and a shower outside each work area. The decontamination unit shall be continuous with the work area. The area shall include a clean room connected by a double poly barrier to a walk-through shower which is also connected by a double poly barrier to an equipment room. There will also be a double poly barrier separating the equipment room and the work area.
 2. The clean room will contain boxes or lockers for each worker's street clothes. These will be provided by the contractor.
 3. Portable showers must be used. No "facsimile" showers will be allowed, (i.e., hose put through a poly slit with poly flooring).

4. Soap, shampoo, disposable towels, etc., shall be provided by the contractor.
5. The decontamination unit chambers are to be cleaned daily.
6. The clean room, shower, and equipment room must be sealed completely to ensure that the sole source of air flow through these areas originates from uncontaminated areas outside the asbestos removal, demolition, or renovation enclosure. The shower must be drained and filtered to retain particles 5.0 microns or larger, after each use to ensure that contaminated water is not released to uncontaminated areas. If waste is inadvertently released, it shall be cleaned up as soon as possible to prevent any asbestos in the water from drying and becoming airborne in areas outside the work area.
7. All workers shall use the following procedure:
 - a. Remove street clothes in the clean room and put on the coveralls and all other protective equipment before entering the work area.
 - b. Before exiting the work area all coveralls, head covers, boots, etc., shall be cleaned with a HEPA vacuum and removed.
 - c. The respirator shall be properly fitted and provide an effective seal.
 - d. Hoods associated with disposable garments shall be worn on the outside of the respirator-no clothing shall be permitted on the head and neck area beneath the respirator.
 - e. After completely disrobing with the exception of respirators, the workers shall proceed to the shower room.
 - f. Under the shower, respirators shall be rinsed thoroughly then removed and cleaned.
 - g. Used filters shall be placed in suitable plastic bags on the contaminated side of the shower, sealed, and labeled for disposal.
 - h. All boots, shoes, etc., will remain in the equipment room until the project is completed when they will be bagged and moved to the next asbestos removal project as contaminated equipment or disposed of as asbestos waste. At no time are they to be worn through the shower to the clean room or outside of the containment area.

C. Work Area Preparation

1. Heating, Ventilation, and Air Conditioning (HVAC)
 - a. The contractor shall notify the owner /project manager, project monitoring consultant, and project designer at least five days in advance of project commencement so that the owner may make the necessary modifications to the HVAC system.
 - b. The contractor shall be responsible (coordinate with owner) for ensuring that the HVAC system is isolated for the asbestos removal work area. There will be a "tagging" process to ensure that the system is not activated until the completion of the project.
 - c. The contractor shall cover/isolate the HVAC duct grills (return and supply) inside the work area with three separate layers of 6 mil polyethylene sheeting. Each layer shall extend a few inches above the first layer and be sealed with duct tape.
 - d. The isolation of the HVAC system will be inspected and approved by the project monitor before the project can proceed.
2. Electrical System Isolation
 - a. The contractor shall notify the owner at least five days in advance of project commencement so the owner will ensure that the electrical system within the asbestos removal project area has been properly isolated and "tagged".
 - b. The contractor will be responsible for "hooking up" to the building's electrical system in order to provide electrical services. All temporary electrical connections will be approved by the project manager prior to energizing.
3. Clean and Remove Non-Stationary Items from the Work Area: Non-stationary items (i.e., furniture) which have been predetermined to be contaminated with asbestos fibers, shall be HEPA vacuumed and/or wet-wiped to remove any asbestos-containing dust. The individuals conducting the cleaning shall wear respiratory protection and disposable clothing. Once this has been accomplished, all non-stationary items will be removed from the work area or covered and staged properly to prevent further contamination.

4. Seal Stationary Items: Items not being removed from the work area (i.e., large machinery, water fountains, etc.) shall be wet-wiped and/or HEPA vacuumed, and then sealed with two layers of 6 mil fire retardant polyethylene and duct tape. Electrical outlets shall be covered with two layers of 6 mil polyethylene and duct tape.
 5. Tape and Seal Windows with Fire Retardant Polyethylene
 - a. The edges of all windows shall be sealed with duct tape. Once the edges are sealed, the windows shall be covered with two layers of 6 mil fire retardant polyethylene and duct tape.
 - b. Windows which will serve as outlets for the negative air machine exhaust shall be boarded with fire retardant plywood. The plywood shall be cut to proper dimensions to allow enough room for the negative air machine duct to exhaust to the outside of the building. The exhaust duct shall be secured to the plywood by with duct tape.
 6. Isolating Access Areas/Critical Barriers
 - a. All access areas (i.e., doors, halls, etc.) which are not part of the work area shall be sealed off from public access. All doors, halls, or other areas not directly needed for work place access, shall be sealed with plywood (fire retardant) barriers and then covered with a minimum of two layers of 6 mil fire retardant polyethylene.
 - b. The owner may choose to padlock boarded access doors in areas where security is a concern.
 7. Sealing All Penetrable Areas: All penetrations of the floor, walls and ceilings shall be sealed with a minimum of two layers 6 mil fire retardant polyethylene and duct tape to prevent airborne asbestos from escaping into the area outside the work area or from lodging in cracks around the penetration.
 8. Emergency and Fire Procedures
 - a. The contractor shall establish emergency and fire procedures for evacuation. Emergency and fire procedures shall have priority over decontamination procedures.
 - b. The contractor shall have arrows marking the exits and fire extinguishers on site.
- D. Negative Air Pressure Within Enclosure(s)
1. After construction of the enclosure is complete, a ventilation system shall be installed by the contractor to create a negative pressure within the enclosure with respect to the area outside the enclosure. This system must be equipped with HEPA filters meeting specifications established in ANSI Standard 29.2-79. The system shall be required to produce a negative pressure of -0.02 inches of water column within the enclosure. The system must provide at least four (4) air changes per hour. Negative air exhaust will not be vented into the building(s).
 2. The negative pressure system shall be operated in accordance with Appendix J., pages J-1 through J-8, of the EPA Guidance Manual No. EPA 560/85-024, entitled "Recommended Specifications and Operating Procedures for the Use of Negative Pressure Systems for Asbestos Abatement".
 3. If during the removal process negative pressure is not maintained in the work area, all removal operations shall be immediately suspended. The owner and project monitor shall be notified immediately.
- E. Removal Process
1. The removal process shall begin once the work preparations have been finished, inspected, and approved.
 2. **The contractor shall have a licensed "supervisor" on the job at all times** (during work hours) to ensure that the enclosure, engineering controls, work methods and personal protective equipment are in compliance with all governing regulations and these specifications. The "supervisor" shall ensure that unauthorized personnel do not enter the enclosure and that all personnel that do enter the enclosure observe proper protection and decontamination procedures.
 3. All asbestos-containing materials shall be thoroughly wetted with amended water to enhance penetration prior to executing removal. Thorough wetting of the asbestos-containing materials shall continue throughout the removal operations.

4. At the beginning of each work day, all polyethylene barriers shall be checked to ensure that they are still intact. Needed corrections/repairs shall be made before or prior to resuming asbestos removal activities.
 5. Upon removal, each of the windows must be wrapped in two separate sheets of 6 mil reinforced polyethylene sheeting and clearly marked as described within the waste handling section of this guidance. The asbestos waste must be placed directly into a lined dumpster.
 6. Once each of the work area locations have been abated (Pipe insulation, window materials, fire doors and roofing materials) the location must be visually inspected for completion by the project monitor.
- F. Cleaning Operations (if required by project size and scope)
1. Upon completion of gross removal, the substrate shall be thoroughly brushed, and repeatedly wet-wiped with amended water until the work area is deemed acceptable by the project monitor. An approved encapsulant material is to be applied to the substrate and all other surfaces throughout the work area.
 2. Following encapsulation, a period of six (6) hours must elapse to allow the encapsulant to dry, prior to initiating final air clearance procedures. Failure of air clearance sampling shall result in the re-execution of fine cleaning activities by the contractor until satisfactory air sampling are yielded.
 3. Following the six (6) hour waiting period, satisfactory air clearance monitoring and final visual inspection, removal of the polyethylene sheeting's may take place.
 4. All critical barriers, decontamination unit, windows, HVAC system, electrical outlets, penetrations, and negative air machines will be left in place until the project has been given final approval by the project monitor.
- G. Project Acceptance
1. Project clearance will be based on ASTM 1368E- 05 Standard for Visual Inspection of Asbestos Abatement to be conducted by the project monitor.
 2. The project monitor's air monitoring results will be the samples used for clearance decisions.
 3. Once the criteria for clearance established in H-1 and H-2 has been met, the project monitor will inform the owner of project completion.
 4. If the criteria for clearance established in G-1 have not been fulfilled to the satisfaction of the project monitor, then re-cleaning of the entire removal area will be required until desired results are achieved. Additional charges for re-inspections and testing by the owner will be deducted from the Contractor's final payment.
- H. Inspections
1. The project monitor shall conduct inspections throughout the project. Each step of the abatement project will require his inspection/approval before proceeding to the next step.
 2. Environmental and clearance sampling will be conducted by a project monitoring firm retained by the owner.
 3. Materials and workmanship shall be subject to examination by the project monitor at all times during the construction and use of the asbestos containment. The project monitor shall have authority to reject defective material and workmanship and require its correction.
 4. The project monitor will immediately suspend any work which is being conducted in an unsafe manner, i.e., the potential for personal injury or property damage exists.
 5. The project monitor shall ensure that the contractor and their employees are licensed by the Commonwealth of Virginia.
- I. Air Monitoring
1. Collection of all OSHA required air sampling shall be conducted by a competent representative of the contractor. Sampling and analysis costs shall be borne by the Contractor.
 2. All analytical results will be posted at the work site entrance within forty-eight (48) hours of sampling. Results shall be designated as to sample type (area or personal) and location.

3. If fiber contamination outside the work area is found to be in excess of 0.01 fibers/cc or background, the contractor shall immediately stop work and notify the building manager and project monitor. Work will not be resumed until corrective action has been engaged.
4. The project monitor may conduct air sampling at critical barriers and/or outside of the regulated work areas, other than those designated to the contractor.

J. Labeling

1. The contractor shall post signs and ensure labels are affixed to all asbestos materials, scrap, waste, debris, etc. Signs shall be posted at all entrances to the work area(s).
2. The signs and labeling shall be of sufficient size to be clearly legible, and display the following:

**DANGER
CONTAINS ASBESTOS FIBERS
AVOID CREATING DUST
CANCER AND LUNG DISEASE HAZARD**

K. Waste Disposal

1. Asbestos debris shall be placed in a 6-mil bag within the enclosure and/or regulated work area and sealed. **Upon removal from the enclosure or regulated work area, the bags shall be rinsed and placed into a second, clear 6-mil bag.**
2. Each asbestos waste bag shall be labeled with the above identified warning sign along with all other pertinent information (including waste generator and generation site) in accordance with applicable federal and state regulations.
3. All asbestos waste bags shall be removed from the work area and stored in a properly prepared hauling container following the completion of each shift.
4. Sharp objects (i.e. ceiling grid work) shall be bagged and placed into a labeled, fiber drum for disposal.
5. Asbestos shall be disposed of at an approved landfill.
6. A manifest must accompany the asbestos waste and shall be signed by a responsible representative of the landfill.
7. Transportation of asbestos waste for disposal must be in accordance with all Federal, State, Regional, and Local standards.
8. If a temporary disposal receptacle (dumpster) is to be utilized, the following conditions must be met:
 - a. The receptacle shall be fully covered.
 - b. Warning signs shall be placed on each side of the receptacle.
 - c. The receptacle shall be locked when not attended.
9. An enclosed or covered vehicle must be used to transport asbestos to the disposal site.
10. Copies of disposal manifests must be submitted to the project manager within 30 days of the landfill receipt date.

L. Removal Via Negative Pressure Glove-Bags (Pipe Insulation):

1. Removal of asbestos-containing materials via negative pressure glove-bag techniques (as specified in these documents and in OSHA 29 CFR 1926.1101) may be performed only in areas preapproved by the Project Monitor.
2. A minimum negative pressure differential of less than 0.02 inches of water column (as opposed to ambient air) shall be maintained within glove-bags throughout asbestos removal operations.
3. **All glove-bag set-up and asbestos removal activities shall be performed by two workers wearing OSHA approved respirators equipped with NIOSH-approved HEPA cartridges.** Workers performing asbestos removal via glove-bag shall also don disposable protective coveralls and gloves.
4. Areas to be affected by glove-bag removal of asbestos-containing materials shall be thoroughly pre-cleaned utilizing wet-wiping and HEPA-vacuums equipment. At least one layer of 6 mil polyethylene will be used under each glove bag as a drop cloth.

5. All glove-bags must be pre-inspected by the project monitor prior to beginning asbestos removal.
6. Workers shall thoroughly wet asbestos-containing materials prior to, and during asbestos removal activities.
7. Each individual glove-bag unit must be inspected and granted visual clearance by the project monitor prior to tear-down.
8. All interior areas of each glove-bag shall be thoroughly encapsulated prior to tear down.

M. Removal of Roofing Material:

1. Full containment of work area is optional.
2. A full three-stage decontamination unit equipped with temperature controllable water source, and HEPA equipped waste water filtering system shall be constructed immediately contiguous to the work area.
3. Workers shall utilize OSHA approved respirators equipped with NIOSH approved HEPA cartridges throughout abatement activities.
4. All suspect asbestos-containing materials shall be wetted with amended water prior to, and during removal.
5. Use of power tools (i.e., roof saws) shall not be permitted unless the equipment is equipped with HEPA filtering attachments. All power tools must be approved by the onsite Project Monitor.
6. Polyethylene sheeting of 6 mil thickness shall be placed on all exterior areas lying directly below the work area. The sheeting shall extend a minimum of 15' feet outward from the base of the effected building (where conditions permit).
7. The contractor shall designate areas of potential hazard through the use of caution barrier tape and signage. All precautions shall be taken to protect pedestrians from falling debris and potential asbestos exposure.
8. Full or partially filled asbestos waste bags and all debris generated during removal operations shall be removed at the termination of each work shift. Dropping or throwing waste bags from the work area to the ground or into receptacles staged on the ground shall be strictly forbidden.
9. All waste bags shall be of 6 mil thickness bearing proper labeling as identified previously in these specifications.
10. All ladders, scaffolding and other fall protection equipment utilized throughout the project shall comply with all applicable federal and state and local regulations.

N. Removal of Window Caulk: Covering the Work Area with Fire Retardant Polyethylene

1. Interior Window Caulk: One layer of 6 mil fire retardant polyethylene sheeting shall be used to cover the work area floors. Duct tape shall be used to sill the sheets of polyethylene to the floor. The floor covering shall be cut to proper dimensions (12" overlap, or greater) to extend up the wall, to be affixed just below the window and/or door caulk to be removed. The polyethylene floor covering shall be flexible enough to prevent damage from foot traffic and extend at a minimum 6 feet from the wall that it is affixed.
2. After covering stationary objects and the floor, two layers of 6 mil fire retardant polyethylene shall be used to cover the interior of the windows to be removed. The polyethylene sheets shall be hung from the top of the windows, starting at a minimum of 12 inches above the frame and shall be long enough to overlap the floor sheeting by approximately twenty-four inches. The vertical sheets shall be overlapped and seam-sealed with adhesive duct tape.

O. Exterior Window Removal: A drop cloth consisting of 6 mil polyethylene sheeting shall be placed at the face of each window extending no less than 15 feet away from the wall in all directions. The edges of the polyethylene sheeting must be secured from wind and/or weather with hay bails. The securing of the polyethylene sheeting must hold throughout the duration of the window removal portion of the project.

P. Removal of Fire Doors (PACM): Covering of floor must be followed as specified above for Removal of Window Caulk.

1. Each door to be removed from the Miller Center must be removed by use of hand tools. Each door must be wrapped intact in two layers of 6 mil polyethylene sheeting and labeled for disposal.
2. Door waste is to be placed at the end of each work shift in a secure waste disposal container.

3.2 WASTE CHARACTERIZATION AND DISPOSAL

- A. Waste from abatement activities from commercial and public buildings that is known or presumed to contain asbestos and/or lead must be characterized as hazardous or non-hazardous prior to transport to an off-site disposal facility. Contractor is to employ a competent person as defined in 29 CFR 1926.62(b) to collect a composite sample of this waste stream and submit the sample to an independent laboratory licensed by the Commonwealth of Virginia to perform the Toxicity Characteristic Leaching Procedure (TCLP) analysis for Lead. TCLP results equal to or greater than 5 parts per million (ppm) lead (Pb) indicate that the waste must be disposed as hazardous. The container(s) for this waste must be properly sealed, labeled and manifested prior to shipment off-site to an approved disposal facility. Waste with a TCLP analysis results less than 5 ppm can be disposed as demolition debris.
- B. Friable asbestos-containing waste materials must be disposed of in a Virginia Department of Environmental Quality managed landfill, licensed to accept friable asbestos wastes. Non-friable asbestos-containing waste material may be disposed of as construction debris, however the landfill accepting the waste must be notified that it is asbestos-containing prior to disposal.

END OF SECTION 028314

Unit Price and Hourly Rates associated with Asbestos Removal

1. Removal and disposal of asbestos containing pipe insulation (gross removal):
 - a. 1" to 3.75" \$ _____ per LF
 - b. 4" to 5.75" \$ _____ per LF
 - c. 6" to 7.75" \$ _____ per LF
 - d. Mudded fittings \$ _____ each

2. Removal and disposal of asbestos containing pipe insulation using Glovebags:
 - a. 1" to 3.75" \$ _____ per LF
 - b. 4" to 5.75" \$ _____ per LF
 - c. 6" to 7.75" \$ _____ per LF
 - d. Mudded fittings \$ _____ each

3. Removal and disposal of asbestos containing boiler, breaching, and tank insulation:
 - a. Insulation (surface area) \$ _____ per SF

4. Removal and disposal of asbestos containing Floor materials:
 - a. Floor tile only \$ _____ per SF
 - b. Floor tile and mastic (nonfriable) \$ _____ per SF
 - d. Sheet flooring \$ _____ per SF

5. Removal and disposal of misc. asbestos materials:
 - a. Window glazing \$ _____ per LF
 - b. Window caulking \$ _____ per LF

6. Removal and disposal of fire door materials:
 - a. Fire Door \$ _____ each

7. Hourly rates and specialized equipment (when not using unit prices):
 - a. Project Manager \$ _____ per hr.
 - b. Supervisor \$ _____ per hr.
 - c. Worker \$ _____ per hr.
 - d. Crane with manbasket \$ _____ per day

8. Rate for mobilization to site for small scale removal project work:
 - a. Mobilization fee \$ _____ each

9. Two-person team of Supervisor and Worker to conduct small activities:
 - a. Daily rate for two man team \$ _____ per day

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mix design, placement procedures, and finishes.
- B. Related Sections include, but are not limited to, the following:
 - 1. Division 31 Section "Earthwork" for drainage fill under slabs-on-grade.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume.

1.4 SUBMITTALS

- A. Product Data: For each type of manufactured material and product indicated.
- B. Design Mixes: For each concrete mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
 - 1. Indicate amounts of mix water to be withheld for later addition at Project site.
- C. Steel Reinforcement Shop Drawings: Details of fabrication, bending, and placement, prepared according to ACI 315, "Details and Detailing of Concrete Reinforcement." Include material, grade, bar schedules, stirrup spacing, bent bar diagrams, arrangement, and supports of concrete reinforcement. Include special reinforcement required for openings through concrete structures.
- D. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials:
- E. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:
 - 1. Cementitious materials and aggregates.
 - 2. Steel reinforcement and reinforcement accessories.
 - 3. Admixtures.
 - 4. Waterstops.
 - 5. Curing materials.
 - 6. Vapor retarders.
 - 7. Repair materials.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed concrete Work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.
 - 1. Manufacturer must be certified according to the National Ready Mixed Concrete Association's Certification of Ready Mixed Concrete Production Facilities.
- C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.
 - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
- D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, each aggregate from one source, and each admixture from the same manufacturer.
- E. ACI Publications: Comply with the following, unless more stringent provisions are indicated:
 - 1. ACI 301, "Specification for Structural Concrete."
 - 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle steel reinforcement to prevent bending and damage.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

- A. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- B. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
- C. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- D. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of the exposed concrete surface.
 - 2. Furnish ties that, when removed, will leave holes not larger than 1 inch in diameter in concrete surface.
 - 3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.2 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

2.3 REINFORCEMENT ACCESSORIES

- A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete or fiber-reinforced concrete of greater compressive strength than concrete, and as follows:

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected or CRSI Class 2 stainless-steel bar supports.

2.4 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, Type I/II.
- B. Normal-Weight Aggregate: ASTM C 33, uniformly graded, and as follows:
 1. Class: Negligible weathering region, but not less than 1N.
 2. Nominal Maximum Aggregate Size: 3/4 inch.
 3. Combined Aggregate Gradation: Well graded from coarsest to finest with not more than 18 percent and not less than 8 percent retained on an individual sieve, except that less than 8 percent may be retained on coarsest sieve and on No. 50 sieve, and less than 8 percent may be retained on sieves finer than No. 50.
- C. Water: Potable and complying with ASTM C 94.

2.5 ADMIXTURES

- A. General: Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material and to be compatible with other admixtures and cementitious materials. Do not use admixtures containing calcium chloride.
- B. Air-Entraining Admixture: ASTM C 260.
- C. Water-Reducing Admixture: ASTM C 494, Type A.
- D. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
- E. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.
- F. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.

2.6 WATERSTOPS

- A. Self-Expanding Strip Waterstops: Manufactured rectangular or trapezoidal strip, sodium bentonite or other hydrophylic material for adhesive bonding to concrete.

2.7 VAPOR RETARDERS

- A. Vapor Retarder: ASTM E 1745, Class B, five-ply, nylon- or polyester-cord-reinforced, high-density polyethylene sheet; 10 mils thick.
- B. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

2.8 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.

- E. Clear, Solvent-Borne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.
- F. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.
- G. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
- H. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

2.9 RELATED MATERIALS

- A. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- B. Epoxy-Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class and grade to suit requirements, and as follows:
 1. Type II, non-load bearing, for bonding freshly mixed concrete to hardened concrete.
 2. Types II, non-load bearing, and I for bonding hardened or freshly mixed concrete to hardened concrete.
 3. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.10 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
 1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
 4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109/C 109M.
- B. Repair Topping: Traffic-bearing, cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch.
 1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
 4. Compressive Strength: Not less than 5700 psi at 28 days when tested according to ASTM C 109/C 109M.

2.11 CONCRETE MIXES

- A. Prepare design mixes for each type and strength of concrete determined by either laboratory trial mix or field test data bases, as follows:
 1. Proportion normal-weight concrete according to ACI 211.1 and ACI 301.
- B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the laboratory trial mix basis.
- C. Footings and Foundation Walls: Proportion normal-weight concrete mix as follows:
 1. Compressive Strength (28 Days): 3000 psi.

2. Maximum Slump: 4 inches.
 3. Maximum Slump for Concrete Containing High-Range Water-Reducing Admixture: 8 inches after admixture is added to concrete with 2- to 4-inch slump.
- D. Slab-on-Grade: Proportion normal-weight concrete mix as follows:
1. Compressive Strength (28 Days): 3000 phi.
 2. Minimum Cementitious Materials Content: 520 lb/cu. yd.
 3. Maximum Slump: 4 inches.
- E. Cementitious Materials: For concrete exposed to deicers, limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 requirements.
- F. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
1. Fly Ash: 25 percent.
 2. Combined Fly Ash and Pozzolan: 25 percent.
 3. Ground Granulated Blast-Furnace Slag: 50 percent.
 4. Combined Fly Ash or Pozzolan and Ground Granulated Blast-Furnace Slag: 50 percent portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.
 5. Silica Fume: 10 percent.
 6. Combined Fly Ash, Pozzolans, and Silica Fume: 35 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
 7. Combined Fly Ash or Pozzolans, Ground Granulated Blast-Furnace Slag, and Silica Fume: 50 percent portland cement minimum, with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
- G. Maximum Water-Cementitious Materials Ratio: 0.50 for concrete required to have low water permeability.
- H. Air Content: Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content of 2 to 4 percent, unless otherwise indicated.
- I. Do not air entrain concrete to trowel-finished interior floors and suspended slabs. Do not allow entrapped air content to exceed 3 percent.
- J. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- K. Synthetic Fiber: Uniformly disperse in concrete mix at manufacturer's recommended rate, but not less than 1 lb/cu. yd.
- L. Admixtures: Use admixtures according to manufacturer's written instructions.
1. Use water-reducing admixture or high-range water-reducing admixture (superplasticizer) in concrete, as required, for placement and workability.
 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
 4. Use corrosion-inhibiting admixture in concrete mixes where indicated.

2.12 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.13 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.
- B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94. Mix concrete materials in appropriate drum-type batch machine mixer.
 1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least one and one-half minutes, but not more than five minutes after ingredients are in mixer, before any part of batch is released.
 2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd.
 3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mix type, mix time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 FORMWORK

- A. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- B. Construct forms tight enough to prevent loss of concrete mortar.
- C. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical. Kerf wood inserts for forming keyways, reglets, recesses, and the like, for easy removal.
 1. Do not use rust-stained steel form-facing material.
- D. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- E. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- F. Chamfer exterior corners and edges of permanently exposed concrete.
- G. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- H. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- I. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use Setting Drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 1. Install anchor bolts, accurately located, to elevations required.

3.3 VAPOR RETARDERS

- A. Vapor Retarder: Place, protect, and repair vapor-retarder sheets according to ASTM E 1643 and manufacturer's written instructions.
- B. Fine-Graded Granular Material: Cover vapor retarder with fine-graded granular material, moisten, and compact with mechanical equipment to elevation tolerances of plus 0 inch or minus 3/4 inch.
- C. Granular Fill: Cover vapor retarder with granular fill, moisten, and compact with mechanical equipment to elevation tolerances of plus 0 inch or minus 3/4 inch.
 - 1. Place and compact a 1/2-inch- thick layer of fine-graded granular material over granular fill.

3.4 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Install welded wire fabric in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.5 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
 - 2. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness, as follows:
 - 1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 - 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- D. Dowel Joints: Install dowel sleeves and dowels or dowel bar and support assemblies at joints where indicated.
 - 1. Use dowel sleeves or lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.6 WATERSTOPS

- A. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, bonding or mechanically fastening and firmly pressing into place. Install in longest lengths practicable.

3.7 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Before placing concrete, water may be added at Project site, subject to limitations of ACI 301.
 - 1. Do not add water to concrete after adding high-range water-reducing admixtures to mix.
- C. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation.
- D. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
 - 1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 - 2. Maintain reinforcement in position on chairs during concrete placement.
 - 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
 - 4. Slope surfaces uniformly to drains where required.
 - 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, free of humps or hollows, before excess moisture or bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
- E. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 - 1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
 - 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mix designs.
- F. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R and as follows, when hot-weather conditions exist:
 - 1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 - 2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
 - 3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.8 FINISHING FLOORS AND SLABS

- A. General: Comply with recommendations in ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes.

1. Apply scratch finish to surfaces indicated and to surfaces to receive concrete floor topping or mortar setting beds for ceramic or quarry tile, portland cement terrazzo, and other bonded cementitious floor finishes.
- C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.
1. Apply float finish to surfaces indicated, to surfaces to receive trowel finish, and to floor and slab surfaces to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.
- D. Trowel Finish: After applying float finish, apply first trowel finish and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
1. Apply a trowel finish to surfaces indicated and to floor and slab surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin film-finish coating system
 2. Finish and measure surface so gap at any point between concrete surface and an unlevelled freestanding 10-foot- long straightedge, resting on two high spots and placed anywhere on the surface, does not exceed the following:
 - a. 1/4 inch .
- E. Trowel and Fine-Broom Finish: Apply a partial trowel finish, stopping after second troweling, to surfaces indicated and to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. Immediately after second troweling, and when concrete is still plastic, slightly scarify surface with a fine broom.
- F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.
1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.9 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel-finish concrete surfaces.

3.10 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with recommendations in ACI 305R for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing

operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing by one or a combination of the following methods:
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces, by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
 - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
 - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer recommends for use with floor coverings.
 - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - 4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.11 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
 - 1. Defer joint filling until concrete has aged at least six months. Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.
- C. Install semirigid epoxy joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.12 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
 - 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension in solid concrete but not less than 1 inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 - 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
 - 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
 - 1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 - 2. After concrete has cured at least 14 days, correct high areas by grinding.
 - 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
 - 4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
 - 5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 - 6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least 3/4 inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mix as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
 - 7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.13 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to sample materials, perform tests, and submit test reports during concrete placement. Sampling and testing for quality control may include those specified in this Article.
- B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
 - 1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mix exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
 - 2. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
 - 3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C 173, volumetric method, for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
 - 4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
 - 5. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
 - 6. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of four standard cylinder specimens for each composite sample.
 - a. Cast and field cure one set of four standard cylinder specimens for each composite sample.
 - 7. Compressive-Strength Tests: ASTM C 39; test two laboratory-cured specimens at 7 days and two at 28 days.
 - a. Test two field-cured specimens at 7 days and two at 28 days.
 - b. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at age indicated.
- C. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
- D. Strength of each concrete mix will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
- E. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-and 28-day tests.
- F. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
- G. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by Architect.

END OF SECTION 033000

SECTION 034500 - PRECAST ARCHITECTURAL CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes, but is not limited to, Architectural precast concrete trim for building envelope and landscape features.
- B. Related Sections include, but are not limited to, the following:
 - 1. Division 04 Section "Unit Masonry."
 - 2. Division 07 Section "Joint Sealants."

1.3 DEFINITION

- A. Design Reference Sample: Sample of approved architectural precast concrete color, finish and texture, preapproved by Architect.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each precast concrete mixture. Include compressive strength and water-absorption tests.
- C. Shop Drawings: Detail fabrication and installation of architectural precast concrete units. Indicate locations, plans, elevations, dimensions, shapes, and cross sections of each unit. Indicate joints, reveals, and extent and location of each surface finish. Indicate details at wall corners.
 - 1. Include plans and elevations showing unit location and sequence of erection for special conditions.
 - 2. Indicate location of each architectural precast concrete unit by same identification mark placed on panel.
 - 3. Indicate relationship of architectural precast concrete units to adjacent materials.
- D. Samples: For each type of finish indicated on exposed surfaces of architectural precast concrete units, in sets of 3, illustrating full range of finish, color, and texture variations expected; approximately 12 by 12 by 2 inches .
 - 1. When other faces of precast concrete unit are exposed, include Samples illustrating workmanship, color, and texture of backup concrete as well as facing concrete.

1.5 QUALITY ASSURANCE

- A. Design Standards: Comply with ACI 318 and design recommendations of PCI MNL 120, "PCI Design Handbook - Precast and Prestressed Concrete," applicable to types of architectural precast concrete units indicated.
- B. Quality-Control Standard: For manufacturing procedures and testing requirements, quality-control recommendations, and dimensional tolerances for types of units required, comply with

PCI MNL 117, "Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver architectural precast concrete units in such quantities and at such times to limit unloading units temporarily on the ground.
- B. Support units during shipment on nonstaining shock-absorbing material.
- C. Store units with adequate dunnage and bracing and protect units to prevent contact with soil, to prevent staining, and to prevent cracking, distortion, warping or other physical damage.
- D. Place stored units so identification marks are clearly visible, and units can be inspected.
- E. Handle and transport units in a position consistent with their shape and design in order to avoid excessive stresses which would cause cracking or damage.
- F. Lift and support units only at designated points shown on Shop Drawings.

1.7 SEQUENCING

- A. Furnish loose connection hardware and anchorage items to be embedded in or attached to other construction without delaying the Work. Provide locations, setting diagrams, templates, instructions, and directions, as required, for installation.

PART 2 - PRODUCTS

2.1 MOLD MATERIALS

- A. Molds: Rigid, dimensionally stable, non-absorptive material, warp and buckle free, that will provide continuous and true precast concrete surfaces within fabrication tolerances indicated; nonreactive with concrete and suitable for producing required finishes.
 - 1. Mold-Release Agent: Commercially produced liquid-release agent that will not bond with, stain or adversely affect precast concrete surfaces and will not impair subsequent surface or joint treatments of precast concrete.

2.2 REINFORCING MATERIALS

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
- B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.
- C. Galvanized Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed bars, ASTM A 767/A 767M, Class II zinc coated, hot-dip galvanized.
- D. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.
- E. Supports: Suspend reinforcement from back of mold or use bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place according to PCI MNL 117.

2.3 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, Type I or Type III, gray, unless otherwise indicated.

1. For surfaces exposed to view in finished structure, mix gray with white cement, of same type, brand, and mill source.
- B. Supplementary Cementitious Materials:
 1. Fly Ash: ASTM C 618, Class C or F, with maximum loss on ignition of 3 percent.
 2. Metakaolin Admixture: ASTM C 618, Class N.
 3. Silica Fume Admixture: ASTM C 1240, with optional chemical and physical requirement.
 4. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
- C. Normal-Weight Aggregates: Except as modified by PCI MNL 117, ASTM C 33, with coarse aggregates complying with Class 5S. Stockpile fine and coarse aggregates for each type of exposed finish from a single source (pit or quarry) for Project.
- D. Lightweight Aggregates: Except as modified by PCI MNL 117, ASTM C 330, with absorption less than 11 percent.
- E. Coloring Admixture: ASTM C 979, synthetic or natural mineral-oxide pigments or colored water-reducing admixtures, temperature stable, and nonfading.
- F. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 117.
- G. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.
- H. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and to not contain calcium chloride, or more than 0.15 percent chloride ions or other salts by weight of admixture.
 1. Water-Reducing Admixtures: ASTM C 494/C 494M, Type A.
 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 4. Water-Reducing and Accelerating Admixture: ASTM C 494/C 494M, Type E.
 5. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 6. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.

2.4 ACCESSORIES

- A. Precast Accessories: Provide clips, hangers, plastic or steel shims, and other accessories required to install architectural precast concrete units.

2.5 GROUT MATERIALS

- A. Sand-Cement Grout: Portland cement, ASTM C 150, Type I, and clean, natural sand, ASTM C 144 or ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
- B. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, plasticizing and water-reducing agents, complying with ASTM C 1107, Grade A for drypack and Grades B and C for flowable grout and of consistency suitable for application within a 30-minute working time.

2.6 CONCRETE MIXTURES

- A. Prepare design mixtures for each type of precast concrete required.

1. Use a single design mixture for units with more than one major face or edge exposed.
 2. Limit use of fly ash and silica fume to twenty percent (20%) of portland cement by weight.
 3. Limit metakaolin and silica fume to ten percent (10%) of portland cement by weight.
- B. Limit water-soluble chloride ions to maximum percentage by weight of cement permitted by ACI 318 or PCI MNL 117 when tested according to ASTM C 1218/C 1218M.
- C. Normal-Weight Concrete Mixtures: Proportion full-depth mixture by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:
1. Compressive Strength (28 Days): 5000 psi minimum.
 2. Maximum Water-Cementitious Materials Ratio: 0.45.
- D. Water Absorption: Six percent (6%) by weight or fourteen percent (14%) by volume, tested according to PCI MNL 117.
- E. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 117.
- F. When included in design mixtures, add other admixtures to concrete mixtures according to manufacturer's written instructions.

2.7 MOLD FABRICATION

- A. Molds: Accurately construct molds, mortar tight, of sufficient strength to withstand pressures due to concrete-placement operations and temperature changes and for prestressing and detensioning operations. Coat contact surfaces of molds with release agent before reinforcement is placed. Avoid contamination of reinforcement and prestressing tendons by release agent.
- B. Maintain molds to provide completed architectural precast concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified.
1. Form joints are not permitted on faces exposed to view in the finished work.
 2. Edge and Corner Treatment: Uniformly radiused.

2.8 FABRICATION

- A. Furnish loose hardware items including steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other hardware shapes for securing architectural precast concrete units to supporting and adjacent construction.
- B. Reinforcement: Comply with recommendations in PCI MNL 117 for fabricating, placing, and supporting reinforcement.
1. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete. When damage to epoxy-coated reinforcing exceeds limits specified in ASTM A 775/A 775M, repair with patching material compatible with coating material and epoxy coat bar ends after cutting.
 2. Accurately position, support, and secure reinforcement against displacement during concrete-placement and consolidation operations. Completely conceal support devices to prevent exposure on finished surfaces.
 3. Place reinforcement to maintain at least 3/4-inch minimum coverage. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Direct wire tie ends away from finished, exposed concrete surfaces.
 4. Place reinforcing steel to maintain at least 3/4-inch minimum concrete cover. Increase cover requirements for reinforcing steel to 1-1/2 inches when units are exposed to

corrosive environment or severe exposure conditions. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Direct wire tie ends away from finished, exposed concrete surfaces.

5. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh spacing and wire tie laps, where required by design. Offset laps of adjoining widths to prevent continuous laps in either direction.

- C. Reinforce architectural precast concrete units to resist handling, transportation, and erection stresses.
- D. Comply with requirements in PCI MNL 117 and requirements in this Section for measuring, mixing, transporting, and placing concrete. After concrete batching, no additional water may be added.
- E. Place face mixture to a minimum thickness after consolidation of the greater of 1 inch or 1.5 times the maximum aggregate size, but not less than the minimum reinforcing cover specified.
- F. Place concrete in a continuous operation to prevent seams or planes of weakness from forming in precast concrete units.
- G. Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items, and minimize pour lines, honeycombing, or entrapped air on surfaces. Use equipment and procedures complying with PCI MNL 117.
- H. Comply with PCI MNL 117 for hot- and cold-weather concrete placement.
- I. Identify pickup points of architectural precast concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark casting date on each architectural precast concrete unit on a surface that will not show in finished structure.
- J. Cure concrete, according to requirements in PCI MNL 117, by moisture retention without heat or by accelerated heat curing using low-pressure live steam or radiant heat and moisture. Cure units until compressive strength is high enough to ensure that stripping does not have an effect on performance or appearance of final product.
- K. Discard and replace architectural precast concrete units that do not comply with requirements, including structural, manufacturing tolerance, and appearance, unless repairs meet requirements in PCI MNL 117 and Architect's approval.

2.9 FABRICATION TOLERANCES

- A. Fabricate architectural precast concrete units straight and true to size and shape with exposed edges and corners precise and true so each finished panel complies with PCI MNL 117 product tolerances as well as position tolerances for cast-in items.
- B. Fabricate architectural precast concrete units straight and true to size and shape with exposed edges and corners precise and true so each finished panel complies with the following product tolerances:
 1. Overall Height and Width of Units, Measured at the Face Exposed to View, plus or minus 1/8 inch.
 2. Overall Height and Width of Units, Measured at the Face Not Exposed to View, plus or minus 1/4 inch.

2.10 FINISHES

- A. Panel faces shall be free of joint marks, grain, and other obvious defects. Corners shall be uniform, straight, and sharp. Finish exposed-face surfaces of architectural precast concrete units to match existing precast concrete elements per sample panels. Base bid on the following:
 - 1. Honed Finish: Use continuous mechanical abrasion with fine grit, followed by filling and rubbing procedures.
- B. Finish exposed surfaces of architectural precast concrete units to match face-surface finish.
- C. Finish unexposed surfaces of architectural precast concrete units by float finish.

2.11 SOURCE QUALITY CONTROL

- A. Quality-Control Testing: Test and inspect precast concrete according to PCI MNL 117 requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting walls or foundation and conditions for compliance with requirements for installation tolerances, true and level bearing surfaces, and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install clips, hangers, bearing pads, and other accessories required for connecting architectural precast concrete units to supporting members.
- B. Erect architectural precast concrete level, plumb, and square within specified allowable tolerances.
- C. Grouting Connections: Grout connections where required or indicated. Retain grout in place until hard enough to support itself. Pack spaces with stiff grout material, tamping until voids are completely filled. Place grout to finish smooth, level, and plumb with adjacent concrete surfaces. Keep grouted joints damp for not less than 24 hours after initial set. Promptly remove grout material from exposed surfaces before it affects finishes or hardens.

3.3 ERECTION TOLERANCES

- A. Erect architectural precast concrete units level, plumb, square, true, and in alignment without exceeding the noncumulative erection tolerances of PCI MNL 117, Appendix I.

3.4 REPAIRS

- A. Repair architectural precast concrete units if permitted by Architect. The Architect reserves the right to reject repaired units that do not comply with requirements.
- B. Mix patching materials and repair units so cured patches blend with color, texture, and uniformity of adjacent exposed surfaces and show no apparent line of demarcation between

original and repaired work, when viewed in typical daylight illumination from a distance of 20 feet.

- C. Prepare and repair damaged galvanized coatings with galvanizing repair paint according to ASTM A 780.
- D. Wire brush, clean, and paint damaged prime-painted components with same type of shop primer.
- E. Remove and replace damaged architectural precast concrete units when repairs do not comply with requirements.

3.5 CLEANING

- A. Clean surfaces of precast concrete units exposed to view.
- B. Clean mortar, plaster, fireproofing, weld slag, and other deleterious material from concrete surfaces and adjacent materials immediately.
- C. Clean exposed surfaces of precast concrete units after erection and completion of joint treatment to remove weld marks, other markings, dirt, and stains.
 - 1. Perform cleaning procedures, if necessary, according to precast concrete fabricator's recommendations. Clean soiled precast concrete surfaces with detergent and water, using stiff fiber brushes and sponges, and rinse with clean water. Protect other work from staining or damage due to cleaning operations.
 - 2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.

END OF SECTION 034500

SECTION 040120 - CLEANING, REPAIR AND RESTORATION OF HISTORIC MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes brick clay masonry restoration and cleaning as follows:
 1. Repairing unit masonry, including replacing units.
 2. Repointing joints.
 3. Preliminary cleaning, including removing plant growth.
 4. Cleaning exposed unit masonry surfaces.
- B. Related Sections include, but are not limited to:
 1. Division 04 Section "Unit Masonry" for new clay masonry construction.
 2. Division 07 Section "Sheet Metal Flashing and Trim" for metal flashing installed in or on restored clay masonry.
 3. Division 09 Section "Elastomeric Coatings" for coatings applied over existing painted masonry (such as at back sides of parapet walls).

1.3 DEFINITIONS

- A. Very Low-Pressure Spray: Under 100 psi.
- B. Low-Pressure Spray: 100 to 400 psi; 4 to 6 gpm.
- C. Medium-Pressure Spray: 400 to 800 psi; 4 to 6 gpm.
- D. High-Pressure Spray: 800 to 1200 psi; 4 to 6 gpm.
- E. Saturation Coefficient: Ratio of the weight of water absorbed during immersion in cold water to weight absorbed during immersion in boiling water; used as an indication of resistance of masonry units to freezing and thawing.

1.4 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on masonry units as follows.
 1. Provide test specimens as indicated and representative of proposed materials and construction.
 2. Existing Brick: Test each type of existing masonry unit indicated for replacement, according to testing methods in ASTM C 67 for compressive strength, 24-hour cold-water absorption, 5-hour boil absorption, saturation coefficient, and initial rate of absorption (suction). Carefully remove five (5) existing units from locations designated by Architect. Take testing samples from these units.
 3. Existing Mortar: Test according to ASTM C 295, modified as agreed by testing service and Architect for Project requirements, to determine proportional composition of original ingredients, sizes and colors of aggregates, and approximate strength. Use X-ray diffraction, infrared spectroscopy, and differential thermal analysis as necessary to supplement microscopical methods. Carefully remove existing mortar from within joints at five (5) locations designated by Architect.

4. Temporary Patch: As directed by Architect, provide temporary materials at locations from which existing samples were taken.
5. Replacement Brick: Test each proposed type of replacement masonry unit, according to sampling and testing methods in ASTM C 67 for compressive strength, 24-hour cold-water absorption, 5-hour boil absorption, saturation coefficient, and initial rate of absorption (suction).

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include recommendations for application and use. Include test data substantiating that products comply with requirements.
- B. Samples for Initial Selection: For the following:
 1. Pointing Mortar: Submit sets of mortar for pointing in the form of sample mortar strips, 6 inches long by 1/2 inch wide, set in aluminum or plastic channels.
 - a. Have each set contain a close color range of at least three (3) Samples of different mixes of colored sands and cements that produce a mortar matching the cleaned masonry when cured and dry.
 - b. Submit with precise measurements on ingredients, proportions, gradations, and sources of colored sands from which each Sample was made.
 2. Patching Compound: Submit sets of patching compound Samples in the form of plugs (patches in drilled holes) in sample units of masonry representative of the range of masonry colors on the building.
 - a. Have each set contain a close color range of at least three (3) Samples of different mixes of patching compound that matches the variations in existing masonry when cured and dry.
 3. Sealant Materials: See Division 07 Section "Joint Sealants."
 4. Include similar Samples of accessories involving color selection.
- C. Samples for Verification: For the following:
 1. Each type of masonry unit to be used for replacing existing units. Include sets of Samples as necessary to show the full range of shape, color, and texture to be expected.
 - a. For each brick type, provide straps or panels containing at least four (4) bricks. Include multiple straps for brick with a wide range.
 2. Each type of sand used for pointing mortar; minimum 1 lb of each in plastic screw-top jars.
 - a. For blended sands, provide Samples of each component and blend.
 - b. Identify sources, both supplier and quarry, of each type of sand.
 3. Each type, color, and texture of pointing mortar in the form of sample mortar strips, 6 inches long by 1/2 inch wide, set in aluminum or plastic channels.
 - a. Include with each Sample a list of ingredients with proportions of each. Identify sources, both supplier and quarry, of each type of sand and brand names of cementitious materials and pigments if any.
 4. Each type of masonry patching compound in the form of briquettes, at least 3 inches long by 1-1/2 inches wide. Document each Sample with manufacturer and stock number or other information necessary to order additional material.
 5. Sealant Materials: See Division 07 Section "Joint Sealants."
 6. Accessories: Each type of anchor, accessory, and miscellaneous support.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For restoration specialists including field supervisors and restoration workers and testing service.
- B. Preconstruction Test Reports: For existing and replacement masonry units.

- C. Restoration Program.
- D. Cleaning Program.

1.7 QUALITY ASSURANCE

- A. Restoration Specialist Qualifications: Engage an experienced masonry restoration and cleaning firm to perform work of this Section. Firm shall have completed work similar in material, design, and extent to that indicated for this Project with a record of successful in-service performance. Experience installing standard unit masonry is not sufficient experience for masonry restoration work.
 - 1. At Contractor's option, work may be divided between two specialist firms: one for cleaning work and one for repair work.
 - 2. Field Supervision: Restoration specialist firms shall maintain experienced full-time supervisors on Project site during times that clay masonry restoration and cleaning work is in progress. Supervisors shall not be changed during Project except for causes beyond the control of restoration specialist firm.
 - 3. Restoration Worker Qualifications: Persons who are experienced in restoration work of types they will be performing.
- B. Chemical-Cleaner Manufacturer Qualifications: A firm regularly engaged in producing masonry cleaners that have been used for similar applications with successful results, and with factory-trained representatives who are available for consultation and Project-site inspection and assistance at no additional cost.
- C. Source Limitations: Obtain each type of material for masonry restoration (face brick, cement, sand, etc.) from one source with resources to provide materials of consistent quality in appearance and physical properties.
- D. Restoration Program: Prepare a written, detailed description of materials, methods, equipment, and sequence of operations to be used for each phase of restoration work including protection of surrounding materials and Project site.
 - 1. Include methods for keeping pointing mortar damp during curing period.
- E. Cleaning Program: Prepare a written cleaning program that describes cleaning process in detail, including materials, methods, and equipment to be used, protection of surrounding materials, and control of runoff during operations.
- F. Cleaning and Repair Appearance Standard: Cleaned and repaired surfaces are to have a uniform appearance as viewed from 20 feet away by Architect. Perform additional paint and stain removal, general cleaning, and spot cleaning of small areas that are noticeably different, so that surface blends smoothly into surrounding areas.
- G. Mockups: Prepare mockups of restoration and cleaning to demonstrate aesthetic effects and set quality standards for materials and execution and for fabrication and installation.
 - 1. Masonry Repair: Prepare sample areas for each type of masonry material indicated to have repair work performed. If not otherwise indicated, size each mockup not smaller than two (2) adjacent whole units or approximately 48 inches in least dimension. Erect sample areas in existing walls unless otherwise indicated, to demonstrate quality of materials, workmanship, and blending with existing work. Include the following as a minimum:
 - a. Replacement: Four (4) brick units replaced.
 - b. Patching: Three (3) small holes at least 1 inch in diameter for each type of masonry material indicated to be patched, so as to leave no evidence of repair.

2. Repointing: Rake out joints in two (2) separate areas, each approximately 16 inches high by 24 inches wide for each type of repointing required and repoint one of the areas.
 3. Cleaning: Clean an area approximately 25 sq. ft. for each type of masonry and surface condition.
 - a. Test cleaners and methods on samples of adjacent materials for possible adverse reactions. Do not use cleaners and methods known to have deleterious effect.
 - b. Allow a waiting period of not less than seven days after completion of sample cleaning to permit a study of sample panels for negative reactions.
 4. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 5. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- H. Preinstallation Conference: Conduct conference at Project site.
1. Review methods and procedures related to masonry restoration and cleaning including, but not limited to, the following:
 - a. Construction schedule. Verify availability of materials, Restoration Specialist's personnel, equipment, and facilities needed to make progress and avoid delays.
 - b. Materials, material application, sequencing, tolerances, and required clearances.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver masonry units to Project site strapped together in suitable packs or pallets or in heavy-duty cartons.
- B. Deliver other materials to Project site in manufacturer's original and unopened containers, labeled with manufacturer's name and type of products.
- C. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- D. Store hydrated lime in manufacturer's original and unopened containers. Discard lime if containers have been damaged or have been opened for more than two days.
- E. Store lime putty covered with water in sealed containers.
- F. Store sand where grading and other required characteristics can be maintained and contamination avoided.

1.9 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit masonry restoration and cleaning work to be performed according to manufacturers' written instructions and specified requirements.
- B. Repair masonry units and repoint mortar joints only when air temperature is between 40 and 90 deg F and is predicted to remain so for at least 7 days after completion of the Work unless otherwise indicated.
- C. Cold-Weather Requirements: Comply with the following procedures for masonry repair and mortar-joint pointing unless otherwise indicated:
 1. When air temperature is below 40 deg F, heat mortar ingredients, masonry repair materials, and existing masonry walls to produce temperatures between 40 and 120 deg F.

2. When mean daily air temperature is below 40 deg F, provide enclosure and heat to maintain temperatures above 32 deg F within the enclosure for 7 days after repair and pointing.
- D. Hot-Weather Requirements: Protect masonry repair and mortar-joint pointing when temperature and humidity conditions produce excessive evaporation of water from mortar and repair materials. Provide artificial shade and wind breaks and use cooled materials as required to minimize evaporation. Do not apply mortar to substrates with temperatures of 90 deg F and above unless otherwise indicated.
 - E. For manufactured repair materials, perform work within the environmental limits set by each manufacturer.
 - F. Clean masonry surfaces only when air temperature is 40 deg F and above and is predicted to remain so for at least 7 days after completion of cleaning.
- 1.10 SEQUENCING AND SCHEDULING
- A. Order replacement materials at earliest possible date to avoid delaying completion of the Work.
 - B. Order sand for pointing mortar immediately after approval of mockups. Take delivery of and store at Project site a sufficient quantity to complete Project.
 - C. Perform masonry restoration work in the following sequence:
 1. Remove plant growth.
 2. Inspect for open mortar joints and repair before cleaning to prevent the intrusion of water and other cleaning materials into the wall.
 3. Remove paint.
 4. Clean masonry surfaces.
 5. Rake out mortar from joints surrounding masonry to be replaced and from joints adjacent to masonry repairs along joints.
 6. Repair masonry, including replacing existing masonry with new masonry materials.
 7. Rake out mortar from joints to be repointed.
 8. Point mortar joints.
 9. After repairs and repointing have been completed and cured, perform a final cleaning to remove residues from this work.
 10. Inspect for open mortar joints and repair before cleaning to prevent the intrusion of water and other cleaning materials into the wall.
 11. Clean masonry surfaces.
 - D. As scaffolding is removed, patch anchor holes used to attach scaffolding. Patch holes in masonry units to comply with "Masonry Unit Patching" Article. Patch holes in mortar joints to comply with "Repointing Masonry" Article.

PART 2 - PRODUCTS

2.1 MASONRY MATERIALS

- A. Face Brick: Provide face brick, including specially molded, ground, cut, or sawed shapes where required to complete masonry restoration work.
 1. Provide units with colors, color variation within units, surface texture, size, and shape to match existing brickwork and with physical properties within 10 percent of those determined from preconstruction testing of selected existing units.

- a. For existing brickwork that exhibits a range of colors or color variation within units, provide brick that proportionally matches that range and variation rather than brick that matches an individual color within that range.
 - 2. Special Shapes:
 - a. Provide specially molded, 100 percent solid shapes for applications where core holes or "frogs" could be exposed to view or weather when in final position and where shapes produced by sawing would result in sawed surfaces being exposed to view.
 - b. Provide specially ground units, shaped to match patterns, for arches and where indicated.
 - c. Mechanical chopping or breaking brick, or bonding pieces of brick together by adhesive, are not acceptable procedures for fabricating special shapes.
 - B. Building Brick: Provide building brick complying with ASTM C 62, of same vertical dimension as face brick, for masonry work concealed from view.
 - 1. Grade SW where in contact with earth.
 - 2. Grade SW, MW, or NW for concealed backup.
 - C. Salvaged Brick: Use salvaged brick to the greatest extent possible. Clean off residual mortar.
- 2.2 MORTAR MATERIALS
- A. Portland Cement: ASTM C 150, Type I or Type II, white or gray or both where required for color matching of exposed mortar.
 - 1. Provide cement containing not more than 0.60 percent total alkali when tested according to ASTM C 114.
 - B. Hydrated Lime: ASTM C 207, Type S.
 - C. Hydraulic Lime: ASTM C1707.
 - 1. Basis of Design: "Virginia Lime Works Hydraulic Lime" available from Virginia Lime Works, PO Box 516, Monroe VA, 24574, Phone (434) 929-8113.
 - 2. Manufacturer shall maintain quality control procedures and maintain records of production.
 - 3. Manufacturer to provide samples of proposed materials for mock-up panels at the site.
 - D. Factory-Prepared Lime Putty: ASTM C 1489.
 - E. Quicklime: ASTM C 5, pulverized lime.
 - F. Mortar Sand:
 - 1. Color: Provide natural sand or ground marble, granite, or other sound stone of color necessary to produce required mortar color.
 - 2. For pointing mortar, provide sand with rounded edges.
 - 3. Match size, texture, and gradation of existing mortar sand as closely as possible. Two or more sands and aggregates may be blended to achieve the color, gradation, and inclusions match.
 - 4. If necessary, sand may be amended to improve gradation.
 - 5. The gradation standards of ASTM C 144 shall be used as a guideline, but the characteristics of the original mortar shall govern.
 - G. Mortar Pigments: Natural or synthetic alkali-resistant iron oxides, compounded for mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortars. The weight of pigment shall not exceed ten percent (10%) of the weight of the binder.

- H. Water: Clean, clear, and potable.
- I. Pre-Mixed Mortar: At the Contractor's option, the following pre-mixed mortar may be used in lieu of site-mixed mortar.
 - 1. Pre-Mixed Hydraulic Lime Mortar: "Virginia Lime Works Mix & Go" available from Virginia Lime Works, PO Box 516, Monroe VA, 24574, Phone (434) 929-8113.
 - 2. Manufacturer shall maintain quality control procedures and maintain records of production.
 - 3. Manufacturer to provide samples of proposed materials for mock-up panels at the site.
 - 4. Hydraulic lime binder shall comply with ASTM C1707.

2.3 MANUFACTURED REPAIR MATERIALS

- A. Masonry Patching Compound: Factory-mixed cementitious product that is custom manufactured for patching masonry.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cathedral Stone Products, Inc.; Jahn M100 Terra Cotta and Brick Repair Mortar.
 - b. Conproco Corporation; Mimic or Matrix.
 - c. Edison Coatings, Inc.; Custom System 45.
 - 2. Use formulation that is vapor- and water permeable (equal to or more than the masonry unit), exhibits low shrinkage, has lower modulus of elasticity than the masonry units being repaired, and develops high bond strength to all types of masonry.
 - 3. Use formulation having working qualities and retardation control to permit forming and sculpturing where necessary.
 - 4. Formulate patching compound used for patching brick in colors and textures to match each masonry unit being patched. Provide sufficient number of colors to enable matching the color, texture, and variation of each unit.

2.4 PAINT REMOVERS

- A. Alkaline Paste Paint Remover: Manufacturer's standard alkaline paste formulation for removing paint coatings from masonry. Subject to compliance with requirements, provide one of the following:
 - 1. ABR Products, Inc.; 800 Brush Grade.
 - 2. Diedrich Technologies Inc.; 606 Multi-Layer Paint Remover or 606X Extra Thick Multi-Layer Paint Remover.
 - 3. Hydroclean, Hydrochemical Techniques, Inc.; Hydroclean HT-716 Heavy Duty Paint Remover.
 - 4. Price Research, Ltd.; Price Heavy Duty Paint Stripper.
 - 5. PROSOCO; Enviro Klean Safety Peel 2, Sure Klean Heavy-Duty Paint Stripper, or Sure Klean Heavy-Duty Paint Stripper D.
- B. Covered or Skin-Forming Alkaline Paint Remover: Manufacturer's standard covered or skin-forming alkaline formulation for removing paint coatings from masonry. Subject to compliance with requirements, provide one of the following:
 - 1. ABR Products, Inc.; Grip 'N Strip 800 Fast Acting.
 - 2. Diedrich Technologies Inc.; 606 Multi-Layer Paint Remover or 606X Extra Thick Multi-Layer Paint Remover with pull-off removal system.
 - 3. Dumond Chemicals, Inc.; Peel Away 1 System.
 - 4. PROSOCO; Enviro Klean Safety Peel 1 or Enviro Klean Safety Peel 3 with Enviro Klean Overcoat.
- C. Solvent-Type Paint Remover: Manufacturer's standard water-rinsable, solvent-type gel formulation for removing paint coatings from masonry. Subject to compliance with requirements, provide one of the following:
 - 1. ABR Products, Inc.; Super Bio Strip Gel.

2. Diedrich Technologies Inc.; 505 Special Coatings Stripper.
3. Dumond Chemicals, Inc.; Peel Away 2.
4. Hydroclean, Hydrochemical Techniques, Inc.; Hydroclean HT-300 Solvent Paint Remover.
5. Price Research, Ltd.; Price Strip-All.
6. PROSOCO; Sure Klean Fast Acting Stripper.

D. Low-Odor, Solvent-Type Paint Remover: Manufacturer's standard low-odor, water-rinsable solvent-type gel formulation, containing no methanol or methylene chloride, for removing paint coatings from masonry. Subject to compliance with requirements, provide one of the following:

1. ABR Products, Inc.; Super Bio Strip Gel.
2. Cathedral Stone Products, Inc.; S-301, S-303 or S-305.
3. Dumond Chemicals, Inc.; Peel Away 6, Peel Away 7 or Peel Away 21.
4. PROSOCO; Enviro Klean Safety Peel 1 or Enviro Klean Safety Peel 3.

2.5 CLEANING MATERIALS

A. Water: Potable.

B. Hot Water: Water heated to a temperature of 140 to 160 deg F.

C. Job-Mixed Detergent Solution: Solution prepared by mixing 2 cups of tetrasodium polyphosphate, 1/2 cup of laundry detergent, and 20 quarts of hot water for every 5 gal. of solution required.

D. Job-Mixed Mold, Mildew, and Algae Remover: Solution prepared by mixing 2 cups of tetrasodium polyphosphate, 5 quarts of 5 percent sodium hypochlorite (bleach), and 15 quarts of hot water for every 5 gal. of solution required.

E. Nonacidic Gel Cleaner: Manufacturer's standard gel formulation, with pH between 6 and 9, that contains detergents with chelating agents and is specifically formulated for cleaning masonry surfaces. Subject to compliance with requirements, provide one of the following:

1. Price Research, Ltd.; Price Marble Cleaner-Gel.
2. PROSOCO; Sure Klean 942 Limestone and Marble Cleaner.

F. Nonacidic Liquid Cleaner: Manufacturer's standard mildly alkaline liquid cleaner formulated for removing mold, mildew, and other organic soiling from ordinary building materials, including polished stone, brick, aluminum, plastics, and wood. Subject to compliance with requirements, provide one of the following:

1. Diedrich Technologies Inc.; Diedrich 910PM Polished Marble Cleaner.
2. Dominion Restoration Products, Inc.; Bio-Cleanse.
3. Dumond Chemicals, Inc.; Safe n' Easy Architectural Cleaner/Restorer.
4. Price Research, Ltd.; Price Non-Acid Masonry Cleaner.
5. PROSOCO; Enviro Klean 2010 All Surface Cleaner.

G. Mild Acidic Cleaner: Manufacturer's standard mildly acidic cleaner containing no muriatic (hydrochloric), hydrofluoric, or sulfuric acid; or ammonium bifluoride or chlorine bleaches. Subject to compliance with requirements, provide one of the following:

1. ABR Products, Inc.; X-190 Limestone & Concrete Cleaner.
2. Diedrich Technologies Inc.; Envirorestore 100.
3. Dominion Restoration Products, Inc.; DR-60 Stone and Masonry Cleaner.
4. PROSOCO; Enviro Klean BioWash.

- H. Acidic Cleaner: Manufacturer's standard acidic masonry cleaner composed of hydrofluoric acid or ammonium bifluoride blended with other acids, detergents, wetting agents, and inhibitors. Subject to compliance with requirements, provide one of the following:
1. ABR Products, Inc.; 801 Heavy Duty Masonry Cleaner.
 2. Diedrich Technologies Inc.; Diedrich 101 Masonry Restorer or Diedrich 101G Granite, Terra Cotta, and Brick Cleaner.
 3. Dumond Chemicals, Inc.; Safe n' Easy Ultimate Stone and Masonry Cleaner or Safe n' Easy Heavy Duty Restoration Cleaner.
 4. EaCo Chem, Inc.; GS-Restoration or HD-Acid
 5. Hydroclean, Hydrochemical Techniques, Inc.; Hydroclean Brick, Granite, Sandstone and Terra Cotta Cleaner (HT-626).
 6. Price Research, Ltd.; Price Heavy Duty Restoration Cleaner or Price Restoration Cleaner.
 7. PROSOCO; Enviro Klean Restoration Cleaner, Sure Klean Restoration Cleaner or Sure Klean Heavy-Duty Restoration Cleaner.
- I. Two-Part Chemical Cleaner: Manufacturer's standard system consisting of potassium or sodium hydroxide based, alkaline prewash cleaner and acidic afterwash cleaner that does not contain hydrofluoric acid. Subject to compliance with requirements, provide one of the following:
1. ABR Products, Inc.; 500 Limestone Prewash Cleaner followed by 500 Limestone Afterwash.
 2. Diedrich Technologies Inc.; Diedrich 808 Limestone Pre-Wash or Diedrich 808X Black Encrustation Remover - Super Strong followed by 707N Limestone Neutralizer After-Rinse.
 3. PROSOCO; Enviro Klean BioKlean followed by Sure Klean Limestone & Masonry Afterwash or Sure Klean 766 Limestone Prewash followed by SureKlean Limestone & Masonry Afterwash.

2.6 ACCESSORY MATERIALS

- A. Liquid Strippable Masking Agent: Manufacturer's standard liquid, film-forming, strippable masking material for protecting glass, metal, and polished stone surfaces from damaging effects of acidic and alkaline masonry cleaners. Subject to compliance with requirements, provide one of the following:
1. ABR Products, Inc.; Rubber Mask.
 2. Price Research, Ltd.; Price Mask.
 3. PROSOCO; Sure Klean Strippable Masking.
- B. Sealant Materials:
1. Provide manufacturer's standard chemically curing, elastomeric sealant(s) that comply with applicable requirements in Division 07 Section "Joint Sealants."
 2. Colors: Provide colors of exposed sealants to match colors of masonry adjoining installed sealant unless otherwise indicated.
 3. Ground-Mortar Aggregate: Custom crushed and ground pointing mortar sand or existing mortar retrieved from joints. Grind to a particle size that matches the adjacent mortar aggregate and color. Remove all fines passing the 100 sieve.
- C. Joint-Sealant Backing:
1. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin) or Type B (bicellular material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
 2. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where acceptable.

- D. Setting Buttons: Resilient plastic buttons, nonstaining to masonry, sized to suit joint thicknesses and bed depths of masonry units without intruding into required depths of pointing materials.
- E. Masking Tape: Nonstaining, nonabsorbent material, compatible with pointing mortar, joint primers, sealants, and surfaces adjacent to joints; that will easily come off entirely, including adhesive.
- F. Miscellaneous Products: Select materials and methods of use based on the following, subject to approval of a mockup:
 - 1. Previous effectiveness in performing the work involved.
 - 2. Little possibility of damaging exposed surfaces.
 - 3. Consistency of each application.
 - 4. Uniformity of the resulting overall appearance.
 - 5. Do not use products or tools that could do the following:
 - a. Remove, alter, or in any way harm the present condition or future preservation of existing surfaces, including surrounding surfaces not in contract.
 - b. Leave a residue on surfaces.

2.7 MORTAR MIXES

- A. General: Provide either premixed or site-mixed hydraulic lime mortar. Hydraulic lime and hydraulic lime binder shall comply with ASTM C1707.
 - 1. The replacement mortar mix shall be governed by the preconstruction testing of existing mortar.
- B. Preparing Lime Putty: Slake quicklime and prepare lime putty according to appendix to ASTM C 5 and manufacturer's written instructions.
- C. Measurement and Mixing: Measure cementitious materials and sand in a dry condition by volume or equivalent weight. Do not measure by shovel; use known measure. Mix materials in a clean, mechanical batch mixer.
 - 1. Mixing Pointing Mortar: Thoroughly mix cementitious materials and sand together before adding any water. Then mix again adding only enough water to produce a damp, unworkable mix that will retain its form when pressed into a ball. Maintain mortar in this dampened condition for 15 to 30 minutes. Add remaining water in small portions until mortar reaches desired consistency. Use mortar within one hour of final mixing; do not retemper or use partially hardened material.
- D. Colored Mortar: Produce mortar of color required by using specified ingredients. Do not alter specified proportions without Architect's approval.
 - 1. Mortar Pigments: Where mortar pigments are indicated, do not exceed a pigment-to-cement ratio of 1:10 by weight.
- E. Do not use admixtures in mortar unless otherwise indicated.
- F. Mortar Proportions: Mix mortar materials in the following proportions:
 - 1. Pointing Mortar for Brick: 1 part portland cement, 2 parts lime, and 6 parts sand. Add mortar pigments to produce mortar colors required.
 - 2. Rebuilding (Setting) Mortar: Same as pointing mortar except mortar pigments are not required.

2.8 CHEMICAL CLEANING SOLUTIONS

- A. Dilute chemical cleaners with water to produce solutions not exceeding concentration recommended by chemical-cleaner manufacturer.

- B. Acidic Cleaner Solution for Brick: Dilute with water to produce hydrofluoric acid content of three percent (3%) or less, but not greater than that recommended by chemical-cleaner manufacturer.

PART 3 - EXECUTION

3.1 PROTECTION

- A. Protect persons, motor vehicles, surrounding surfaces of building being restored, building site, plants, and surrounding buildings from harm resulting from masonry restoration work.
- B. Comply with chemical-cleaner manufacturer's written instructions for protecting building and other surfaces against damage from exposure to its products. Prevent chemical-cleaning solutions from coming into contact with people, motor vehicles, landscaping, buildings, and other surfaces that could be harmed by such contact.
 - 1. Cover adjacent surfaces with materials that are proven to resist chemical cleaners used unless chemical cleaners being used will not damage adjacent surfaces. Use materials that contain only waterproof, UV-resistant adhesives. Apply masking agents to comply with manufacturer's written instructions. Do not apply liquid masking agent to painted or porous surfaces. When no longer needed, promptly remove masking to prevent adhesive staining.
 - 2. Keep wall wet below area being cleaned to prevent streaking from runoff.
 - 3. Do not clean masonry during winds of sufficient force to spread cleaning solutions to unprotected surfaces.
 - 4. Neutralize and collect alkaline and acid wastes for disposal off Owner's property.
 - 5. Dispose of runoff from cleaning operations by legal means and in a manner that prevents soil erosion, undermining of paving and foundations, damage to landscaping, and water penetration into building interiors.
- C. Prevent mortar from staining face of surrounding masonry and other surfaces.
 - 1. Cover sills, ledges, and projections to protect from mortar droppings.
 - 2. Keep wall area wet below rebuilding and pointing work to discourage mortar from adhering.
 - 3. Immediately remove mortar in contact with exposed masonry and other surfaces.
 - 4. Clean mortar splatters from scaffolding at end of each day.
- D. Remove downspouts adjacent to masonry and store during masonry restoration and cleaning. Reinstall when masonry restoration and cleaning are complete.
 - 1. Provide temporary rain drainage during work to direct water away from building.

3.2 BRICK REMOVAL AND REPLACEMENT

- A. At locations indicated, remove bricks that are damaged, spalled, or deteriorated or are to be reused. Carefully demolish or remove entire units from joint to joint, without damaging surrounding masonry, in a manner that permits replacement with full-size units.
 - 1. When removing single bricks, remove material from center of brick and work toward outside edges.
- B. Support and protect remaining masonry that surrounds removal area. Maintain flashing, reinforcement, lintels, and adjoining construction in an undamaged condition.
- C. Notify Architect of unforeseen detrimental conditions including voids, cracks, bulges, and loose units in existing masonry backup, rotted wood, rusted metal, and other deteriorated items.
- D. Remove in an undamaged condition as many whole bricks as possible.

1. Remove mortar, loose particles, and soil from brick by cleaning with hand chisels, brushes, and water.
 2. Remove sealants by cutting close to brick with utility knife and cleaning with solvents.
 3. Store brick for reuse. Store off ground, on skids, and protected from weather.
 4. Deliver cleaned brick not required for reuse to Owner unless otherwise indicated.
- E. Clean bricks surrounding removal areas by removing mortar, dust, and loose particles in preparation for replacement.
- F. Replace removed damaged brick with other removed brick and salvaged brick in good quality, where possible, or with new brick matching existing brick, including size. Do not use broken units unless they can be cut to usable size.
- G. Install replacement brick into bonding and coursing pattern of existing brick. If cutting is required, use a motor-driven saw designed to cut masonry with clean, sharp, unchipped edges.
1. Maintain joint width for replacement units to match existing joints.
 2. Use setting buttons or shims to set units accurately spaced with uniform joints.
- H. Lay replacement brick with completely filled bed, head, and collar joints. Butter ends with sufficient mortar to fill head joints and shove into place. Wet both replacement and surrounding bricks that have ASTM C 67 initial rates of absorption (suction) of more than 30 g/30 sq. in. per min.. Use wetting methods that ensure that units are nearly saturated but surface is dry when laid.
1. Tool exposed mortar joints in repaired areas to match joints of surrounding existing brickwork.
 2. Rake out mortar used for laying brick before mortar sets and point new mortar joints in repaired area to comply with requirements for repointing existing masonry, and at same time as repointing of surrounding area.
 3. When mortar is sufficiently hard to support units, remove shims and other devices interfering with pointing of joints.

3.3 MASONRY UNIT PATCHING

- A. Patch the following masonry units unless another type of replacement or repair is indicated:
1. Units with holes.
 2. Units with chipped edges or corners.
 3. Units with small areas of deep deterioration.
- B. Remove and replace existing patches unless otherwise indicated or approved by Architect.
- C. Patching Bricks:
1. Remove loose material from masonry surface. Carefully remove additional material so patch will not have feathered edges but will have square or slightly undercut edges on area to be patched and will be at least 1/4 inch thick, but not less than recommended by patching compound manufacturer.
 2. Mask adjacent mortar joint or rake out for repointing if patch will extend to edge of masonry unit.
 3. Mix patching compound in individual batches to match each unit being patched. Combine one or more colors of patching compound, as needed, to produce exact match.
 4. Rinse surface to be patched and leave damp, but without standing water.
 5. Brush-coat surfaces with slurry coat of patching compound according to manufacturer's written instructions.
 6. Place patching compound in layers as recommended by patching compound manufacturer, but not less than 1/4 inch or more than 2 inches thick. Roughen surface of each layer to provide a key for next layer.

7. Trowel, scrape, or carve surface of patch to match texture and surrounding surface plane or contour of the masonry unit. Shape and finish surface before or after curing, as determined by testing, to best match existing masonry unit.
8. Keep each layer damp for 72 hours or until patching compound has set.

3.4 CLEANING MASONRY, GENERAL

- A. Proceed with cleaning in an orderly manner; work from top to bottom of each scaffold width and from one end of each elevation to the other. Ensure that dirty residues and rinse water will not wash over cleaned, dry surfaces.
- B. Use only those cleaning methods indicated for each masonry material and location.
 1. Do not use wire brushes or brushes that are not resistant to chemical cleaner being used. Do not use plastic-bristle brushes if natural-fiber brushes will resist chemical cleaner being used.
 2. Use spray equipment that provides controlled application at volume and pressure indicated, measured at spray tip. Adjust pressure and volume to ensure that cleaning methods do not damage masonry.
 - a. Equip units with pressure gages.
 3. For chemical-cleaner spray application, use low-pressure tank or chemical pump suitable for chemical cleaner indicated, equipped with cone-shaped spray tip.
 4. For water-spray application, use fan-shaped spray tip that disperses water at an angle of 25 to 50 degrees.
 5. For high-pressure water-spray application, use fan-shaped spray tip that disperses water at an angle of at least 40 degrees.
 6. For heated water-spray application, use equipment capable of maintaining temperature between 140 and 160 deg F at flow rates indicated.
 7. For steam application, use steam generator capable of delivering live steam at nozzle.
- C. Perform each cleaning method indicated in a manner that results in uniform coverage of all surfaces, including corners, moldings, and interstices, and that produces an even effect without streaking or damaging masonry surfaces.
- D. Water Application Methods:
 1. Water-Soak Application: Soak masonry surfaces by applying water continuously and uniformly to limited area for time indicated. Apply water at low pressures and low volumes in multiple fine sprays using perforated hoses or multiple spray nozzles. Erect a protective enclosure constructed of polyethylene sheeting to cover area being sprayed.
 2. Water-Spray Applications: Unless otherwise indicated, hold spray nozzle at least 6 inches from surface of masonry and apply water in horizontal back and forth sweeping motion, overlapping previous strokes to produce uniform coverage.
- E. Steam Cleaning: Apply steam to masonry surfaces at the very low pressures indicated for each type of masonry material. Hold nozzle at least 6 inches from surface of masonry and apply steam in horizontal back and forth sweeping motion, overlapping previous strokes to produce uniform coverage.
- F. Chemical-Cleaner Application Methods: Apply chemical cleaners to masonry surfaces to comply with chemical-cleaner manufacturer's written instructions; use brush or spray application but do not spray apply at pressures exceeding 50 psi. Do not allow chemicals to remain on surface for periods longer than those indicated or recommended by manufacturer.
- G. Rinse off chemical residue and soil by working upward from bottom to top of each treated area at each stage or scaffold setting. Periodically during each rinse, test pH of rinse water running off of cleaned area to determine that chemical cleaner is completely removed.

1. Apply neutralizing agent and repeat rinse if necessary to produce tested pH of between 6.7 and 7.5.

H. After cleaning is complete, remove protection no longer required. Remove tape and adhesive marks.

3.5 PRELIMINARY CLEANING

A. Removing Plant Growth: Completely remove visible plant, moss, and shrub growth from masonry surfaces. Carefully remove plants, creepers, and vegetation by cutting at roots and allowing to dry as long as possible before removal. Remove loose soil and debris from open masonry joints to whatever depth they occur.

B. Preliminary Cleaning: Before beginning general cleaning, remove extraneous substances that are resistant to cleaning methods being used. Extraneous substances include paint, calking, asphalt, and tar.

1. Carefully remove heavy accumulations of material from surface of masonry with a sharp chisel. Do not scratch or chip masonry surface.
2. Remove paint and calking with alkaline paint remover.
 - a. Comply with requirements in "Paint Removal" Article.
 - b. Repeat application up to two times if needed.
3. Remove asphalt and tar with solvent-type paint remover.
 - a. Comply with requirements in "Paint Removal" Article.
 - b. Apply paint remover only to asphalt and tar by brush without prewetting.
 - c. Allow paint remover to remain on surface for 10 to 30 minutes.
 - d. Repeat application if needed.

3.6 PAINT REMOVAL

A. Paint Removal with Alkaline Paste Paint Remover:

1. Remove loose and peeling paint using low or medium-pressure spray, scrapers, stiff brushes, or a combination of these. Let surface dry thoroughly.
2. Apply paint remover to dry, painted masonry with brushes.
3. Allow paint remover to remain on surface for period recommended by manufacturer.
4. Rinse with cold water applied by low-pressure spray to remove chemicals and paint residue.
5. Repeat process if necessary to remove all paint.
6. Apply acidic cleaner or manufacturer's recommended afterwash to masonry, while surface is still wet, using low-pressure spray equipment or soft-fiber brush. Let cleaner or afterwash remain on surface as a neutralizing agent for period recommended by chemical cleaner or afterwash manufacturer.
7. Rinse with cold water applied by low or medium-pressure spray to remove chemicals and soil.

B. Paint Removal with Covered or Skin-Forming Alkaline Paint Remover:

1. Remove loose and peeling paint using low or medium-pressure spray, scrapers, stiff brushes, or a combination of these. Let surface dry thoroughly.
2. Apply paint remover to dry, painted masonry with trowel, spatula, or as recommended by manufacturer.
3. Apply cover, if required by manufacturer, per manufacturer's written instructions.
4. Allow paint remover to remain on surface for period recommended by manufacturer or as determined in test panels.
5. Scrape off paint and remover and collect for disposal.
6. Rinse with cold water applied by low-pressure spray to remove chemicals and paint residue.

7. Use alkaline paste paint remover, according to "Paint Removal with Alkaline Paste Paint Remover" Paragraph, if necessary to remove remaining paint.
8. Apply acidic cleaner or manufacturer's recommended afterwash to masonry, while surface is still wet, using low-pressure spray equipment or soft-fiber brush. Let cleaner or afterwash remain on surface as a neutralizing agent for period recommended by chemical-cleaner or afterwash manufacturer.
9. Rinse with cold water applied by low or medium-pressure spray to remove chemicals and soil.

C. Paint Removal with Solvent-Type Paint Remover:

1. Remove loose and peeling paint using low or medium-pressure spray, scrapers, stiff brushes, or a combination of these. Let surface dry thoroughly.
2. Apply thick coating of paint remover to painted masonry with natural-fiber cleaning brush, deep-nap roller, or large paint brush.
3. Allow paint remover to remain on surface for period recommended by manufacturer. Agitate periodically with stiff-fiber brush.
4. Rinse with cold water applied by low-pressure spray to remove chemicals and paint residue.

3.7 CLEANING BRICKWORK

A. Cold-Water Soak:

1. Apply cold water by intermittent spraying to keep surface moist.
2. Use perforated hoses or other means that will apply a fine water mist to entire surface being cleaned.
3. Apply water in cycles with at least 30 minutes between cycles.
4. Continue spraying until surface encrustation has softened sufficiently to permit its removal by water wash, as indicated by cleaning tests.
5. Continue spraying for 72 hours.
6. Remove soil and softened surface encrustation from masonry with cold water applied by low-pressure spray.

B. Cold-Water Wash: Use cold water applied by low or medium-pressure spray.

C. Hot-Water Wash: Use hot water applied by low or medium-pressure spray.

D. Steam Cleaning: Apply steam at very low pressures not exceeding 30 psi. Remove dirt softened by steam with wood scrapers, stiff-nylon or -fiber brushes, or cold-water wash, as indicated by cleaning tests.

E. Detergent Cleaning:

1. Wet masonry with cold water applied by low-pressure spray.
2. Scrub masonry with detergent solution using medium-soft brushes until soil is thoroughly dislodged and can be removed by rinsing. Use small brushes to remove soil from mortar joints and crevices. Dip brush in solution often to ensure that adequate fresh detergent is used and that masonry surface remains wet.
3. Rinse with cold water applied by low-pressure spray to remove detergent solution and soil.
4. Repeat cleaning procedure above where required to produce cleaning effect established by mockup.

F. Mold, Mildew, and Algae Removal:

1. Wet masonry with cold water applied by low-pressure spray.
2. Apply mold, mildew, and algae remover by brush or low-pressure spray.
3. Scrub masonry with medium-soft brushes until mold, mildew, and algae are thoroughly dislodged and can be removed by rinsing. Use small brushes for mortar joints and

crevices. Dip brush in mold, mildew, and algae remover often to ensure that adequate fresh cleaner is used and that masonry surface remains wet.

4. Rinse with cold water applied by low-pressure spray to remove mold, mildew, and algae remover and soil.
5. Repeat cleaning procedure above where required to produce cleaning effect established by mockup.

G. Nonacidic Gel Chemical Cleaning:

1. Wet masonry with cold water applied by low-pressure spray.
2. Apply nonacidic gel cleaner in 1/8-inch thickness by brush, working into joints and crevices. Apply quickly and do not brush out excessively so area will be uniformly covered with fresh cleaner and dwell time will be uniform throughout area being cleaned.
3. Let cleaner remain on surface for period indicated below:
 - a. As recommended by chemical-cleaner manufacturer.
 - b. As established by mockup.
4. Remove bulk of nonacidic gel cleaner by squeegeeing into containers for disposal.
5. Rinse with cold water applied by low-pressure spray to remove chemicals and soil.
6. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.

H. Nonacidic Liquid Chemical Cleaning:

1. Wet masonry with cold water applied by low-pressure spray.
2. Apply cleaner to masonry in two applications by brush or low-pressure spray. Let cleaner remain on surface as recommended by chemical-cleaner manufacturer and established by mockup.
3. Rinse with cold water applied by low-pressure spray to remove chemicals and soil.
4. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.

I. Mild Acidic Chemical Cleaning:

1. Wet masonry with cold water applied by low-pressure spray.
2. Apply cleaner to masonry in two applications by brush or low-pressure spray. Let cleaner remain on surface as recommended by chemical-cleaner manufacturer and established by mockup.
3. Rinse with cold water applied by low-pressure spray to remove chemicals and soil.
4. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use a steam cleaning.

3.8 REPOINTING MASONRY

A. Rake out and repoint joints to the following extent:

1. All joints in areas indicated.
2. Joints where mortar is missing or where they contain holes.
3. Cracked joints where cracks can be penetrated at least 1/4 inch by a knife blade 0.027 inch thick.
4. Cracked joints where cracks are 1/8 inch or more in width and of any depth.
5. Joints where they sound hollow when tapped by metal object.
6. Joints where they are worn back 1/4 inch or more from surface.
7. Joints where they are deteriorated to point that mortar can be easily removed by hand, without tools.
8. Joints where they have been filled with substances other than mortar.
9. Joints indicated as sealant-filled joints.

- B. Do not rake out and repoint joints where not required.
- C. Rake out joints as follows, according to procedures demonstrated in approved mockup:
 - 1. Remove mortar from joints to depth of whichever of the following depths is greatest:
 - a. One inch.
 - b. Two-and-one-half times the width of the existing mortar joint.
 - c. Until bonded, cohesive existing mortar is encountered.
 - 2. Remove mortar from masonry surfaces within raked-out joints to provide reveals with square backs and to expose masonry for contact with pointing mortar. Brush, vacuum, or flush joints to remove dirt and loose debris.
 - 3. Do not spall edges of masonry units or widen joints. Replace or patch damaged masonry units as directed by Architect.
 - a. Cut out mortar by hand with chisel and resilient mallet. Do not use power-operated grinders without Architect's written approval based on approved quality-control program.
 - b. Cut out center of mortar bed joints using angle grinders with diamond-impregnated metal blades. Remove remaining mortar by hand with chisel and resilient mallet. Strictly adhere to approved quality-control program.
- D. Notify Architect of unforeseen detrimental conditions including voids in mortar joints, cracks, loose masonry units, rotted wood, rusted metal, and other deteriorated items.
- E. Pointing with Mortar:
 - 1. Rinse joint surfaces with water to remove dust and mortar particles. Time rinsing application so, at time of pointing, joint surfaces are damp but free of standing water. If rinse water dries, dampen joint surfaces before pointing.
 - 2. Apply pointing mortar first to areas where existing mortar was removed to depths greater than surrounding areas. Apply in layers not greater than 3/8 inch until a uniform depth is formed. Fully compact each layer thoroughly and allow it to become thumbprint hard before applying next layer.
 - 3. After low areas have been filled to same depth as remaining joints, point all joints by placing mortar in layers not greater than 3/8 inch . Fully compact each layer and allow to become thumbprint hard before applying next layer. Where existing masonry units have worn or rounded edges, slightly recess finished mortar surface below face of masonry to avoid widened joint faces. Take care not to spread mortar beyond joint edges onto exposed masonry surfaces or to featheredge the mortar.
 - 4. When mortar is thumbprint hard, tool joints to match original appearance of joints as demonstrated in approved mockup. Remove excess mortar from edge of joint by brushing.
 - 5. Cure mortar by maintaining in thoroughly damp condition for at least 72 consecutive hours including weekends and holidays.
 - a. Acceptable curing methods include covering with wet burlap and plastic sheeting, periodic hand misting, and periodic mist spraying using system of pipes, mist heads, and timers.
 - b. Adjust curing methods to ensure that pointing mortar is damp throughout its depth without eroding surface mortar.
 - 6. Hairline cracking within the mortar or mortar separation at edge of a joint is unacceptable. Completely remove such mortar and repoint.
- F. Where repointing work precedes cleaning of existing masonry, allow mortar to harden at least 30 days before beginning cleaning work.

3.9 FINAL CLEANING

- A. After mortar has fully hardened, thoroughly clean exposed masonry surfaces of excess mortar and foreign matter; use wood scrapers, stiff-nylon or -fiber brushes, and clean water, spray applied at low pressure.
 - 1. Do not use metal scrapers or brushes.
 - 2. Do not use acidic or alkaline cleaners.
- B. Wash adjacent woodwork and other nonmasonry surfaces. Use detergent and soft brushes or cloths.
- C. Clean mortar and debris from roof; remove debris from gutters and downspouts. Rinse off roof and flush gutters and downspouts.
- D. Sweep and rake adjacent pavement and grounds to remove mortar and debris. Where necessary, pressure wash pavement surfaces to remove mortar, dust, dirt, and stains.

3.10 FIELD QUALITY CONTROL

- A. Inspectors: Owner may engage qualified independent inspectors to perform inspections and prepare test reports. Allow inspectors use of lift devices and scaffolding, as needed, to perform inspections.
- B. Notify inspectors in advance of times when lift devices and scaffolding will be relocated. Do not relocate lift devices and scaffolding until inspectors have had reasonable opportunity to make inspections and observations of work areas at lift device or scaffold location.

END OF SECTION 040120

SECTION 042000 - UNIT MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes, but is not limited to:
 - 1. Concrete masonry units.
 - 2. Concrete building brick.
 - 3. Decorative concrete masonry units.
 - 4. Face brick.
 - 5. Building (common) brick.
 - 6. Mortar and grout.
 - 7. Steel reinforcing bars.
 - 8. Masonry joint reinforcement.
 - 9. Ties and anchors.
 - 10. Embedded flashing.
 - 11. Miscellaneous masonry accessories.
 - 12. Cavity-wall insulation.
- B. Related Sections:
 - 1. Division 04 Section "Cleaning, Repair, and Restoration of Historic Brick Masonry."
 - 2. Division 05 Section "Metal Fabrications" for furnishing steel lintels and shelf angles for unit masonry.
 - 3. Division 07 Section "Sheet Metal Flashing and Trim" for sheet metal flashing and for furnishing manufactured reglets installed in masonry joints.

1.3 DEFINITIONS

- A. CMU(s): Concrete masonry unit(s).
- B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 PERFORMANCE REQUIREMENTS

- A. Provide structural unit masonry that develops indicated net-area compressive strengths at 28 days.
 - 1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For the following:
 - 1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
 - 2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement."
 - 3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

- C. Samples for Verification: For each type and color of the following:
 - 1. Decorative CMUs.
 - 2. Face brick, in the form of straps of five or more bricks.
 - 3. Pigmented and colored-aggregate mortar. Make Samples using same sand and mortar ingredients to be used on Project.
 - 4. Weep holes and vents.
 - 5. Accessories embedded in masonry.

1.6 INFORMATIONAL SUBMITTALS

- A. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.
 - 1. Submittal is for information only. Neither receipt of list nor approval of mockup constitutes acceptance of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and accepted in writing.
- B. Qualification Data: For testing agency.
- C. Material Certificates: For each type and size of the following:
 - 1. Masonry units.
 - a. Include material test reports substantiating compliance with requirements.
 - b. For brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.
 - c. For exposed brick, include test report for efflorescence according to ASTM C 67.
 - d. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.
 - 2. Cementitious materials. Include brand, type, and name of manufacturer.
 - 3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
 - 4. Grout mixes. Include description of type and proportions of ingredients.
 - 5. Reinforcing bars.
 - 6. Joint reinforcement.
 - 7. Anchors, ties, and metal accessories.
- D. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
 - 1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
 - 2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.
- E. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.
- F. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.7 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.

- B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.
 - C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.
 - D. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.
 - E. Mockup: Build mockup to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Build mockup for typical exterior wall approximately 72 inches long by 48 inches high by full thickness, including face and backup wythes and accessories.
 - a. Include a sealant-filled joint at least 16 inches long in exterior wall mockup.
 - b. Include through-wall flashing installed for a 24-inch length in corner of exterior wall mockup approximately 16 inches down from top of mockup, with a 12-inch length of flashing left exposed to view (omit masonry above half of flashing).
 - c. Include veneer anchors, flashing, cavity drainage material, and weep holes in exterior masonry-veneer wall mockup.
 - d. Include decorative CMUs on interior face of exterior masonry wall mockup.
 - 2. Clean exposed faces of mockups with masonry cleaner as indicated.
 - 3. Protect accepted mockups from the elements with weather-resistant membrane.
 - 4. Acceptance of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.
 - a. Acceptance of mockups is also for other material and construction qualities specifically reviewed by Architect in writing.
 - b. Acceptance of mockups does not constitute acceptance of deviations from the Contract Documents contained in mockups unless such deviations are specifically reviewed by Architect in writing.
 - 5. Accepted mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
 - F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."
- 1.8 DELIVERY, STORAGE, AND HANDLING
- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
 - B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
 - C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
 - D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in covered weatherproof dispensing silos.

- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.9 PROJECT CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 - 1. Extend cover a minimum of 24 inches down both sides of walls and hold cover securely in place.
 - 2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
 - 1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 - 2. Protect sills, ledges, and projections from mortar droppings.
 - 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 - 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
 - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.
- E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

- A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.
- B. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing according to ASTM E 119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

2.2 CONCRETE MASONRY UNITS

- A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
2. Provide bullnose units for outside corners unless otherwise indicated.

B. CMUs: ASTM C 90.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2150 psi.
2. Density Classification: Lightweight unless otherwise indicated.
3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
4. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.
5. Faces to Receive Plaster: Where units are indicated to receive a direct application of plaster, provide textured-face units made with gap-graded aggregates.

C. Concrete Building Brick: ASTM C 55.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2800 psi.
2. Density Classification: Lightweight.
3. Size (Actual Dimensions): 3-5/8 inches wide by 2-1/4 inches high by 7-5/8 inches long.

D. Decorative CMUs: ASTM C 90.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2150 psi.
2. Density Classification: Lightweight.
3. Size (Width): Manufactured to dimensions specified in "CMUs" Paragraph.
4. Pattern and Texture: Embossed and scored vertically and horizontally so that units laid in running bond appear as brick running bond pattern.

2.3 CONCRETE AND MASONRY LINTELS

A. General: Provide one of the following:

B. Concrete Lintels:

1. ASTM C 1623, matching CMUs in color, texture, and density classification; and with reinforcing bars indicated. Provide lintels with net-area compressive strength not less than CMUs.
2. Precast or formed-in-place concrete lintels complying with requirements in Division 03 Section "Cast-in-Place Concrete," and with reinforcing bars indicated.

C. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.4 BRICK

A. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units:

1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
3. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.

4. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.

B. Face Brick: Facing brick complying with ASTM C 216.

1. Products for Brick at Building Addition: Subject to compliance with requirements, provide one of the following:
 - a. TBD.
 - b. TBD.
 - c. TBD.
2. Products for Brick patching at Existing Building: subject to compliance with requirements, provide one for the following:
 - a. TBD.
 - b. TBD.
 - c. TBD.
3. Grade: SW.
4. Type: FBX.
5. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3350 psi.
6. Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested per ASTM C 67.
7. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
8. Size (Actual Dimensions):
 - a. For Brick at Building Addition: 3-5/8 inches wide by 2-1/4 inches high by 7-5/8 inches long.
 - b. For Size (Actual Dimensions) for Brick Infill and Repair at Existing Building: 3-1/2 inches or 3-5/8 inches wide by 2-3/8 inches high by 8-1/2 inches long.
9. Application: Use where brick is exposed unless otherwise indicated.
10. Where shown to "match existing," provide face brick matching color range, texture, and size of existing adjacent brickwork.

C. Building (Common) Brick: ASTM C 62, Grade MW or SW.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2100 psi.
2. Size: Match size of face brick.
3. Application: At the Contractor's option, common brick may be used in lieu of face brick where brick is indicated for concealed locations.

2.5 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of Portland cement and hydrated lime containing no other ingredients.
- D. Masonry Cement: ASTM C 91.
- E. Mortar Cement: ASTM C 1329.

- F. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979. Use only pigments with a record of satisfactory performance in masonry mortar.
- G. Colored Cement Product: Packaged blend made from Portland cement and hydrated lime, masonry cement, or mortar cement and mortar pigments, all complying with specified requirements, and containing no other ingredients.
 - 1. Formulate blend as required to produce color as selected from manufacturer's standard colors.
 - 2. Pigments shall not exceed ten percent (10%) of Portland cement by weight.
 - 3. Pigments shall not exceed five percent (5%) of masonry cement or mortar cement by weight.
- H. Aggregate for Mortar: ASTM C 144.
 - 1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
 - 2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
 - 3. White-Mortar Aggregates: Natural white sand or crushed white stone.
 - 4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.
- I. Aggregate for Grout: ASTM C 404.
- J. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
- K. Water: Potable.

2.6 REINFORCEMENT

- A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.
- B. Masonry Joint Reinforcement, General: ASTM A 951/A 951M.
 - 1. Interior Walls: Hot-dip galvanized, carbon steel.
 - 2. Exterior Walls: Hot-dip galvanized, carbon steel.
 - 3. Wire Size for Side Rods: 0.187-inch diameter.
 - 4. Wire Size for Cross Rods: 0.148-inch diameter.
 - 5. Wire Size for Veneer Ties: 0.187-inch diameter.
 - 6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
 - 7. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.
- C. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.
- D. Masonry Joint Reinforcement for Multiwythe Masonry: Provide one of the following:
 - 1. Ladder type with 1 side rod at each face shell of hollow masonry units more than 4 inches wide, plus 1 side rod at each wythe of masonry 4 inches wide or less.
 - 2. Tab type, either ladder or truss design, with 1 side rod at each face shell of backing wythe and with rectangular tabs sized to extend at least halfway through facing wythe but with at least 5/8-inch cover on outside face.
 - 3. Adjustable (two-piece) type, either ladder or truss design, with one side rod at each face shell of backing wythe and with separate adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches. Size ties to extend at least halfway

through facing wythe but with at least 5/8-inch cover on outside face. Ties have hooks or clips to engage a continuous horizontal wire in the facing wythe.

2.7 TIES AND ANCHORS

- A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated.
1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M; with ASTM A 153/A 153M, Class B-2 coating.
 2. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304.
 3. Galvanized Steel Sheet: ASTM A 653/A 653M, Commercial Steel, G60 zinc coating.
 4. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, with ASTM A 153/A 153M, Class B coating.
 5. Stainless-Steel Sheet: ASTM A 666, Type 304.
 6. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
 7. Stainless-Steel Bars: ASTM A 276 or ASTM a 666, Type 304.
- B. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8-inch cover on outside face. Outer ends of wires are bent 90 degrees and extend 2 inches parallel to face of veneer.
- C. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches wide.
1. Z-shaped ties with ends bent 90 degrees to provide hooks not less than 2 inches long may be used for masonry constructed from solid units.
 2. Where wythes do not align or are of different materials, use adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches.
 3. Wire: Fabricate from 3/16-inch-diameter, hot-dip galvanized steel wire. Mill-galvanized wire ties may be used in interior walls unless otherwise indicated.
- D. Partition Top Anchors: 0.105-inch- thick metal plate with 3/8-inch- diameter metal rod 6 inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.
- E. Rigid Anchors: Fabricate from steel bars 1-1/2 inches wide by 1/4 inch thick by 24 inches long, with ends turned up 2 inches or with cross pins unless otherwise indicated.
1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A 153/A 153M.

2.8 MISCELLANEOUS ANCHORS

- A. Unit Type Inserts in Concrete: Cast-iron or malleable-iron wedge-type inserts.
- B. Dovetail Slots in Concrete: Furnish dovetail slots with filler strips, of slot size indicated, fabricated from 0.034-inch, galvanized steel sheet.
- C. Anchor Bolts: Headed or L-shaped steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153/A 153M, Class C; of dimensions indicated.
- D. Postinstalled Anchors: Torque-controlled expansion anchors or chemical anchors.
1. Load Capacity: Capable of sustaining, without failure, a load equal to six (6) times the load imposed when installed in unit masonry and four (4) times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
 2. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5 unless otherwise indicated.

3. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 or Group 2 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

2.9 EMBEDDED FLASHING MATERIALS

- A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and Division 07 Section "Sheet Metal Flashing and Trim" and as follows:
- B. Flexible Flashing: Use one of the following unless otherwise indicated:
 1. Copper-Laminated Flashing: 5-oz./sq. ft. copper sheet bonded between two (2) layers of glass-fiber cloth. Use only where flashing is fully concealed in masonry.
 2. Asphalt-Coated Copper Flashing: 5-oz./sq. ft. copper sheet coated with flexible asphalt. Use only where flashing is fully concealed in masonry.
 3. Rubberized-Asphalt Flashing: Composite flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 0.040 inch.
 - a. Accessories: Provide preformed corners, end dams, other special shapes, and seaming materials produced by flashing manufacturer.
 4. Elastomeric Thermoplastic Flashing: Composite flashing product consisting of a polyester-reinforced ethylene interpolymer alloy.
 - a. Monolithic Sheet: Elastomeric thermoplastic flashing, 0.040 inch thick.
 - b. Self-Adhesive Sheet: Elastomeric thermoplastic flashing, 0.025 inch thick, with a 0.015-inch- thick coating of adhesive.
 - c. Self-Adhesive Sheet with Drip Edge: Elastomeric thermoplastic flashing, 0.025 inch thick, with a 0.015-inch- thick coating of rubberized-asphalt adhesive. Where flashing extends to face of masonry, rubberized-asphalt coating is held back approximately 1-1/2 inches from edge.
 - d. Accessories: Provide preformed corners, end dams, other special shapes, and seaming materials produced by flashing manufacturer.
- C. Application: Unless otherwise indicated, use the following:
 1. Where flashing is indicated to receive counterflashing, use metal flashing.
 2. Where flashing is indicated to be turned down at or beyond the wall face, use metal flashing.
 3. Where flashing is partly exposed and is indicated to terminate at the wall face, use metal flashing with a sealant stop or flexible flashing with a metal sealant stop.
 4. Where flashing is fully concealed, use flexible flashing.
- D. Adhesives, Primers, and Seam Tapes for Flashing: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.10 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Pre-molded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene, urethane, or PVC.
- B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 or PVC, complying with ASTM D 2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
- C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

- D. Weep/Vent Products: Use one of the following unless otherwise indicated:
1. Mesh Weep/Vent: Free-draining mesh; made from polyethylene strands, full height and width of head joint and depth 1/8 inch less than depth of outer wythe; in color selected from manufacturer's standard.
- E. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity. Provide one of the following configurations:
1. Strips, full-depth of cavity and 10 inches high, with dovetail shaped notches 7 inches deep that prevent clogging with mortar droppings.
 2. Strips, not less than 1-1/2 inches thick and 10 inches high, with dimpled surface designed to catch mortar droppings and prevent weep holes from clogging with mortar.
 3. Sheets or strips full depth of cavity and installed to full height of cavity.
 4. Sheets or strips not less than 1 inch thick and installed to full height of cavity with additional strips 4 inches high at weep holes and thick enough to fill entire depth of cavity and prevent weep holes from clogging with mortar.
- F. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

2.11 CAVITY-WALL INSULATION

- A. Rigid Board Insulation: One of the following:
1. Extruded-Polystyrene Board Insulation with Increased R-Value: ASTM C 578, Type IV, but with an aged thermal resistance (R-value) for 1-inch thickness of 5.6 deg F x h x sq. ft./Btu at 75 deg F at 5 years; closed-cell product with a carbon-black filler and extruded with an integral skin.
 2. Molded-Polystyrene Board Insulation: ASTM C 578, Type I.
 3. Polyisocyanurate Board Insulation: ASTM C 1289, Type I (aluminum-foil-faced), Class 2 (glass-fiber-reinforced).
- B. Adhesive: Type recommended by insulation board manufacturer for application indicated.

2.12 MASONRY CLEANERS

- A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

2.13 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
1. Do not use calcium chloride in mortar or grout.
 2. Use Portland cement-lime, masonry cement, or mortar cement mortar unless otherwise indicated.
 3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

- C. Mortar for Unit Masonry: Comply with ASTM C 270. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.
 - 1. For masonry below grade or in contact with earth, use Type S.
 - 2. For reinforced masonry, use Type S.
 - 3. For mortar parge coats, use Type S or Type N.
 - 4. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.
 - 5. For interior non-load-bearing partitions, Type O may be used instead of Type N.
- D. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.
 - 1. Pigments shall not exceed ten percent (10%) of Portland cement by weight.
 - 2. Pigments shall not exceed five percent (5%) of masonry cement or mortar cement by weight.
 - 3. Mix to match Architect's sample.
 - 4. Application: Use pigmented mortar for exposed mortar joints with face brick.
- E. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.
 - 1. Mix to match Architect's sample.
 - 2. Application: Use colored aggregate mortar for exposed mortar joints with face brick.
- F. Grout for Unit Masonry: Comply with ASTM C 476.
 - 1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
 - 2. Proportion grout in accordance with ASTM C 476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi.
 - 3. Provide grout with a slump of 8 to 10 inches as measured according to ASTM C 143/C 143M.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
 - 2. Verify that foundations are within tolerances specified.
 - 3. Verify that reinforcing dowels are properly placed.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.

- B. Build chases and recesses to accommodate items specified in this and other Sections.
- C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.
- D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
 - 1. Mix units from several pallets or cubes as they are placed.
- F. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.
- G. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

3.3 TOLERANCES

- A. Dimensions and Locations of Elements:
 - 1. For dimensions in cross section or elevation do not vary by more than plus 1/2 inch or minus 1/4 inch.
 - 2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 inch.
 - 3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.
- B. Lines and Levels:
 - 1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
 - 2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
 - 3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
 - 4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
 - 5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
 - 6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
 - 7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

- C. Joints:
1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
 2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
 3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
 4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.

3.4 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
- C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2 inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
- D. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- F. Fill space between steel frames and masonry solidly with grout unless otherwise indicated.
- G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod grout into core.
- H. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.
- I. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated. Terminate partitions using one of the following methods:
1. Install compressible filler in joint between top of partition and underside of structure above.
 2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch clearance between end of anchor rod and end of tube. Space anchors 48 inches o.c. unless otherwise indicated.
 3. Wedge non-load-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.

4. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Division 07 Section "Penetration Firestopping."

3.5 MORTAR BEDDING AND JOINTING

- A. Lay hollow CMUs as follows:
 1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
 2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
 3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
 4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.
- B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
- D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

3.6 COMPOSITE MASONRY

- A. Bond wythes of composite masonry together using one of the following methods:
 1. Individual Metal Ties: Provide ties as shown installed in horizontal joints, but not less than one metal tie for 2.67 sq. ft. of wall area spaced not to exceed 24 inches o.c. horizontally and 16 inches o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches of openings and space not more than 36 inches apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches o.c. vertically.
 - a. Where bed joints of wythes do not align, use adjustable (two-piece) type ties.
 2. Masonry Joint Reinforcement: Installed in horizontal mortar joints.
 - a. Where bed joints of both wythes align, use ladder-type reinforcement extending across both wythes or tab-type reinforcement.
 - b. Where bed joints of wythes do not align, use adjustable (two-piece) type reinforcement with continuous horizontal wire in facing wythe attached to ties.
- B. Collar Joints: Solidly fill collar joints by parging face of first wythe that is laid and shoving units of other wythe into place.
- C. Corners: Provide interlocking masonry unit bond in each wythe and course at corners unless otherwise indicated.
 1. Provide continuity with masonry joint reinforcement at corners by using prefabricated L-shaped units as well as masonry bonding.
- D. Intersecting and Abutting Walls: Unless vertical expansion or control joints are shown at juncture, bond walls together using one of the following methods:
 1. Provide individual metal ties not more than 16 inches o.c.
 2. Provide continuity with masonry joint reinforcement by using prefabricated T-shaped units.
 3. Provide rigid metal anchors not more than 24 inches o.c. If used with hollow masonry units, embed ends in grout-filled cores.

3.7 CAVITY WALLS

- A. Bond wythes of cavity walls together using one of the following methods:
1. Individual Metal Ties: Provide ties installed in horizontal joints, but not less than one metal tie for 2.67 sq. ft. of wall area spaced not to exceed 24 inches o.c. horizontally and 16 inches o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches of openings and space not more than 36 inches apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches o.c. vertically.
 - a. Where bed joints of wythes do not align, use adjustable (two-piece) type ties.
 - b. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable (two-piece) type ties to allow for differential movement regardless of whether bed joints align.
 2. Masonry Joint Reinforcement: Installed in horizontal mortar joints.
 - a. Where bed joints of both wythes align, use ladder-type reinforcement extending across both wythes or tab-type reinforcement.
 - b. Where bed joints of wythes do not align, use adjustable (two-piece) type reinforcement with continuous horizontal wire in facing wythe attached to ties.
 - c. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable (two-piece) type reinforcement with continuous horizontal wire in facing wythe attached to ties to allow for differential movement regardless of whether bed joints align.
- B. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.
- C. Coat cavity face of backup wythe to comply with Division 07 Section "Bituminous Dampproofing."
- D. Installing Cavity-Wall Insulation: Place small dabs of adhesive, spaced approximately 12 inches o.c. both ways, on inside face of insulation boards, or attach with plastic fasteners designed for this purpose. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as shown.
 1. Fill cracks and open gaps in insulation with crack sealer compatible with insulation and masonry.

3.8 MASONRY JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
 1. Space reinforcement not more than 16 inches o.c.
 2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
 3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings in addition to continuous reinforcement.
- B. Continuity
 1. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.
 2. Provide continuity at wall intersections by using prefabricated T-shaped units.
 3. Provide continuity at corners by using prefabricated L-shaped units.
 4. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.9 CONTROL AND EXPANSION JOINTS

- A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
- B. Form control joints in concrete masonry using one of the following methods:
 - 1. Install preformed control-joint gaskets designed to fit standard sash block.
 - 2. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.
- C. Form expansion joints in brick by building in compressible joint fillers where indicated.
- D. Provide horizontal, pressure-relieving joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Division 07 Section "Joint Sealants," but not less than 3/8 inch.
 - 1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.10 LINTELS

- A. Install steel lintels where indicated.
- B. Provide concrete or masonry lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.
- C. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.11 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

- A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.
- B. Install flashing as follows unless otherwise indicated:
 - 1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
 - 2. At multiwythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of 8 inches, and seal to the inner wythe approximately 2 inches on interior face.
 - 3. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
 - 4. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Division 07 Section "Joint Sealants" for application indicated.
 - 5. Install metal drip edges and sealant stops with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Division 07 Section "Joint Sealants" for application indicated.
 - 6. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.

- C. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.
- D. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:
 - 1. Use specified weep/vent products to form weep holes.
 - 2. Space weep holes 16 inches o.c. unless otherwise indicated.
- E. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.

3.12 REINFORCED UNIT MASONRY INSTALLATION

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
 - 1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
 - 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
 - 1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
 - 2. Limit height of vertical grout pours to not more than 60 inches.

3.13 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.
- B. Inspections: Level 1 special inspections according to the "International Building Code."
 - 1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
 - 2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
 - 3. Place grout only after inspectors have verified proportions of site-prepared grout.
- C. Testing Prior to Construction: One set of tests.
- D. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.
- E. Clay Masonry Unit Test: For each type of unit provided, according to ASTM C 67 for compressive strength.
- F. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.

- G. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.
- H. Mortar Test (Property Specification): For each mix provided, according to ASTM C 780. Test mortar for mortar air content and compressive strength.
- I. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.
- J. Prism Test: For each type of construction provided, according to ASTM C 1314 at 7 days and at 28 days.

3.14 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
 3. Protect adjacent precast concrete and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
 5. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
 6. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
 7. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.15 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
- B. Waste Disposal as Fill Material: At the Contractor's option, dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
 1. Crush masonry waste to less than 4 inches in each dimension.
 2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Division 31 Section "Earth Moving."
 3. Do not dispose of masonry waste as fill within 18 inches of finished grade.

- C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042000

SECTION 051200 - STRUCTURAL STEEL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes, but is not limited to, the following:
 - 1. Structural steel.
 - 2. Grout.
- B. Related Sections include, but are not limited to, the following:
 - 1. Division 01 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.
 - 2. Division 09 painting Sections for surface preparation and priming requirements.

1.3 DEFINITIONS

- A. Structural Steel: Elements of structural-steel frame, as classified by AISC's "Code of Standard Practice for Steel Buildings and Bridges," that support design loads.

1.4 PERFORMANCE REQUIREMENTS

- A. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator to withstand ASD-service loads indicated and comply with other information and restrictions indicated.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication of structural-steel components.
 - 1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
 - 2. Include embedment drawings.
 - 3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
 - 4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts.
- C. Welding certificates.
- D. Qualification Data: For fabricator .
- E. Mill Test Reports: Signed by manufacturers certifying that the following products comply with requirements:
 - 1. Structural steel including chemical and physical properties.
 - 2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
- F. Source quality-control test reports.

1.6 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."
- B. Comply with applicable provisions of the following specifications and documents:
 - 1. AISC's "Code of Standard Practice for Steel Buildings and Bridges."
 - 2. AISC's "Seismic Provisions for Structural Steel Buildings" and "Supplement No. 2."
 - 3. AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."
 - 4. AISC's "Specification for Allowable Stress Design of Single-Angle Members."
 - 5. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from erosion and deterioration.
 - 1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.
 - 2. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.8 COORDINATION

- A. Furnish anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes: ASTM A 992/A 992M.
- B. Channels, Angles: ASTM A 36/A 36M.
- C. Plate and Bar: ASTM A 36/A 36M..
- D. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.
 - 1. Finish: Plain.
- B. Headed Anchor Rods: ASTM A 307, Grade A, straight.
 - 1. Nuts: ASTM A 563 hex carbon steel.
 - 2. Washers: ASTM F 436 hardened carbon steel.
 - 3. Finish: Plain.

2.3 PRIMER

- A. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer.

2.4 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.5 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."
 - 1. Mark and match-mark materials for field assembly.
 - 2. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
 - 1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.
- C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.
- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Holes: Provide holes required for securing other work to structural steel and for passage of other work through steel framing members.
 - 1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
 - 2. Base-Plate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
 - 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.6 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened.
- B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
 - 1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
 - 2. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances.

2.7 SHOP PRIMING

- A. Shop prime steel surfaces except the following:
 - 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches .
 - 2. Surfaces to be field welded.
- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
 - 1. SSPC-SP 2, "Hand Tool Cleaning."
 - 2. SSPC-SP 3, "Power Tool Cleaning."

- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils . Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
 - 2. Apply two coats of shop paint to inaccessible surfaces after assembly or erection. Change color of second coat to distinguish it from first.

2.8 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/ A 123M.
 - 1. Fill vent holes and grind smooth after galvanizing.
 - 2. Galvanize lintels shelf angles attached to structural-steel frame and located in exterior walls.

2.9 SOURCE QUALITY CONTROL

- A. Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.
 - 1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
- B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.
- C. Bolted Connections: Shop-bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- D. Welded Connections: In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1 and the following inspection procedures, at testing agency's option:
 - 1. Liquid Penetrant Inspection: ASTM E 165.
 - 2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 - 3. Ultrasonic Inspection: ASTM E 164.
 - 4. Radiographic Inspection: ASTM E 94.
- E. In addition to visual inspection, shop-welded shear connectors will be tested and inspected according to requirements in AWS D1.1 for stud welding and as follows:
 - 1. Bend tests will be performed if visual inspections reveal either a less-than- continuous 360-degree flash or welding repairs to any shear connector.
 - 2. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments, with steel erector present, for compliance with requirements.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated.
 - 1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."
- B. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.
 - 1. Set base and bearing plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate before packing with grout.
 - 3. Promptly pack grout solidly between bearing surfaces and base or bearing plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
- D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of structure.
 - 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- E. Splice members only where indicated.
- F. Do not use thermal cutting during erection unless approved by Architect.
- G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened.
- B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
 - 1. Comply with AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design" for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
 - 2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.

3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.
- B. Bolted Connections: Shop-bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- C. Welded Connections: Field welds will be visually inspected according to AWS D1.1.
 1. In addition to visual inspection, field welds will be tested according to AWS D1.1 and the following inspection procedures, at testing agency's option:
 - a. Liquid Penetrant Inspection: ASTM E 165.
 - b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 - c. Ultrasonic Inspection: ASTM E 164.
 - d. Radiographic Inspection: ASTM E 94.
- D. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.6 REPAIRS AND PROTECTION

- A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists and accessories, and abutting structural steel.
 1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
 2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.

END OF SECTION 051200

SECTION 053100 - STEEL DECK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes, but is not limited to, the following:
 - 1. Roof deck.
 - 2. Floor deck.
- B. Related Sections include, but are not limited to, the following:
 - 1. Division 03 Section "Cast-in-Place Concrete" for concrete fill and reinforcing steel.

1.3 SUBMITTALS

- A. Product Data: For each type of deck, accessory, and product indicated.
- B. Shop Drawings: Show layout and types of deck panels, anchorage details, reinforcing channels, pans, deck openings, special jointing, accessories, and attachments to other construction.
- C. Product Certificates: Signed by steel deck manufacturers certifying that products furnished comply with requirements.
- D. Welding Certificates: Copies of certificates for welding procedures and personnel.
- E. Product Test Reports: From a qualified testing agency indicating that each of the following complies with requirements, based on comprehensive testing of current products:
 - 1. Mechanical fasteners.
- F. Research/Evaluation Reports: Evidence of steel deck's compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed steel deck similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Testing Agency Qualifications: An independent testing agency, acceptable to authorities

having jurisdiction, qualified according to ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.

- C. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code – Steel," and AWS D1.3, "Structural Welding Code – Sheet Steel."
- D. Fire-Test-Response Characteristics: Where indicated, provide steel deck units identical to those steel deck units tested for fire resistance per ASTM E 119 by a testing and inspection agency acceptable to authorities having jurisdiction.
 - 1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.
 - 2. Steel deck units shall be identified with appropriate markings of applicable testing and inspecting agency.
- E. AISI Specifications: Calculate structural characteristics of steel deck according to AISI's "Specification for the Design of Cold-Formed Steel Structural Members."
- F. FM Listing: Provide steel roof deck evaluated by FM and listed in FM's "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 ROOF DECK

- A. Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 29, and the following:
 - 1. Prime-Painted Steel Sheet: ASTM A 611, Grade minimum, shop primed with gray or white baked-on, lead- and chromate-free rust-inhibitive primer complying with performance requirements of FS TT-P-664.
 - 2. Profile Depth: 1-1/2 inches
 - 3. Design Uncoated-Steel Thickness: 0.0295 inch
 - 4. Span Condition: Triple span or more
 - 5. Side Laps: Overlapped

2.2 FLOOR DECK

- A. Steel Floor Deck Galvanized ASTM A 653-00 with minimum yield of 33KSI.
 - 1. Profile Depth: 9/16 inch.
 - 2. Design Uncoated-Steel Thickness: 0.0295 inch.
 - 3. Span Condition: 35 span or more.

4. Side Laps: Overlapped

2.3 ACCESSORIES

- A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.
- C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.
- D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.
- E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
- F. Steel Sheet Accessories: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.
- G. Repair Paint: Lead and chromate-free rust-inhibitive primer complying with performance requirements of FS TT-P-664.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

3.2 INSTALLATION, GENERAL

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 29, manufacturer's written instructions, and requirements in this Section.
- B. Install temporary shoring before placing deck panels, if required to meet deflection limitations.
- C. Locate decking bundles to prevent overloading of supporting members.
- D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
- E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- F. Cut and neatly fit deck panels and accessories around openings and other work

projecting through or adjacent to decking.

- G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of decking, and support of other work.
- H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

3.3 ROOF DECK INSTALLATION

- A. Fasten roof deck panels to steel supporting members as indicated on plans.
- B. Side-Lap Fastening: Fasten side laps of panels between supports, as indicated on plans.
 - 1. Mechanically fasten with self-drilling No. 10 diameter or larger carbon-steel screws.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches.

3.4 FLOOR DECK

- A. Fasten roof deck panels to steel supporting members as indicated on plans.
- B. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches.

3.5 FIELD QUALITY CONTROL

- A. Testing: Owner will engage a qualified independent testing agency to perform field quality control testing.
- B. Field welds will be subject to inspection.
- C. Testing agency will report test results promptly and in writing to Contractor and Architect.
- D. Remove and replace work that does not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.6 REPAIRS AND PROTECTION

Repairs: Prepare and repair damaged coatings on both surfaces of deck with repair paint according to ASTM A 780 and manufacturer's written instructions.

- A. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on top surface of prime-painted deck immediately after installation, and apply repair paint.
 - 1. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.

2. Wire brushing, cleaning, and repair painting of bottom deck surfaces are included in Division 09.
- B. Repair Painting: Wire brushing, cleaning and repair painting of rust spots, welds, and abraded areas of both deck surfaces are included in Division 09.
 - C. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 053100

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes, but is not limited to:
 - 1. Steel framing and supports for countertops.
 - 2. Steel framing and supports for applications where framing and supports are not specified in other Sections.
 - 3. Shelf angles.
 - 4. Metal ladders.
 - 5. Metal ships' ladders.
 - 6. Window bars.
 - 7. Abrasive metal nosings.
 - 8. Loose bearing and leveling plates for applications where they are not specified in other Sections.
 - 9. Miscellaneous custom metal fabrications such as stainless steel countertop, ballet barres and exercise ball wall shelves.
- B. Products furnished, but not installed, under this Section include the following:
 - 1. Loose steel lintels.
 - 2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
 - 3. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.
- C. Related Requirements include, but are not limited to:
 - 1. Division 03 Section "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.
 - 2. Division 04 Section "Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.
 - 3. Division 05 Section "Structural Steel Framing."
 - 4. Division 05 Section "Metal Stairs."
 - 5. Division 05 Section "Pipe and Tube Railings."

1.3 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.4 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Nonslip aggregates and nonslip-aggregate surface finishes.
 - 2. Metal nosings.
 - 3. Grout.
 - 4. Laboratory Test Reports for Primers: Documentation indicating that products comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services) "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Small-Scale Environmental Chambers."

- B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:
 - 1. Steel framing and supports for countertops.
 - 2. Metal ladders.
 - 3. Metal ships' ladders.
 - 4. Window bars.

- C. Delegated-Design Submittal: For vertical ladders and ships ladders, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For professional engineer.
- B. Welding certificates.

1.6 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.7 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Division 01 Section "Quality Requirements," to design vertical ladders and ships ladders.

- B. Structural Performance of Ships Ladders: Ships ladders shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.
 - 1. Uniform Load: 100 lbf/sq. ft.
 - 2. Concentrated Load: 300 lbf applied on an area of 4 sq. in.
 - 3. Uniform and concentrated loads need not be assumed to act concurrently.
 - 4. Ships Ladder Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.

- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Steel Tubing: ASTM A 500/A 500M, cold-formed steel tubing.
- D. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.

2.3 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.
- C. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 325, Type 3; with hex nuts, ASTM A 563, Grade C3; and, where indicated, flat washers.
- D. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593; with hex nuts, ASTM F 594; and, where indicated, flat washers; Alloy Group 1 or Group 2.
- E. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.
 - 1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
- F. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six (6) times the load imposed when installed in unit masonry and four (4) times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.
- G. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.
- H. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
 - 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 or Group 2 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

2.4 MISCELLANEOUS MATERIALS

- A. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- C. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- D. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.
- F. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- G. Concrete: Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi.

2.5 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
- J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
 - 1. Furnish inserts for units installed after concrete is placed.
- C. Galvanize miscellaneous framing and supports where indicated.

2.7 SHELF ANGLES

- A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.
 - 1. Provide mitered and welded units at corners.
 - 2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches larger than expansion or control joint.
- B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.
- C. Galvanize shelf angles located in exterior walls.
- D. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.8 METAL LADDERS

- A. General:
 - 1. Comply with ANSI A14.3, except for elevator pit ladders.
 - 2. For elevator pit ladders, comply with ASME A17.1/CSA B44.
- B. Steel Ladders:
 - 1. Space siderails 18 inches apart unless otherwise indicated.
 - 2. Siderails: Continuous, 3/8-by-2-1/2-inch or 1/2-by-2-1/2-inch steel flat bars, with eased edges.
 - 3. Rungs: 3/4-inch- diameter or 3/4-inch- square steel bars.
 - 4. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
 - 5. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.

6. Support each ladder near top and bottom and not more than 60 inches o.c. with welded or bolted steel brackets.

2.9 METAL SHIPS' LADDERS

- A. Provide metal ships' ladders where indicated. Fabricate of open-type construction with channel or plate stringers and pipe and tube railings unless otherwise indicated. Provide brackets and fittings for installation.
 1. Treads shall be not less than 5 inches exclusive of nosing or less than 8-1/2 inches including the nosing, and riser height shall be not more than 9-1/2 inches.
 2. Fabricate ships' ladders, including railings from steel.
 3. Fabricate treads and platforms from welded or pressure-locked steel bar grating. Limit openings in gratings to no more than 3/4 inch in least dimension.
- B. Galvanize exterior steel ships' ladders, including treads, railings, brackets, and fasteners.

2.10 ABRASIVE METAL NOSINGS

- A. Cast-Metal Units: Cast bronze (leaded red or semired brass) or nickel silver (leaded nickel bronze), with an integral-abrasive, as-cast finish consisting of aluminum oxide, silicon carbide, or a combination of both. Fabricate units in lengths necessary to accurately fit openings or conditions.
 1. Nosings: Cross-hatched units, 4 inches wide with 1/4-inch lip, for casting into concrete.
- B. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.
- C. Drill for mechanical anchors and countersink. Locate holes not more than 4 inches from ends and not more than 12 inches o.c., evenly spaced between ends, unless otherwise indicated. Provide closer spacing if recommended by manufacturer.
- D. Apply bituminous paint to concealed surfaces of cast-metal units.

2.11 LOOSE BEARING AND LEVELING PLATES

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.
- B. Galvanize plates.
- C. Prime plates with [zinc-rich primer.] [primer specified in Section 099600 "High-Performance Coatings."]

2.12 LOOSE STEEL LINTELS

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.
- B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span, but not less than 8 inches unless otherwise indicated.
- C. Galvanize loose steel lintels located in exterior walls.

2.13 STEEL WELD PLATES AND ANGLES

- A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two (2) integrally welded steel strap anchors for embedding in concrete.

2.14 FINISHES, GENERAL

- A. Finish metal fabrications after assembly.
- B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.15 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
 - 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
- B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, or masonry, or unless otherwise indicated.
 - 1. Shop prime with universal shop primer unless indicated.
- C. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."
- D. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

3.3 INSTALLING NOSINGS

- A. Center nosings on tread widths unless otherwise indicated.
- B. For nosings embedded in concrete steps or curbs, align nosings flush with riser faces and level with tread surfaces.

3.4 INSTALLING BEARING AND LEVELING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with nonshrink grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.5 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION 055000

SECTION 055100 - METAL STAIRS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes, but is not limited to:
 - 1. Preassembled steel stairs with concrete-filled treads.
 - 2. Pipe and Steel tube railings attached to metal stairs.
- B. Related Sections include, but are not limited to:
 - 1. Division 03 Section "Cast-in-Place Concrete" for concrete fill for stair treads and platforms.
 - 2. Division 04 Section "Unit Masonry" for masonry bearing walls.
 - 3. Division 05 Section "Metal Fabrications" for metal nosings installed at locations other than in metal stairs and ships ladders.
 - 4. Division 05 Section "Pipe and Tube Railings" for pipe and tube railings not attached to metal stairs.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design metal stairs, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance of Stairs: Metal stairs shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.
 - 1. Uniform Load: 100 lbf/sq. ft.
 - 2. Concentrated Load: 300 lbf applied on an area of 4 sq. in.
 - 3. Uniform and concentrated loads need not be assumed to act concurrently.
 - 4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
 - 5. Limit deflection of treads, platforms, and framing members to L/240 or 1/4 inch, whichever is less.
- C. Structural Performance of Railings: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.
 - 1. Handrails and Top Rails of Guards:
 - a. Uniform load of 50 lbf/ ft. applied in any direction.
 - b. Concentrated load of 200 lbf applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 - 2. Infill of Guards:
 - a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
 - b. Infill load and other loads need not be assumed to act concurrently.
- D. Seismic Performance: Metal stairs shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. Component Importance Factor is 1.25.

1.4 ACTION SUBMITTALS

- A. Product Data: For metal stairs and the following:
 - 1. Prefilled metal-pan stair treads.
 - 2. Grout.
 - 3. Laboratory Test Reports for Primers: Documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- C. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified professional engineer.
- B. Welding certificates.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.
- D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for stairs and railings.
 - 1. Test railings according ASTM E 894 and ASTM E 935.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," for commercial class, unless more stringent requirements are indicated.
- C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- D. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.3, "Structural Welding Code - Sheet Steel."

1.7 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for metal stairs. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.2 FERROUS METALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Steel Tubing: ASTM A 500 (cold formed) or ASTM A 513.
- C. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.
- D. Uncoated, Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, either commercial steel, Type B, or structural steel, Grade 25, unless another grade is required by design loads; exposed.
- E. Uncoated, Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, either commercial steel, Type B, or structural steel, Grade 30, unless another grade is required by design loads.

2.3 FASTENERS

- A. General: Provide zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 12 for exterior use, and Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.
- B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.
- C. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.
- D. Machine Screws: ASME B18.6.3.
- E. Lag Screws: ASME B18.2.1.
- F. Plain Washers: Round, ASME B18.22.1.
- G. Lock Washers: Helical, spring type, ASME B18.21.1.
- H. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to six (6) times the load imposed when installed in unit masonry and four (4) times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.

2.4 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

- B. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- E. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior applications.
- F. Concrete Materials and Properties: Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.
- G. Welded Wire Fabric: ASTM A 185/A 185M, 6 by 6 inches, W1.4 by W1.4, unless otherwise indicated.

2.5 FABRICATION, GENERAL

- A. Provide complete stair assemblies, including metal framing, railings, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
 - 1. Join components by welding unless otherwise indicated.
 - 2. Use connections that maintain structural value of joined pieces.
- B. Preassembled Stairs: Assemble stairs in shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- E. Form exposed work with accurate angles and surfaces and straight edges.
- F. Weld connections to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Weld exposed corners and seams continuously unless otherwise indicated.
 - 5. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 2 welds: completely sanded joint, some undercutting and pinholes okay.

- G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated. Locate joints where least conspicuous.

2.6 STEEL-FRAMED STAIRS

- A. Stair Framing:
 - 1. Fabricate stringers of steel channels.
 - a. Provide closures for exposed ends of channel stringers.
 - 2. Construct platforms of steel channel or tube headers and miscellaneous framing members as needed to comply with performance requirements indicated.
 - 3. Weld or bolt stringers to headers; weld or bolt framing members to stringers and headers. If using bolts, fabricate and join so bolts are not exposed on finished surfaces.
 - 4. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.
- B. Metal-Pan Stairs: Form risers, subtread pans, and subplatforms to configurations shown from steel sheet of thickness needed to comply with performance requirements but not less than 0.067 inch.
 - 1. Steel Sheet: Uncoated cold or hot-rolled steel sheet.
 - 2. Directly weld metal pans to stringers; locate welds on top of subtreads where they will be concealed by concrete fill. Do not weld risers to stringers.
 - 3. Attach risers and subtreads to stringers with brackets made of steel angles or bars. Weld brackets to stringers and attach metal pans to brackets by welding, riveting, or bolting.
 - 4. Shape metal pans to include nosing integral with riser.
 - 5. At Contractor's option, provide stair assemblies with metal-pan subtreads filled with reinforced concrete during fabrication.

2.7 STAIR RAILINGS

- A. Steel Pipe and Tube Railings: Fabricate railings to comply with requirements and sizes indicated for design, dimensions, details, finish, and member sizes, including wall thickness of tube, post spacings, and anchorage, but not less than that needed to withstand indicated loads.
- B. Welded Connections: Fabricate railings with welded connections. Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
 - 1. Finish welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 2 welds: completely sanded joint, some undercutting and pinholes okay.
- C. Close exposed ends of railing members with prefabricated end fittings.
- D. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.
- E. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.
 - 1. Connect posts to stair framing by direct welding unless otherwise indicated.
 - 2. For nongalvanized railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors embedded in exterior masonry and concrete construction.

2.8 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal stairs after assembly.
- C. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."
- D. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.
- C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- D. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- E. Field Welding: Comply with requirements for welding in "Fabrication, General" Article.
- F. Place and finish concrete fill for treads and platforms to comply with Division 03 Section "Cast-in-Place Concrete."

3.2 INSTALLING METAL STAIRS WITH GROUTED BASEPLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of baseplates.
- B. Set steel stair baseplates on wedges, shims, or leveling nuts. After stairs have been positioned and aligned, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
 - 1. Use nonmetallic, nonshrink grout unless otherwise indicated.
 - 2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.3 INSTALLING RAILINGS

- A. Adjust railing systems before anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated. Plumb posts in each direction. Secure posts and rail ends to building construction as follows:
 - 1. Anchor posts to steel by welding directly to steel supporting members.
 - 2. Anchor handrail ends to concrete and masonry with steel round flanges welded to rail ends and anchored with postinstalled anchors and bolts.

- B. Attach handrails to wall with wall brackets. Provide bracket with 1-1/2-inch clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads. Secure wall brackets to building construction as required to comply with performance requirements.
 - 1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
 - 2. For hollow masonry anchorage, use toggle bolts.

3.4 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

END OF SECTION 055100

SECTION 055213 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes, but is not limited to steel pipe and tube railings.
- B. Related Requirements include, but are not limited to:
 - 1. Division 05 Section "Metal Stairs" for steel tube railings associated with stairs.
 - 2. Division 05 Section "Metal Fabrications"
 - 3. Division 09 Sections "Interior Painting" and "Exterior Painting".

1.3 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- C. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

1.4 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Railing brackets.
 - 2. Grout, anchoring cement, and paint products.
 - 3. Laboratory Test Reports for Primers: Documentation indicating that products comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work. Include results of field measurements
- C. Delegated-Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Welding certificates.

- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

1.6 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

1.8 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication. Indicate field measurements on shop drawings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Division 01 Section "Quality Requirements," to design railings, including attachment to building construction.
- B. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Handrails and Top Rails of Guards:
 - a. Uniform load of 50 lbf/ ft. applied in any direction.
 - b. Concentrated load of 200 lbf applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 - 2. Infill of Guards:
 - a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
 - b. Infill load and other loads need not be assumed to act concurrently.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F material surfaces.

2.2 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.
 - 1. Provide type of bracket with flange tapped for concealed anchorage to threaded hanger bolt and that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface.

2.3 STEEL

- A. Tubing: ASTM A 500 (cold formed) or ASTM A 513.
- B. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
 - 1. Provide galvanized finish for exterior installations and where indicated.
- C. Plates, Shapes, and Bars: ASTM A 36/A 36M.

2.4 FASTENERS

- A. General: Provide the following:
 - 1. Ungalvanized-Steel Railings: Plated steel fasteners complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5 for zinc coating.
 - 2. Hot-Dip Galvanized Railings: Type 304 stainless-steel or hot-dip zinc-coated steel fasteners complying with ASTM A 153/A 153M or ASTM F 2329 for zinc coating.
 - 3. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.
- B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.
- C. Fasteners for Interconnecting Railing Components:
 - 1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless otherwise indicated.
 - 2. Provide tamper-resistant square or hex socket flat-head machine screws for exposed fasteners unless otherwise indicated.
- D. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to six (6) times the load imposed when installed in unit masonry and four (4) times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.
 - 1. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
 - 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 or Group 2 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

2.5 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- C. Etching Cleaner for Galvanized Metal: Complying with MPI#25.
- D. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

- E. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- F. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- G. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- H. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.
 1. Water-Resistant Product: At exterior locations provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.6 FABRICATION

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
- B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form work true to line and level with accurate angles and surfaces.
- E. Fabricate connections that are exposed to weather in a manner that excludes water. Provide weep holes where water may accumulate.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- G. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove flux immediately.
 4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.
- H. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- I. Close exposed ends of railing members with prefabricated end fittings.

- J. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.
- K. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.
 - 1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.
- L. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.
- M. For railing posts set in concrete, provide steel sleeves not less than 6 inches long with inside dimensions not less than 1/2 inch greater than outside dimensions of post, with metal plate forming bottom closure.

2.7 STEEL FINISHES

- A. Galvanized Railings:
 - 1. Hot-dip galvanize exterior steel railings, including hardware, after fabrication.
 - 2. Comply with ASTM A 123/A 123M for hot-dip galvanized railings.
 - 3. Comply with ASTM A 153/A 153M for hot-dip galvanized hardware.
 - 4. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
 - 5. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
- B. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.
- C. Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.
- D. For nongalvanized-steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves; however, galvanize anchors to be embedded in exterior concrete or masonry.
- E. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with requirements indicated below:
 - 1. Exterior Railings: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 2. Other Railings: SSPC-SP 3, "Power Tool Cleaning."
- F. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.
 - 1. Shop prime uncoated railings with universal shop primer for steel.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements are clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

- A. Fit exposed connections together to form tight, hairline joints.
- B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
 - 1. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 - 2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
 - 3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.
- C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
- D. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

- A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.
- B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.

3.4 ANCHORING POSTS

- A. Use metal sleeves preset and anchored into concrete for installing posts. After posts are inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.
- B. At existing concrete, form or core-drill holes not less than 5 inches deep and 3/4 inch larger than OD of post. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.
- C. Leave anchorage joint exposed with 1/8-inch buildup, sloped away from post.

- D. Anchor posts to metal surfaces with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:
 - 1. For steel pipe railings, weld flanges to post and bolt to metal supporting surfaces.

3.5 ATTACHING RAILINGS

- A. Attach railings to wall with wall brackets. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
- B. Secure wall brackets and railing end flanges to building construction as follows:
 - 1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
 - 2. For hollow masonry anchorage, use toggle bolts.
 - 3. For wood stud partitions, use hanger or lag bolts set into studs or wood backing between studs. Coordinate with carpentry work to locate backing members.
 - 4. For steel-framed partitions, use one of the following:
 - a. Hanger or lag bolts set into wood backing between studs. Coordinate with stud installation to locate backing members.
 - b. Self-tapping screws fastened to steel framing or to concealed steel reinforcements.
 - c. Toggle bolts installed through flanges of steel framing or through concealed steel reinforcements.

3.6 ADJUSTING AND CLEANING

- A. Touchup Priming: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop primer, and prime exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 requirements for touching up shop-primed surfaces.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A 780/A 780M.

3.7 PROTECTION

- A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

END OF SECTION 055213

SECTION 061000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes, but is not limited to:
 1. Framing with dimension lumber.
 2. Rooftop equipment bases and support curbs.
 3. Wood blocking and nailers.
 4. Wood furring.
 5. Wood sleepers.
 6. Utility shelving.
 7. Plywood backing panels.
- B. Related Requirements include but are not limited to:
 1. Division 06 Section "Sheathing."
 2. Division 06 Section "Interior Finish Carpentry".
 3. Division 06 Section "Cellular PVC Trim".

1.3 DEFINITIONS

- A. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.
- B. Lumber grading agencies, and the abbreviations used to reference them, include the following:
 1. NeLMA: Northeastern Lumber Manufacturers' Association.
 2. NLGA: National Lumber Grades Authority.
 3. SPIB: The Southern Pine Inspection Bureau.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
 2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
 3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
 4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
 5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.
 6. For adhesives, documentation including printed statement of VOC content.

7. For composite wood products, documentation indicating that product contains no urea formaldehyde.
8. Laboratory Test Reports for Adhesives and Composite-Wood Products: Documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

1.5 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.
- B. Evaluation Reports: For the following, from ICC-ES:
 1. Wood-preservative-treated wood.
 2. Fire-retardant-treated wood.
 3. Metal framing anchors.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
 1. Factory mark each piece of lumber with grade stamp of grading agency.
 2. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
 3. Provide dressed lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber: 15 percent unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWWPA U1; Use Category UC2 for interior construction not in contact with the ground.
 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.

- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- D. Application: Treat items indicated on Drawings, and the following:
 - 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 - 2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
 - 3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
 - 4. Wood framing members that are less than 18 inches above the ground unexcavated areas.
 - 5. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
 - 1. Use treatment that does not promote corrosion of metal fasteners.
 - 2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
 - 3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
 - 4. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D 5664 and design value adjustment factors shall be calculated according to ASTM D 6841.
- C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
- E. Application: Treat items indicated on Drawings.

2.4 DIMENSION LUMBER FRAMING

- A. Load-Bearing Partitions: Construction or No. 2 grade.
 - 1. Application: Interior load-bearing partitions.
 - 2. Species: One of the following:
 - a. Hem-fir (north); NLGA.

- b. Southern pine; SPIB.
- c. Mixed southern pine; SPIB.
- d. Spruce-pine-fir; NLGA.
- e. Douglas fir-larch (north); NLGA.
- f. Spruce-pine-fir (south); NeLMA.

B. Floor Joists: Construction or No. 2, one of the following species:

- 1. Hem-fir (north); NLGA.
- 2. Southern pine; SPIB.
- 3. Douglas fir-larch (north); NLGA.
- 4. Mixed southern pine; SPIB.
- 5. Spruce-pine-fir; NLGA.
- 6. Spruce-pine-fir (south); NeLMA.
- 7. Northern species; NLGA.
- 8. Eastern softwoods; NeLMA.

C. Joists, Rafters, and Other Framing Not Listed Above: Construction, Stud, or No. 3 grade, one of the following species:

- 1. Hem-fir (north); NLGA.
- 2. Southern pine; SPIB.
- 3. Mixed southern pine; SPIB.
- 4. Spruce-pine-fir; NLGA.
- 5. Douglas fir-larch (north); NLGA.
- 6. Spruce-pine-fir (south); NeLMA.

2.5 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

- 1. Blocking.
- 2. Nailers.
- 3. Rooftop equipment bases and support curbs.
- 4. Cants.
- 5. Furring.
- 6. Utility shelving.

B. For items of dimension lumber size, provide Construction or No. 2 grade lumber and any of the following species:

- 1. Hem-fir (north); NLGA.
- 2. Mixed southern pine; SPIB.
- 3. Spruce-pine-fir; NLGA.
- 4. Spruce-pine-fir (south); NeLMA.
- 5. Northern species; NLGA.
- 6. Eastern softwoods; NeLMA.

C. For utility shelving, provide lumber with 15 percent maximum moisture content and any of the following species and grades:

- 1. Eastern white pine, Idaho white, lodgepole, ponderosa, or sugar pine; Premium or No. 2 Common (Sterling) grade; NeLMA or NLGA.
- 2. Mixed southern pine; No. 1 grade; SPIB.
- 3. Hem-fir or hem-fir (north); Select Merchantable or No. 1 Common grade; NLGA.
- 4. Spruce-pine-fir (south) or spruce-pine-fir; Select Merchantable or No. 1 Common grade; NeLMA or NLGA.

D. For concealed boards, provide lumber with 15 percent maximum moisture content and any of the following species and grades:

1. Mixed southern pine; No. 2 grade; SPIB.
2. Hem-fir or hem-fir (north); Construction or No. 2 Common grade; NLGA.
3. Spruce-pine-fir (south) or spruce-pine-fir; Construction or No. 2 Common grade; NeLMA or NLGA.
4. Eastern softwoods; No. 2 Common grade; NeLMA.
5. Northern species; No. 2 Common grade; NLGA.

- E. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- F. For furring strips for installing plywood, select boards with no knots capable of producing bent-over nails and damage to plywood.

2.6 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: DOC PS 1, Exterior, AC in thickness indicated or, if not indicated, not less than 1/2-inch nominal thickness.
1. Plywood shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.7 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Lag Bolts: ASME B18.2.1.
- F. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.
- G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six (6) times the load imposed when installed in unit masonry assemblies and equal to four (4) times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.

2.8 METAL FRAMING ANCHORS

- A. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 coating designation.
1. Use for interior locations unless otherwise indicated.

- B. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A 653/A 653M; structural steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 coating designation; and not less than 0.036 inch thick.
 - 1. Use for wood-preserved-treated lumber and where indicated.
- C. Bridging: Rigid, V-section, nailless type, 0.050 inch thick, length to suit joist size and spacing.

2.9 MISCELLANEOUS MATERIALS

- A. Sill-Sealer Gaskets: One of the following:
 - 1. Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; 1-inch nominal thickness, compressible to 1/32 inch; selected from manufacturer's standard widths to suit width of sill members indicated.
 - 2. Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to suit width of sill members indicated.
- B. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.
- C. Adhesives for Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.
 - 1. Adhesives shall have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Adhesives shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- D. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbamate, combined with an insecticide containing chlorpyrifos as its active ingredient.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- B. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant treated plywood backing panels with classification marking of testing agency exposed to view.
- D. Metal Framing Anchors: Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- E. Install sill sealer gasket to form continuous seal between sill plates and concrete floor slab.
- F. Do not splice structural members between supports unless otherwise indicated.

- G. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
 - 1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.
- H. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- I. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
 - 1. Use inorganic boron for items that are continuously protected from liquid water.
 - 2. Use copper naphthenate for items not continuously protected from liquid water.
- J. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. NES NER-272 for power-driven fasteners.
 - 2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
- K. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 WOOD SLEEPER, BLOCKING, AND NAILER INSTALLATION

- A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.
- C. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

3.3 WOOD FURRING INSTALLATION

- A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.
- B. Furring to Receive Plywood: Install 1-by-3-inch nominal-size furring at 24 inches o.c.
- C. Furring to Receive Gypsum Board: Install 1-by-2-inch nominal-size furring vertically at 16 inches o.c.

3.4 WALL AND PARTITION FRAMING INSTALLATION

- A. General: Provide single bottom plate and double top plates using members of 2-inch nominal thickness whose widths equal that of studs, except single top plate may be used for load-bearing partitions where framing members bearing on partition are located directly over studs. Fasten plates to supporting construction unless otherwise indicated.

1. Provide continuous horizontal blocking at midheight of partitions more than 96 inches high, using members of 2-inch nominal thickness and of same width as wall or partitions.
- B. Construct corners and intersections with three or more studs.
- C. Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Support headers on jamb studs.

3.5 FLOOR JOIST FRAMING INSTALLATION

- A. General: Install floor joists with crown edge up and support ends of each member with not less than 1-1/2 inches of bearing on wood or metal, or 3 inches on masonry. Attach floor joists as follows:
 1. Where supported on wood members, by using metal framing anchors.
 2. Where framed into wood supporting members, by using wood ledgers as indicated or, if not indicated, by using metal joist hangers.
- B. Do not notch in middle third of joists; limit notches to one-sixth depth of joist, one-third at ends. Do not bore holes larger than 1/3 depth of joist; do not locate closer than 2 inches from top or bottom.
- C. Provide solid blocking of 2-inch nominal thickness by depth of joist at ends of joists unless nailed to header or band.
- D. Provide solid blocking between joists under jamb studs for openings.

3.6 RAFTER FRAMING INSTALLATION

- A. Rafters: Notch to fit exterior wall plates and toe nail or use metal framing anchors. Double rafters to form headers and trimmers at openings in roof framing, if any, and support with metal hangers. Where rafters abut at ridge, place directly opposite each other and nail to ridge member or use metal ridge hangers.

3.7 STAIR FRAMING INSTALLATION

- A. Provide stair framing members of size, space, and configuration indicated and to comply with the following requirements:
 1. Size: 2-by-12-inch nominal-size, minimum.
 2. Material: Solid lumber.
 3. Notching: Notch rough carriages to receive treads, risers, and supports; leave at least 3-1/2 inches of effective depth.
 4. Spacing: At least three framing members for each 36-inch clear width of stair.
- B. Provide stair framing with no more than 3/16-inch variation between adjacent treads and risers and no more than 3/8-inch variation between largest and smallest treads and risers within each flight.

3.8 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

- B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061000

SECTION 061600 - SHEATHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes, but is not limited to:
 - 1. Wall sheathing at parapet walls of the building addition (above curtain walls).
 - 2. Roof sheathing at the existing building.
 - 3. Sheathing joint and penetration treatment.
- B. Related Requirements include, but are not limited to:
 - 1. Division 06 Section "Rough Carpentry" for plywood backing panels.
 - 2. Division 09 Section "Non-Structural Metal Framing" for metal stud support framing at parapet walls.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PANEL PRODUCTS

- A. Plywood: DOC PS 1.
- B. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.
- C. Factory mark panels to indicate compliance with applicable standard.

2.2 WALL SHEATHING

- A. Glass-Mat Gypsum Wall Sheathing: ASTM C 1177/1177M.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed Corporation; GlasRoc.
 - b. G-P Gypsum Corporation; Dens-Glass Gold.
 - c. National Gypsum Company; Gold Bond e(2)XP.
 - d. Temple-Inland Inc.; GreenGlass
 - e. United States Gypsum Co.; Securock.
 - 2. Type and Thickness: Type X, 5/8 inch thick.
 - 3. Size: 48 by 96 inches.

- B. Cellulose Fiber-Reinforced Gypsum Sheathing: ASTM C 1278/C 1278M, gypsum sheathing.
 - 1. Product: Subject to compliance with requirements, provide "Fiberock Sheathing with Aqua-Tough" by United States Gypsum Co.
 - 2. Type and Thickness: Type X, 5/8 inch thick.
 - 3. Size: 48 by 96 inches.

2.3 ROOF SHEATHING

- A. Plywood Roof Sheathing: Exposure 1, Structural I sheathing.
 - 1. Span Rating: Not less than 40/20.
 - 2. Nominal Thickness: Not less than 1/2 inch.

2.4 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 - 1. For roof sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.
 - 1. For steel framing less than 0.0329 inch thick, use screws that comply with ASTM C 1002.
 - 2. For steel framing from 0.033 to 0.112 inch thick, use screws that comply with ASTM C 954.

2.5 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

- A. Sealant for Glass-Mat Gypsum Sheathing: Provide one of the following:
 - 1. Elastomeric, medium-modulus, neutral-curing silicone joint sealant compatible with joint substrates formed by gypsum sheathing and other materials, recommended by sheathing manufacturer for application indicated and complying with requirements for elastomeric sealants specified in Division 07 Section "Joint Sealants."
 - 2. Silicone emulsion sealant complying with ASTM C 834, compatible with sheathing tape and sheathing and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.
 - a. Sheathing Tape: Self-adhering glass-fiber tape, minimum 2 inches wide, 10 by 10 or 10 by 20 threads/inch of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing and with a history of successful in-service use.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.
- C. Securely attach to substrate by fastening as indicated, complying with the following:
 - 1. NES NER-272 for power-driven fasteners.
 - 2. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."
 - 3. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's "International Residential Code for One- and Two-Family Dwellings."
- D. Use steel screws unless otherwise indicated.
- E. Coordinate wall and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 WOOD STRUCTURAL PANEL INSTALLATION

- A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.
- B. Fastening Methods: Fasten roof sheathing panels as indicated below:
 - 1. Nail to wood support framing at 4" on center edge nailing and 6" on center field nailing using 10d nails.
 - 2. Space panels 1/8 inch apart at edges and ends.

3.3 GYPSUM SHEATHING INSTALLATION

- A. Comply with GA-253 and with manufacturer's written instructions.
 - 1. Fasten gypsum sheathing to cold-formed metal framing with screws.
 - 2. Install boards with a 3/8-inch gap where non-load-bearing construction abuts structural elements.
 - 3. Install boards with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.
- B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.
- C. Seal sheathing joints according to sheathing manufacturer's written instructions.
 - 1. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient amount of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.
 - 2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel silicone emulsion sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

END OF SECTION 061600

SECTION 062023 - INTERIOR FINISH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes, but is not limited to:
 - 1. Interior standing and running trim.
 - 2. Shelving.
 - 3. Interior stairs.
- B. Related Requirements include but are not limited to:
 - 1. Division 06 Section "Rough Carpentry" for furring, blocking, and other carpentry work not exposed to view.
 - 2. Division 06 Section "Interior Architectural Woodwork" for shop-fabricated interior woodwork.
 - 3. Division 09 Section "Interior Painting" for priming and backpriming of interior finish carpentry.

1.3 DEFINITIONS

- A. MDF: Medium-density fiberboard.
- B. MDO: Plywood with a medium-density overlay on the face.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials, dimensions, profiles, textures, and colors and include construction and application details.
 - 1. For adhesives and glues used at Project site, documentation including printed statement of VOC content.
 - 2. For composite wood products, documentation indicating that product contains no urea formaldehyde.
 - 3. Laboratory Test Reports for adhesives and composite wood products indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. Shop Drawings: Provide details for interior trim and railings. Include results of field measurements.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber, plywood, and other panels flat with spacers between each bundle to provide air circulation. Protect materials from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.
- B. Deliver interior finish carpentry materials only when environmental conditions meet requirements specified for installation areas. If interior finish carpentry materials must be stored

in other than installation areas, store only where environmental conditions meet requirements specified for installation areas.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install interior finish carpentry materials until building is enclosed and weatherproof, wet work in space is completed and nominally dry, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.
 - 1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Obtain field measurements prior to fabrication and indicate measurements on Shop Drawings.
 - 1. Work of this section includes new interior trim members that exactly match existing trim. Field verify dimensions and profiles of existing trim members by field measurements. Where feasible, remove and salvage existing trim members for use as templates.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Low-Emitting Materials: Composite wood products shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. Lumber: DOC PS 20 and the following grading rules:
 - 1. NeLMA: Northeastern Lumber Manufacturers' Association, "Standard Grading Rules for Northeastern Lumber."
 - 2. NHLA: National Hardwood Lumber Association, "Rules for the Measurement and Inspection of Hardwood & Cypress."
 - 3. NLGA: National Lumber Grades Authority, "Standard Grading Rules for Canadian Lumber."
 - 4. SPIB: The Southern Pine Inspection Bureau, "Standard Grading Rules for Southern Pine Lumber."
- C. Factory mark each piece of lumber with grade stamp of inspection agency indicating grade, species, moisture content at time of surfacing, and mill.
 - 1. For exposed lumber, mark grade stamp on end or back of each piece, or omit grade stamp and provide certificates of grade compliance issued by inspection agency.
- D. Softwood Plywood: DOC PS 1.
- E. Hardboard: AHA A135.4.
- F. MDF: ANSI A208.2, Grade 130, made with binder containing no urea-formaldehyde resin.

2.2 INTERIOR TRIM

- A. Lumber Trim for Opaque Finish (Painted Finish):
 - 1. Species and Grade: One of the following:
 - a. Eastern white pine, D Select; NeLMA or NLGA.
 - b. Idaho white, lodgepole, ponderosa, radiata, or sugar pine; D Select (Quality); NLGA.
 - c. Douglas fir-larch or Douglas fir south, Superior or C & Btr finish; NLGA.
 - d. Spruce-pine-fir, 1 Common; NeLMA, or NLGA.
 - e. Alder, aspen, basswood, cottonwood, gum, magnolia, soft maple, sycamore, tupelo, or yellow poplar; A Finish; NHLA.
 - 2. Maximum Moisture Content: 15 percent with at least 85 percent of shipment at 12 percent or less.
 - 3. Finger Jointing: Allowed.
 - 4. Face Surface: Surfaced (smooth).
 - 5. Optional Material: Primed MDF of same actual dimensions as lumber indicated may be used in lieu of lumber.

- B. Moldings for Opaque Finish (Painted Finish): Made to patterns indicated.
 - 1. Softwood Moldings: WMMPA WM 4, P grade.
 - a. Species: Eastern white, Idaho white, lodgepole, ponderosa, radiata, or sugar pine.
 - b. Maximum Moisture Content: 15 percent with at least 85 percent of shipment at 12 percent or less.
 - 2. Hardwood Moldings: WMMPA HWM 2, P-grade.
 - a. Species: Aspen, basswood, cottonwood, gum, magnolia, soft maple, tupelo, or yellow poplar.
 - b. Maximum Moisture Content: 9 percent.
 - 3. Optional Material: Primed MDF.
 - 4. Finger Jointing: Allowed.

2.3 SHELVING

- A. Exposed Closet and Utility Shelving: Made from one of the following materials, 3/4 inch thick.
 - 1. MDO softwood plywood with solid-wood edge.
 - 2. Wood boards as specified above for lumber trim for opaque finish.

- B. Shelf Cleats: 3/4-by-3-1/2-inch boards, as specified above for shelving.

- C. Shelf Brackets with Rod Support: BHMA A156.16, B04051; prime-painted formed steel.

- D. Shelf Brackets without Rod Support: BHMA A156.16, B04041; prime-painted formed steel.

2.4 STAIRS AND RAILINGS

- A. Risers: 3/4-inch finish boards as specified above for interior lumber trim for opaque finish.

- B. Treads: One of the following:
 - 1. 1-inch kiln-dried Douglas fir, C & Btr VG (Vertical Grain) stepping; NLGA Hem-fir, C & Btr VG (Vertical Grain) stepping; NLGA or Southern pine, B & B stepping; SPIB with half-round or rounded edge nosing.
 - 2. 1-inch particleboard with half-round nosing.

- C. Balusters: Clear, kiln-dried, turned balusters of pattern and size indicated to match existing where used as infill or replacement in existing railings.

2.5 MISCELLANEOUS MATERIALS

- A. Fasteners for Interior Finish Carpentry: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.
- B. Low-Emitting Materials: Adhesives shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Glue: Aliphatic-resin, polyurethane, or resorcinol wood glue recommended by manufacturer for general carpentry use.
 - 1. Wood glue shall have a VOC content of 30 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- D. Multipurpose Construction Adhesive: Formulation complying with ASTM D 3498 that is recommended for indicated use by adhesive manufacturer.
 - 1. Adhesive shall have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.6 FABRICATION

- A. Back out or kerf backs of the following members except those with ends exposed in finished work:
 - 1. Interior standing and running trim except shoe and crown molds.
- B. Ease edges of lumber less than 1 inch in nominal thickness to 1/16-inch radius and edges of lumber 1 inch or more in nominal thickness to 1/8-inch radius.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of projections and substances detrimental to application.
- B. Before installing interior finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours.

3.3 INSTALLATION, GENERAL

- A. Do not use materials that are unsound, warped, improperly treated or finished, inadequately seasoned, too small to fabricate with proper jointing arrangements, or with defective surfaces, sizes, or patterns.

- B. Install interior finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.
 - 1. Scribe and cut interior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
 - 2. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.
 - 3. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining interior finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.
 - 4. Install stairs with no more than 3/16-inch variation between adjacent treads and risers and with no more than 3/8-inch variation between largest and smallest treads and risers within each flight.
 - 5. Coordinate interior finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate interior finish carpentry.

3.4 STANDING AND RUNNING TRIM INSTALLATION

- A. Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches long, except where necessary. Stagger joints in adjacent and related standing and running trim. Miter at returns, miter at outside corners, and cope at inside corners to produce tight-fitting joints with full-surface contact throughout length of joint. Use scarf joints for end-to-end joints. Plane backs of casings to provide uniform thickness across joints where necessary for alignment.
 - 1. Install trim after gypsum-board joint finishing operations are completed.
 - 2. Install without splitting; drill pilot holes before fastening where necessary to prevent splitting. Fasten to prevent movement or warping. Countersink fastener heads on exposed carpentry work and fill holes.

3.5 SHELVING INSTALLATION

- A. Cut shelf cleats at ends of shelves about 1/2 inch less than width of shelves and sand exposed ends smooth.
- B. Install shelf cleats by fastening to framing or backing with finish nails or trim screws, set below face and filled. Space fasteners not more than 16 inches o.c. Use two fasteners at each framing member or fastener location for cleats 4 inches nominal in width and wider.
 - 1. Apply a bead of multipurpose construction adhesive to back of shelf cleats before installing. Remove adhesive that is squeezed out after fastening shelf cleats in place.
- C. Install shelf brackets according to manufacturer's written instructions, spaced not more than 32 inches o.c. Fasten to framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors.
- D. Cut shelves to neatly fit openings with only enough gap to allow shelves to be removed and reinstalled. Install shelves, fully seated on cleats, brackets, and supports.
 - 1. Fasten shelves to cleats with finish nails or trim screws, set flush.
 - 2. Fasten shelves to brackets to comply with bracket manufacturer's written instructions.

3.6 STAIR AND RAILING INSTALLATION

- A. Treads and Risers at Interior Stairs: Secure treads and risers by gluing and nailing to rough carriages.

- B. Balusters: Dovetail or mortise balusters into treads, glue, and nail in place. Let into railings and glue in place.

3.7 ADJUSTING

- A. Replace interior finish carpentry that is damaged or does not comply with requirements. Interior finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing. Adjust joinery for uniform appearance.

3.8 CLEANING

- A. Clean interior finish carpentry on exposed and semi-exposed surfaces. Restore damaged or soiled areas and touch up factory-applied finishes, if any.

3.9 PROTECTION

- A. Protect installed products from damage from weather and other causes during construction.
- B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.
 1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 062023

SECTION 064023 - INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes but is not limited to:
 - 1. Plastic laminate countertops.
 - 2. Solid surface material countertops.
 - 3. Plastic-laminate-faced architectural cabinets.
 - 4. Wood furring, blocking, shims, and hanging strips for installing counter and cabinets unless concealed within other construction before cabinet installation.
- B. Related Requirements include, but are not limited to:
 - 1. Division 05 Section "Metal Fabrications" for stainless steel countertop at Kitchen.
 - 2. Division 06 Section "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing counters and cabinets and concealed within other construction before counter and cabinet installation.
 - 3. Division 22 for plumbing fixtures and piping.
 - 4. Division 26 for surface-mounted raceway used as counter backsplash at some locations.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product, including panel products, high-pressure decorative laminate, adhesive for bonding plastic laminate and cabinet hardware and accessories.
 - 1. Laboratory Test Reports for Adhesives: Documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
 - 2. Product Data for Adhesives and Composite Wood Products: Documentation indicating that products contain no urea formaldehyde.
 - 3. Laboratory Test Reports for Composite Wood Products: Documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
 - 1. Show details full size.
 - 2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
 - 3. Show locations and sizes of cutouts and holes for electrical switches and outlets and other items installed in architectural woodwork.
 - 4. Apply WI Certified Compliance Program label to Shop Drawings.
 - 5. Apply AWI Quality Certification Program label to Shop Drawings.
 - 6. Include field measurements.
- C. Samples for Initial Selection:
 - 1. Solid surface material.
 - 2. Plastic laminates.

3. PVC edge material.

D. Samples for Verification:

1. Solid surface material, 3 by 3 inches, for each type, color and pattern.
2. Plastic laminates, 8 by 10 inches for each type, color, pattern, and surface finish.
3. Exposed cabinet hardware and accessories, one unit for each type.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

B. Product Certificates: For the following:

1. Composite wood and agrifiber products.
2. Solid surface material.
3. High-pressure decorative laminate.
4. Adhesives.

C. Woodwork Quality Standard Compliance Certificates: One of the following:

1. AWI Quality Certification Program certificates
2. WI Certified Compliance Program certificates.

D. Sample Warranty.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Shop shall be either a certified participant in AWI's Quality Certification Program or a licensee of WI's Certified Compliance Program.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements: Where counters and cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support counters and cabinets by field measurements before being enclosed, and indicate measurements on Shop Drawings.

C. Established Dimensions: Where counters and cabinets are indicated to fit to other construction, establish dimensions for areas where counter and cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.8 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that cabinets can be supported and installed as indicated.

1.9 WARRANTY

- A. Furnish solid surface material manufacturer's limited 10-year warranty.

PART 2 - PRODUCTS

2.1 SOLID SURFACE MATERIAL

- A. Solid Polymer Components: Cast, nonporous, filled polymer, not coated, laminated, or of composite construction with through body colors meeting ANSI Z124.3 or ANSI Z124.6, with the following minimum physical and performance properties:
 1. Superficial damage to a depth of 0.010 inch shall be repairable by sanding and/or polishing.
 2. Nominal Sheet Thickness: 0.050 inch.
 3. Edge Treatment: As indicated.
 4. Surface burning characteristics in accordance with ASTM E84: Class I of A, and as follows:
 - a. Flame Spread: Less than 25.
 - b. Smoke Developed: Less than 25.
 5. Izod Impact, ASSTM D 256, Method A: 0.28 foot pounds per inch of notch.
 6. Tensile Modulus, ASTM D 638 Nominal: 1.2 million pounds per square inch.
 7. Thermal Expansion: ASTM D 696: 0.000018 inch per inch per degree F, maximum.
 8. Hardness, ASTM D2583, Barcol Impressor: 56.
 9. Flexural Strength, ASTM D790L 10,000 psi.
 10. Stain Resistance, ASNI Z-124.3 Modified; 3.4: No effect.
 11. Boiling Water Resistance, NEMA LD 303.05: No effect.
 12. High Temperature Resistance, NEMA LD 3-3.06: No effect.
 13. Radiant Heat Resistance, NEMA LD 3.3-10: No effect.
 14. Light Resistance: NEMA LD 3-3.03: No effect.
 15. Ball Impact Resistance, NEMA LD 3-3.08, one half pound ball, unsupported, ½-inch sheet: 125 inches.
 16. Approximate Weight: 4.20 pounds per square foot.
 17. Weatherability, ASTM D 2565: Pass.
 18. Fungus Resistance, ASTM G 21: Pass.
 19. Bacterial Resistance, ASTM G 22: Pass.
 20. Color and Pattern: As selected by Architect from manufacturer's full range of available colors.

2.2 PLASTIC-LAMINATE COUNTERTOPS

- A. Grade and Style: Custom grade, laminate tops with back and sidewall splash where applicable.
- B. High-Pressure Decorative Laminate Grade: HGL.
 1. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces as selected by Architect from manufacturer's full range in the following categories:
 - a. Solid colors, gloss or matte finish.
 - b. Solid colors with core same color as surface, gloss or matte finish.
 - c. Patterns, glass or matte finish.

- C. Edge Treatment: Solid Surface Material
- D. Core Material: One of the following:
 1. Particleboard made with exterior glue.
 2. Medium-density fiberboard made with exterior glue.
 3. Exterior-grade plywood.
- E. Core Material at Sinks: Exterior-grade plywood.
- F. Backer Sheet: Provide plastic-laminate backer sheet, Grade BKL, on underside of countertop substrate.

2.3 PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of architectural plastic-laminate cabinets indicated for construction, finishes, installation, and other requirements.
 1. Provide labels and certificates from AWI or WI certification program indicating that woodwork, including installation, complies with requirements of grades specified.
- B. Grade: Custom.
- C. Type of Construction: Frameless.
- D. Cabinet, Door, and Drawer Front Interface Style: Flush overlay.
- E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by woodwork quality standard.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Formica Corporation.
 - b. Nevamar.
 - c. Panolam Industries International, Inc.
 - d. Pionite.
 - e. Wilsonart International; Div. of Premark International, Inc.
- F. Laminate Cladding for Exposed Surfaces:
 1. Horizontal Surfaces: Grade HGS or HGL.
 2. Vertical Surfaces: Grade HGS or VGS.
 3. Edges: PVC edge banding, 3 mm thick.
- G. Materials for Semi-Exposed Surfaces:
 1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, NEMA LD 3, Grade VGS or Grade CLS, or Thermoset decorative panels.
 - a. Edges of Plastic-Laminate Shelves: PVC T-mold or PVC edge banding, 3 mm thick.
 - b. Edges of Thermoset Decorative Panel Shelves: PVC or polyester edge banding.
 - c. For semi-exposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, NEMA LD 3, Grade VGS or CLS.
 2. Drawer Sides and Backs: Solid-hardwood lumber or Thermoset decorative panels with PVC or polyester edge banding.
 3. Drawer Bottoms: Hardwood plywood or Thermoset decorative panels.
- H. Dust Panels: 1/4-inch plywood or tempered hardboard above compartments and drawers unless located directly under tops.

- I. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.
- J. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
 - 1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners or glued dovetail joints.
- K. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate as selected by Architect from laminate manufacturer's full range in the following categories:
 - 1. Solid colors, matte finish.
 - 2. Patterns, matte finish.

2.4 WOOD MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
 - 1. Wood Moisture Content: 5 to 10 percent.
- B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
 - 1. Composite Wood and Agrifiber Products: Products shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
 - 2. Medium-Density Fiberboard: ANSI A208.2, Grade 130, made with binder containing no urea formaldehyde.
 - 3. Particleboard: ANSI A208.1, Grade M-2, made with binder containing no urea formaldehyde.
 - 4. Softwood Plywood: DOC PS 1, medium-density overlay.
 - 5. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for test methods 3.3, 3.4, 3.6, 3.8, and 3.10.

2.5 CABINET HARDWARE AND ACCESSORIES

- A. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 170 degrees of opening.
- B. Back-Mounted Pulls: BHMA A156.9, B02011.
- C. Wire Pulls: Back mounted, solid metal, 4 inches long, 5/16 inch in diameter.
- D. Catches: One of the following:
 - 1. Magnetic catches, BHMA A156.9, B03141
 - 2. Push-in magnetic catches, BHMA A156.9, B03131
 - 3. Roller catches, BHMA A156.9, B03071
 - 4. Ball friction catches, BHMA A156.9, B03013.
- E. Adjustable Shelf Standards and Supports, One of the following:
 - 1. BHMA A156.9, B04071; with shelf rests, B04081
 - 2. BHMA A156.9, B04102; with shelf brackets, B04112.

- F. Shelf Rests: BHMA A156.9, B04013; metal, two-pin type with shelf hold-down clip.
- G. Drawer Slides: BHMA A156.9: Grade 1 and Grade 2: Side mounted and extending under bottom edge of drawer; full-extension type; zinc-plated steel or epoxy-coated steel with polymer rollers.
- H. Door Locks: BHMA A156.11, E07121.
- I. Drawer Locks: BHMA A156.11, E07041.
- J. Door and Drawer Silencers: BHMA A156.16, L03011.
- K. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
 - 1. Dark, Oxidized, Satin Bronze, Oil Rubbed: BHMA 613 for bronze base; BHMA 640 for steel base; match Architect's sample.
- L. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.6 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.
- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.
- C. Adhesives:
 - 1. Do not use adhesives that contain urea formaldehyde.
 - 2. Use adhesives that meet the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- D. Solid Surface Material Counter Accessories
 - 1. Joint Adhesive: Manufacturer's standard one- or two-part adhesive kit to create inconspicuous, nonporous joints.
 - 2. Sealant: Manufacturer's standard mildew resistant, FDA-compliant, NSF 51-compliant (food zone - any type), UL-listed silicone sealant in colors matching components.
 - 3. Conductive Tape: Manufacturer's standard aluminum foil tape, with required thickness, for use with cutouts near heat sources.
 - 4. Insulating Felt Tape: Manufacturer's standard for use with conductive tape in insulating solid surface material from adjacent hear source.

2.7 FABRICATION

- A. Fabricate counters and cabinets to dimensions, profiles, and details indicated.
- B. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

1. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.
 2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements before disassembling for shipment.
- C. Shop-cut openings to maximum extent possible to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
1. Seal edges of openings in plastic laminate counters with a coat of varnish.
- D. Form joints between solid surface material counters using manufacturer's standard joint adhesive without conspicuous joints and without voids. Reinforce with strip of solid polymer material under joint, minimum 2 inches wide.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installation, condition counter and cabinets to average prevailing humidity conditions in installation areas.
- B. Before installing counters and cabinets, examine shop-fabricated work for completion and complete work as required.

3.2 INSTALLATION

- A. Grade: Install woodwork to comply with same grade as item to be installed.
- B. Assemble woodwork and complete fabrication at Project site to the extent that it was not completed in the shop.
- C. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
- D. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.
 1. Use filler matching finish of items being installed.
- F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
 1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
 2. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c. with one of the following:
 - a. No. 10 wafer-head screws sized for not less than 1-1/2-inch penetration into wood framing, blocking, or hanging strips

- b. No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish
 - c. Toggle bolts through metal backing or metal framing behind wall finish.
- G. Install solid surface material counters level, plumb, true, and straight. Shim as required with concealed shims.
 - 1. Scribe and cut components to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
 - 2. Form field joints using manufacturer's recommended adhesive, with joints inconspicuous in finished work. Exposed joints/seams shall not be allowed.
 - 3. Reinforce field joints with solid surface strips extending a minimum of 1 inch on either side of the seam with the strip being in the same thickness as the top.
 - 4. Cut and finish component edges with clean, sharp returns.
 - 5. Anchor securely to supports.
 - 6. Align adjacent countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop.
 - 7. Carefully dress joints smooth, remove surface scratches and clean entire surface.
 - 8. Install countertops with no more than 1/8 inch sag, bow or other variation from a straight line.
 - 9. Install applied side splashes and adhere to counters using manufacturer's standard color-matched silicone sealant.
- H. Plastic Laminate Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
 - 1. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variations from a straight line.
 - 2. Secure backsplashes to tops with concealed metal brackets at 16 inches o.c. and to wall with adhesive.
 - 3. Seal space between backsplash and wall with sealant specified in Division 07 Section "Joint Sealants".
- I. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.

3.3 ADJUSTING, CLEANING AND PROTECTION

- A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean woodwork on exposed and semi-exposed surfaces.
 - 1. Remove adhesives, sealants, and other stains.
 - 2. Touch-up shop-applied finishes to restore damaged or soiled areas.
- D. Protect surfaces from damage until date of Substantial Completion.

END OF SECTION 064023

SECTION 066100 – ARCHITECTURAL FIBERGLASS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes, but is not limited to, Architectural Fiberglass Reinforced Polymer (FRP) fabrications:
 - 1. Molded cornice.
 - 2. Molded curtain wall insert panels.
 - 3. Flat curtain wall insert panels.
- B. Related requirements include, but are not limited to:
 - 1. Division 06 Section "Rough Carpentry for blocking.
 - 2. Division 07 Section "Joint Sealants" for field applied sealants.
 - 3. Division 08 Section "Glazed Aluminum Curtain Walls" for curtain wall framing to receive insert panels.

1.3 DESIGN REQUIREMENTS

- A. Installed architectural fiberglass cornice and fastening systems shall be designed, engineered, fabricated, and installed to conform to the state codes, local codes, and the Architect's design.

1.4 SUBMITTALS

- A. Shop Drawings: Include plan views, elevations, sections, profiles, and details of cornice sections. Illustrate dimensions, adjacent construction, materials, thickness, fabrications details, required clearances, field jointing, tolerances, colors, finishes, methods of support, attachments, anchorage to substrates, integration of components and anchorages. Detail all corner sections, unique sections, cornice termination sections, and all joint locations.
- B. Submit current valid third party product Listing and Labeling from International Code Council (ICC)–sanctioned authority to be affixed to all products manufactured and delivered to the jobsite as required per the 2009 International Building Code (IBC). ICC–sanctioned Listing and Labeling Program shall be in place at bid time and state compliance with Flame Spread Index requirements stipulated in the 2009 IBC, section 2612. Manufactured products without Listing and Labeling Program at bid time will not be considered.
- C. Submit manufacturer's current valid certification with The Certified Composites Technician (CCT) program created by the American Composites Manufacturers Association (ACMA).
- D. Submit manufacturer's internal Quality Control and Assurance Procedures based upon provisions published in the "Guidelines and Recommended Practices for Fiberglass Reinforced Plastic Architectural Products" upon request.
- E. Product Data: Submit manufacturer's product data and installation instructions.
- F. Product Samples: Submit minimum 3-inch x 5-inch samples in specified color, texture and finish when applicable.

1.5 QUALITY ASSURANCE

- A. Obtain architectural fiberglass cornice from a single source manufacturer that has the ability and resources to comply with the requirements and schedule of the project.
- B. Manufacturer's ICC-sanctioned Listing and Labeling Program shall include site visits to manufacturing facility by third party testing authority witnessing compliance with manufacturing procedures and Listing and Labeling Program.
- C. Manufacturer shall comply with Quality Control & Assurance Procedures, and fabricate architectural fiberglass cornice based upon provisions published in the "Guidelines and Recommended Practices for Fiberglass Reinforced Plastic Architectural Products".
- D. Inspect each molded piece to ensure that it complies with specified requirements, including nominal dimensions.

1.6 MANUFACTURER'S QUALIFICATIONS

- A. Manufacturer: Provide products manufactured by a firm specializing in the manufacture of fiberglass cornice, in the United States with a minimum of ten (10) years experience.
- B. All products manufactured shall carry ICC-sanctioned Listing and Labeling per 2009 IBC.
- C. Manufacturer shall demonstrate current valid certification and participation in the CCT program and fabricate material based upon provisions published in the "Guidelines and Recommended Practices for Fiberglass Reinforced Plastic Architectural Products".
- D. Provide a list of projects comparable in size, scope, and complexity as indicated, upon request.
- E. Provide verification that fiberglass cornice meets or exceeds products specified.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Handle, store and transport architectural fiberglass cornice according to manufacturer's recommendations and in a manner that prevents damage.
- B. Protect architectural fiberglass cornice from damage by retaining shipping protection in place until installation.
- C. Damage Responsibility: Except for damage caused by others, the installer is responsible for chipping, cracking, or other damage to fiberglass cornice, after delivery to the jobsite and until installation is completed and inspected and approved by the Architect or owner's representative.

1.8 WARRANTY

- A. Warrant architectural fiberglass components to be free from defect due to materials and workmanship for one year.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Basis of Design: Architectural Fiberglass, Inc.
 - 1. Address: 8300 Bessemer Ave, Cleveland, Ohio 44127
 - 2. Toll Free: 1-888-483-1775

3. Phone: 216-641-8300
4. Fax: 216-641-8150
5. Website: www.fiberglass-afi.com

- B. Requests for substitutions will be considered in accordance with Division 01 Section "Product Requirements".

2.2 FABRICATION PATTERNS/MOLDS

- A. Custom Pattern/Mockups: Patterns and mockups shall be hand carved and/or CNC machined by skilled pattern makers with minimum of ten (10) years experience with Architectural elements. Patterns and mockups shall be available at manufacturing facility for architect's inspection and approval before molds are produced.
- B. Custom Molds: Molds shall be produced with ample layers of tooling resin, tooling gel-coat, glass fibers and/or flexible rubber by skilled mold makers with minimum of ten (10) years experience with architectural elements. Produced molds shall have rigidity and thickness to prevent distortion and deflection of molded architectural fiberglass.
- C. Cornice sections shall be manufactured with sealable lap and/or butt joints. Cornice joints shall be manufactured to accommodate adjoining sections and alignment of cornice surface sections.
- D. Factory inside and outside corners, and unique transition sections shall be shop fabricated. Field corner fabrication will not be permitted.
- E. Cornice shall be fabricated with the required rigidity and strength to maintain profile dimensional stability. Additional field skeleton framing will not be provided unless indicated otherwise on architectural drawings.
- F. Coordinate miscellaneous cutouts required for vents, drainage, and other cornice obstructions/penetrations.

2.3 MATERIALS CHARACTERISTICS

- A. Molded Exterior Surface: U-V inhibited, NPG-ISO polyester gel coat, 18 to 22 mils thick. Color to match in texture and finish of sample supplied by Architect.
- B. Barrier Coat: Specifically formulated backup polyester surface veil 18-20 mils thick to prevent glass print through and ultimate Class A finish.
- C. Back Up Laminate:
1. Resin: Polyester resin shall be fire retardant, and meet Class 1 flame spread rating of 25 or less and smoke density under 450 without the use of antimony trioxide as characterized by the ASTM E-84 tunnel test at typical 1/8" glass mat laminate. General Purpose resin will not be permitted.
 2. Filler: Functional filler to be added to resin matrix to minimize shrinkage, add stiffness, control opacity, add fire retardance, improve surface finish, minimize crazing, and control dimensional stability from weather extremes.
 3. Fiberglass Reinforcement: Type "E" fiberglass, glass cloth, matt and/or random chopped glass fibers. Glass content approximately 20% to 30%.
 4. Laminate Thickness: Nominal laminate shall be minimum 3/16" thickness. Additional core reinforcements and/or sandwich structure added as required for rigidity and structural integrity. Fiberglass laminate thickness to meet the structural design as indicated on the drawings. Additional stiffeners and framing as required shall be embedded in the fiberglass composite to ensure straightness, strength, and profile dimensional stability.

Additional skeleton framing will not be field provided. Flat surfaces equal to or greater than 12" by 12" or any running surface equal to or greater than 9" in width, shall be fabricated with a minimum 1/4" thick sandwich core structure.

- D. Average Mechanical Properties:
1. Tensile Strength 12,000 PSI per ASTM D638
 2. Flexural Strength 20,000 PSI per ASTM D790
 3. Flexural Modulus 0.9 x 10⁶ PSI per ASTM D790
 4. Compressive Strength 17,000 PSI per ASTM D695
 5. Bearing Strength 9,000 PSI per ASTM D638
 6. Thermal Expansion 10 x 10⁻⁶ (°F)
 7. Specific Gravity 1.5

2.4 FINISH

- A. Color: White as selected by Architect.
- B. Surface Texture/Exposed side shall be smooth or textured based upon approved sample.

2.5 TOLERANCES

- A. Allowable Tolerances for Fabricated Units
 1. Part Thickness: + or - 1/8 inch.
 2. Gel Coat Thickness: + or - 2.5 mils.
 3. Length: + or - 1/8 inch.
 4. Variation from Square: 1/8 inch.
 5. Hardware Location Variation: + or - 1/4 inch.

2.6 IDENTIFICATION

- A. Identify each architectural fiberglass cornice unit with a permanent serial number.
- B. Number cornice parts to coordinate with shop drawings.

2.7 CURING AND CLEANING

- A. Cure and clean components prior to shipment and remove material which may be:
 1. Toxic to plant or animal life.
 2. Incompatible with adjacent building material.

2.8 ANCHORS AND FASTENERS

- A. Provide anchors and fasteners and other accessories for proper installation of architectural fiberglass cornice as recommended and approved by fiberglass fabrication manufacturer.

PART 3 - EXECUTION

3.1 PRE-INSTALLATION EXAMINATION

- A. Carefully observe and verify field conditions that substrates are ready for installation of architectural fiberglass cornice.
- B. Verify that bearing surfaces are true and level.

- C. Verify that support framing has been constructed to allow accurate placement, alignment and connection of architectural fiberglass cornice to structure.
- D. Report discrepancies between design dimensions and field dimensions, which could adversely affect cornice installation, to the Architect.
- E. Do not proceed with installation until discrepancies are corrected, or until installation requirements are modified and approved by the Architect.
- F. Beginning of installation means acceptance of existing conditions and fiberglass materials.

3.2 INSTALLATION

- A. Install architectural fiberglass cornice in accordance with manufacturer's instructions and approved shop drawings.
- B. Erect required connection blocking, framing, and cornice, plumb, square, and true to line and level to substrate. Recess blocking or notch continuous blocking behind each panel joint per manufacturer's instructions. The installer shall supply connectors, blocking and framing approved by cornice manufacturer.
- C. Space joints according to shop drawings, not less than 1/8" and not greater than 3/8". Prepare joints by lightly sanding and filling joints with a continuous bead of specified sealant as work progresses to make a weather tight joint. Carefully monitor ambient temperatures at time of installation to prevent excessive expansion and contraction of panels during sealant application.
- D. Do not field cut cornice where the finish cannot be field restored. Installer may repair small unnoticeable finish repairs with manufacturer's supplied colored gel-coat patching material.
- E. Countersink all exposed fasteners and repair with manufacturer's supplied colored gel-coat patching material. Repairs shall be made with care to be undetectable.
- F. Allowable Tolerances for Installed Units:
 - 1. Maximum Offset from True Alignment: 1/4 inch in 20 feet.
 - 2. Maximum Variation from True Position: 1/2 inch in 20 feet.

3.3 CLEANING AND PROTECTION

- A. Clean installed architectural fiberglass cornice using cleaning methods and material approved by manufacturer.
- B. Comply with manufacturer's recommendations and instructions for protecting installed cornice during construction activities.

END OF SECTION 066100

SECTION 066500 – CELLULAR PVC TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes cellular PVC trim boards and moldings for repairs to exterior finish carpentry and woodwork.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's data for specified products.
- B. Samples: Submit three (3) material samples representative of the texture, thickness, and widths anticipated for use.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with Local Building Code for installation requirements.
- B. Allowable Tolerances:
 - 1. Variation in component length: -0.00 / +1.00"
 - 2. Variation in component width: $\pm 1/16"$.
 - 3. Variation in component thickness: $\pm 1/16"$.
 - 4. Variation in component edge cut: $\pm 2"$.
 - 5. Variation in Density: -0% - +10%.
- C. Workmanship, Finish, and Appearance:
 - 1. Free foam cellular PVC shall be homogeneous and free of voids, holes, cracks, and foreign inclusions and other defects. Edges must be square, and top and bottom surfaces shall be flat with no convex or concave deviation.
 - 2. Uniform surface free from cupping, warping, and twisting.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store trim materials on a flat and level surface on a full shipping pallet. Handle materials to prevent damage to product edges and corners. Store materials under a protective covering to prevent jobsite dirt and residue from collecting on the boards.

1.6 WARRANTY

- A. Provide manufacturer's 25 year warranty against defects in manufacturing that cause the products to rot, corrode, delaminate, or excessively swell from moisture.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Subject to compliance with requirements, provide one of the following:

1. "AZEK" products, manufactured by Vycom Corporation – cited as design standard.
 - a. Street Address: 801 Corey Street, Scranton, PA 18505
 - b. Telephone: 877.ASK.AZEK.
 - c. Website: www.azek.com.
2. Plasti-Clad Lifetime Exterior Trim.
 - a. Street Address: 131 Sachs Ave., Franklin, VA 23851
 - b. Telephone: 877.895.1212.
 - c. Website: www.plasticlad.com.

B. Refer to Division 01 Section "Product Requirements" for substitutions.

2.2 MATERIALS

A. Material: Free foam cellular PVC material with a small-cell microstructure and density of .55 grams/cm³.

B. Physical Properties:

1. Density: 0.55 g/ cm³ per ASTM D 792.
2. Water Absorption: 0.15% per ASTM D 570.

C. Mechanical Characteristics:

1. Tensile Strength: 2256 psi per ASTM D 638.
2. Tensile Modulus: 144,000 psi per ASTM D 638.
3. Flexural Strength: 3329 psi per ASTM D 790.
4. Flexural Modular: 144,219 psi per ASTM D 790.
5. Nail Hold: 35 lbf/in. of penetration per ASTM D 1761
6. Screw Hold: 680 lbf/in. of penetration per ASTM D 1761.
7. Staple Hold: 180 lbf/in. of penetration per ASTM D 1761.
8. Gardner Impact: 103 in.-lbs per ASTM D 5420.
9. Charpy Impact (at 23°C) 4.5 in.-lbs per ASTM D 256.

D. Thermal Properties:

1. Coefficient of Linear Expansion: 3.2×10^{-5} in/in/°F per ASTM D696.
2. Burning Rate: No burn when flame removed per ASTM D 635.
3. Flame Spread Index: 25, per ASTM E 84.
4. Heat Deflection Temperature 264 psi: 150°F per ASTM D648.
5. Oil Canning (at 140°F) Pass, per ASTM D 648.

2.3 ACCESSORY PRODUCTS

A. Fasteners:

1. Use fasteners designed for wood trim and wood siding (thinner shank, blunt point, full round head) with cellular PVC.
2. Use highly durable fasteners such as stainless steel or hot-dipped galvanized.
3. Staples, small brads and wire nails must not be used as fastening members.

B. Adhesives:

1. For all cellular PVC to cellular PVC joints, use manufacturer's specially formulated cellular PVC cement.
2. To bond cellular PVC to other substrates, various adhesives may be used. Consult adhesive manufacturer to determine suitability.

C. Sealants: Use urethane, polyurethane or acrylic based sealants without silicone.

2.4 FINISHES

- A. Preparation:
 - 1. No special surface preparations are required prior to painting; sanding is not necessary for paint adhesion.
 - 2. Surface must be clean and dry.
 - 3. Fill nail holes with polyurethane or acrylic based caulk.
- B. Painting:
 - 1. Use a 100% acrylic latex paint with a Light Reflective Value (LRV) of 55 or higher.
 - 2. Follow the paint manufacturer's application recommendations.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Manufacturer's Instructions: Comply with manufacturer's product catalog installation instructions and product technical bulletin instructions.
- B. Cutting: Cut cellular PVC products using the same tools used to cut lumber.
 - 1. Use carbide tipped blades designed to cut wood. Do not use fine tooth metal cutting blades.
 - 2. Rough edges from cutting may be caused by excessive friction, poor board support, or worn or improper tooling.
- C. Drilling: Drill cellular PVC using the same tools used to drill lumber.
 - 1. Drilling cellular PVC products is similar to drilling a hardwood. Exercise care to avoid frictional heat buildup.
 - 2. Use standard woodworking drills. Do not use drills made for normal rigid PVC.
 - 3. Periodically remove cellular PVC shavings from the drill hole.
- D. Milling: Mill cellular PVC products using standard milling machines used to mill lumber.
 - 1. Relief Angle 20° to 30°.
 - 2. Optimize cutting speed with the number of knives and feed rate.
- E. Routing: Rout cellular PVC using standard carbide-tipped router bits and the same tools used to rout lumber.
- F. Finish edges by sanding, grinding, or filing with traditional woodworking tools.
- G. Fastener Location:
 - 1. Use two (2) fasteners per every framing member for trimboard applications.
 - 2. Use additional fasteners for trimboards over 12" or wider, as well as sheets.
 - 3. Install fasteners no more than 2" from the end of each board.
 - 4. Fasten cellular PVC into a flat, solid substrate; do not fasten into hollow or uneven areas.
 - 5. Pre-drilling is typically not required unless a large fastener is used or product is installed in low temperatures.
 - 6. Do not rip 3/8" and 1/2" sheet product into trim pieces. These profiles must be glued to a substrate and mechanically fastened.
- H. Adhesive Installation:
 - 1. Glue all cellular PVC to cellular PVC joints such as window surrounds, long fascia runs, etc., with manufacturer's specially formulated cellular PVC cement to prevent joint separation.

2. Secure the glue joint with a fastener and/or fasten on each side of the joint to allow adequate bonding time.
3. Observe manufacturer's adhesive working time of 10 minutes; adhesive will be fully cured in 24 hours.
4. Use of standard PVC cements that cure quickly will result in limited working time and may reduce adhesive strength.
5. Surfaces to be glued shall be smooth, clean, and in complete contact with each other.

I. Thermal Expansion and Contraction:

1. Properly fasten cellular PVC material along its entire length to minimize expansion and contraction.
2. Glue joints between pieces of cellular PVC to eliminate joint separation. When gaps are glued on a long run of cellular PVC, allow expansion and contraction at ends of the run.

3.2 CLEANING

- A. After installation, clean exposed surfaces of cellular PVC to remove dirt, adhesive, sealant, and other blemishes. Comply with manufacturer's printed cleaning instructions.

END OF SECTION 066500

SECTION 06610 - PERGOLA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes, but is not limited to, structural pergola and fixed canopy components.
- B. Related sections include, but are not limited to:
 - 1. Division 03 Section "Cast-In-Place Concrete" for footings.
 - 2. Division 26 Section "Lighting Systems" for fixtures mounted on the pergola.
- C. References:
 - 1. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 2. ASCE 7-10 - American Society of Civil Engineers, Minimum Design Loads for Buildings and other structures.

1.3 DESIGN/PERFORMANCE REQUIREMENTS

- A. Design members to withstand wind loads in accordance with ASCE 7-10 and applicable code.
- B. Design connections to foundations in accordance with applicable code and good construction practices for the specific structure and site conditions.
- C. Cooperate with regulatory agency or authority having jurisdiction and provide data as requested.
- D. Design pergola for required allowable ground snow load in accordance with the applicable code.
- E. Design pergola in accordance with applicable fire code and provide data on ASTM E 84 testing performance.

1.4 SUBMITTALS

- A. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Product specification sheets.
 - 2. Installation instructions.
- B. Shop Drawings: Indicate assembly dimensions, locations of structural members, connections, and general construction details, anchorages and method of anchorage, and method of installation.
- C. Selection Samples: For each finish product specified, two (2) complete sets of color samples representing manufacturer's full range of available colors.
- D. Verification Samples: For each finish product specified, two (2) samples representing actual product and color.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Single source manufacturer for design, engineering, structure pre-fabrication, and shipping.
- B. Installer Qualifications: Familiar with manufacturer's structures and installation techniques, and acceptable to the manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Open and inspect all packages and pallets for hidden damage upon receipt. Note any missing or damaged components on the delivery receipt with the carrier before accepting the shipment.
- B. Repackage components and carefully store in an area protected from the weather until ready for installation.
- C. Handle materials so as to protect materials, coatings, and finishes during transportation and installation to prevent damage or staining.

1.7 SEQUENCING

- A. Ensure that footing location plans and other information required for installation of products of this section are furnished to affected trades in time to prevent interruption of construction progress.
- B. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.8 WARRANTY

- A. Provide manufacturer's warranties, as appropriate, for all pergola components, canopy systems, and finish coatings.
 - 1. 10 Year commercial warranty on cellular PVC pergola.
 - 2. 10 Year warranty against degradation of the polycarbonate fixed canopy panels UV protection of greater than six percent (6%).

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Basis of Design Manufacturer: Backyard America.
 - 1. Address: 3300 Dill Smith Dr.; Fredericksburg, VA 22408.
 - 2. Phone: 877 489 8064.
 - 3. Fax: 877 489 2009.
 - 4. Email: questions@backyardamerica.com.
 - 5. Website: www.backyardamerica.com.
- B. Requests for substitutions will be considered in accordance with provisions of Division 01.

2.2 MATERIALS

- A. Provide the following pergola of the overall size and configuration indicated on the Drawings.
- B. Attachment Method: Freestanding.
- C. Dimensions:

1. Overall Width (Direction of Beam): 48'-0" nominal.
 2. Overall Projection (Direction of rafters): 10'-8" nominal.
- D. Components:
1. Column Selection: Fiberglass 12" x 10' High Round Tapered Column with Tension Rod and Aluminum Plate Mounting System, cut to custom heights. Include matching column capital and base trim.
 2. Beam Component Selection: 3-1/2" x 9-1/2" cellular PVC with aluminum core.
 3. Rafter Component Selection: 1-1/2" x 7-1/4" cellular PVC.
 4. Stringer Component Selection: 1-1/2" x 1-1/2" cellular PVC.
- E. Hardware: All exposed hardware to be stainless steel or aluminum.
- F. Accessories: Provide all accessories required for a complete installation, including but not limited to the following manufacturer's standard items:
1. Top and bottom mount plates.
 2. 3/8-inch leveling rods and nuts.
 3. 1/2-inch nuts, washer, storm load washer, coupler, and threaded rod.
- G. Fixed Canopy: System consisting of polycarbonate panels and aluminum extrusions specifically designed as a shade and watertight system that does not rely on rubber washers and screws.
1. Polycarbonate Panels: Solar Gray panels that block 80% of visible light and 99.9% of UV rays (A and B).
 - a. Width: 24 inches, nominal, with center striation
 - b. Length: As indicated.
 - c. Edge: Molded profile specifically shaped to engage aluminum tracks.
 2. Aluminum Tracks: Manufacturer's standard extrusions specifically designed to lock the panels in place so that water cannot penetrate.
 3. Accessories: Manufacturer's standard plastic purlin clip for anchoring tracks to cellular PVC stringers.
 4. Basis of Design: ShadeRight™ Fixed Canopy.

2.3 FINISH

- A. Provide all fiberglass pergola components (columns, capitals, and base trim) with ColorLast Process finish coating applied.
1. Color: White.
- B. Provide all cellular PVC pergola components (beams, rafters, and stringers) without a finish coating applied for installation without any additional finishing (none required).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until supporting structures have been properly prepared.
- B. If foundation preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Clean component surfaces thoroughly prior to installation.

3.3 INSTALLATION

- A. Install in strict accordance with manufacturer's installation instructions.
- B. Construct foundations in accordance with local codes and good construction practices for the specific structure and site conditions.
 - 1. Surface Mount on New Footings: Surface mount units on new concrete footings as indicated on the approved shop drawings. Slab requirements vary according to structure size. Concrete shall conform to Division 03 Section "Cast-In-Place Concrete".
 - 2. Set anchor bolts for surface mounted units accurately using manufacturer's instructions.

3.4 CLEANING AND PROTECTION

- A. Clean all surfaces and restore any marred surfaces to original conditions as approved by the Architect.
- B. Protect installed products until completion of project.
- C. Touch-up, repair, or replace damaged products before Substantial Completion.

END OF SECTION 066610

SECTION 071113 - BITUMINOUS DAMPPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes, but is not limited to, bituminous dampproofing of one of the following types:
 - 1. Hot-applied asphalt dampproofing.
 - 2. Cold-applied, cut-back-asphalt dampproofing.
 - 3. Cold-applied, emulsified-asphalt dampproofing.
- B. Related Requirements include, but are not limited to:
 - 1. Division 03 Section "Cast-in-Place Concrete".
 - 2. Division 04 Section "Unit Masonry".

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Product VOC Content: For dampproofing, documentation including printed statement of VOC content.
 - 2. Laboratory Test Reports: For dampproofing, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

1.4 FIELD CONDITIONS

- A. Weather Limitations: Proceed with application only when existing and forecasted weather conditions permit dampproofing to be performed according to manufacturers' written instructions.
- B. Ventilation: Provide adequate ventilation during application of dampproofing in enclosed spaces. Maintain ventilation until dampproofing has cured.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Source Limitations: Obtain primary dampproofing materials and primers from single source from single manufacturer. Provide auxiliary materials recommended in writing by manufacturer of primary materials.
- B. VOC Content: Products shall comply with VOC content limits of authorities having jurisdiction unless otherwise required.

2.2 DAMPPROOFING

- A. At the Contractor's option, provide one of the following three types of asphalt dampproofing.

- B. Hot-Applied Asphalt Dampproofing
 - 1. Hot-Applied Asphalt: ASTM D 449, Type II or Type III.
 - 2. VOC Content: 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. Low-Emitting Materials: Dampproofing shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

- C. Cold-Applied, Cut-Back-Asphalt Dampproofing
 - 1. Trowel Coats: ASTM D 4586, Type I, Class 1, fibered.
 - 2. Brush and Spray Coats: ASTM D 4479, Type I, fibered or nonfibered.
 - 3. VOC Content: 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 4. Low-Emitting Materials: Dampproofing shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

- D. Cold-Applied, Emulsified-Asphalt Dampproofing
 - 1. Trowel Coats: ASTM D 1227, Type II, Class 1.
 - 2. Fibered Brush and Spray Coats: ASTM D 1227, Type II, Class 1.
 - 3. Brush and Spray Coats: ASTM D 1227, Type III, Class 1.
 - 4. VOC Content: 30 g/L or less.
 - 5. Low-Emitting Materials: Dampproofing shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.3 AUXILIARY MATERIALS

- A. General: Furnish auxiliary materials recommended in writing by dampproofing manufacturer for intended use and compatible with bituminous dampproofing.

- B. Cut-Back-Asphalt Primer: ASTM D 41.

- C. Emulsified-Asphalt Primer: ASTM D 1227, Type III, Class 1, except diluted with water as recommended in writing by manufacturer.
 - 1. Primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

- D. Asphalt-Coated Glass Fabric: ASTM D 1668, Type I.

- E. Patching Compound: Epoxy or latex-modified repair mortar or Asbestos-free fibered mastic of type recommended in writing by dampproofing manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions with Applicator present, for compliance with requirements for surface smoothness, surface moisture, and other conditions affecting performance of bituminous dampproofing work.
 - 1. Test for surface moisture according to ASTM D 4263.

- B. Proceed with application only after substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Mask or otherwise protect adjoining exposed surfaces from being stained, spotted, or coated with dampproofing. Prevent dampproofing materials from entering and clogging weep holes and drains.
- B. Clean substrates of projections and substances detrimental to the dampproofing work; fill voids, seal joints, and remove bond breakers if any, as recommended in writing by prime material manufacturer.
- C. Apply patching compound to patch and fill tie holes, honeycombs, reveals, and other imperfections; cover with asphalt-coated glass fabric if recommended by manufacturer.

3.3 APPLICATION, GENERAL

- A. Comply with manufacturer's written instructions for dampproofing application, cure time between coats, and drying time before backfilling unless more stringent requirements are indicated.
 - 1. Apply dampproofing to provide continuous plane of protection.
 - 2. Apply additional coats if recommended in writing by manufacturer or to achieve a smooth surface and uninterrupted coverage.
- B. Where dampproofing footings and foundation walls, apply from finished-grade line to top of footing; extend over top of footing and down a minimum of 6 inches over outside face of footing.
 - 1. Extend dampproofing 12 inches onto intersecting walls and footings, but do not extend onto surfaces exposed to view when Project is completed.
 - 2. Install flashings and corner protection stripping at internal and external corners, changes in plane, construction joints, cracks, and where shown as "reinforced," by embedding an 8-inch-wide strip of asphalt-coated glass fabric in a heavy coat of dampproofing. Dampproofing coat for embedding fabric is in addition to other coats required.
- C. Where dampproofing exterior face of inner wythe of exterior masonry cavity walls, lap dampproofing at least 1/4 inch onto flashing, masonry reinforcement, veneer ties, and other items that penetrate inner wythe.
 - 1. Extend dampproofing over outer face of structural members and concrete slabs that interrupt inner wythe.
 - 2. Lap dampproofing at least 1/4 inch onto shelf angles supporting veneer.
- D. Where dampproofing interior face of above-grade, exterior concrete and masonry single-wythe masonry walls, continue dampproofing through intersecting walls by keeping vertical mortar joints at intersection temporarily open or by dampproofing wall before constructing intersecting walls.

3.4 HOT-APPLIED ASPHALT DAMPPROOFING

- A. Do not apply hot asphalt when substrate condition causes foaming.
- B. Kettle Temperature: Comply with dampproofing-material manufacturer's written instructions, and keep at least 25 deg F below the flash point.
- C. Prime masonry and other porous substrates.

- D. Apply a uniform coat of hot asphalt by mopping or spraying at not less than 20 lb or 2.5 gal./100 sq. ft..
 - 1. Apply a second coat to below-grade foundation walls and where first application has failed to produce a smooth surface and uninterrupted coverage. Apply second coat at the rate specified for first coat.

3.5 COLD-APPLIED, CUT-BACK-ASPHALT DAMPPROOFING

- A. Concrete Foundations and Parged Masonry Foundation Walls: Apply one of the following:
 - 1. Two brush or spray coats at not less than 1.25 gal./100 sq. ft. for first coat. 1 gal./100 sq. ft. for second coat.
 - 2. One trowel coat at not less than 4 gal./100 sq. ft..
- B. Unparged Masonry Foundation Walls: Apply one of the following:
 - 1. Primer and two brush or spray coats at not less than 1.25 gal./100 sq. ft. for first coat and 1 gal./100 sq. ft. for second coat.
 - 2. Primer and one trowel coat at not less than 4 gal./100 sq. ft..
- C. Unexposed Face of Concrete Retaining Walls: Apply one brush or spray coat at not less than 1.25 gal./100 sq. ft..
- D. Unexposed Face of Masonry Retaining Walls: Apply primer and one brush or spray coat at not less than 1.25 gal./100 sq. ft..
- E. Concrete Backup for Brick Veneer Assemblies: Apply one brush or spray coat at not less than 1 gal./100 sq. ft..
- F. Masonry Backup for Brick Veneer Assemblies: Apply primer and one brush or spray coat at not less than 1 gal./100 sq. ft..
- G. Exterior Face of Inner Wythe of Cavity Walls: Apply primer and one brush or spray coat at not less than 1 gal./100 sq. ft..

3.6 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

- A. Concrete Foundations and Parged Masonry Foundation Walls: Apply one of the following:
 - 1. Two brush or spray coats at not less than 1.5 gal./100 sq. ft. for first coat and 1 gal./100 sq. ft. for second coat
 - 2. One fibered brush or spray coat at not less than 3 gal./100 sq. ft.
 - 3. One trowel coat at not less than 4 gal./100 sq. ft.
- B. Unparged Masonry Foundation Walls: Apply one of the following:
 - 1. Primer and two brush or spray coats at not less than 1.5 gal./100 sq. ft. for first coat and 1 gal./100 sq. ft. for second coat.
 - 2. Primer and one fibered brush or spray coat at not less than 3 gal./100 sq. ft.
 - 3. Primer and one trowel coat at not less than 5 gal./100 sq. ft..
- C. Unexposed Face of Concrete Retaining Walls: Apply one brush or spray coat at not less than 1.25 gal./100 sq. ft..
- D. Unexposed Face of Masonry Retaining Walls: Apply primer and one brush or spray coat at not less than 1.25 gal./100 sq. ft..
- E. Concrete Backup for Brick Veneer Assemblies: Apply one brush or spray coat at not less than 1 gal./100 sq. ft..

- F. Masonry Backup for Brick Veneer Assemblies: Apply primer and one brush or spray coat at not less than 1 gal./100 sq. ft..
- G. Exterior Face of Inner Wythe of Cavity Walls: Apply primer and one brush or spray coat at not less than 1 gal./100 sq. ft..
- H. Interior Face of Exterior Concrete Walls: Where above grade and indicated to be furred and finished, apply one brush or spray coat at not less than 1 gal./100 sq. ft..
- I. Interior Face of Single-Wythe Exterior Masonry Walls: Where above grade and indicated to be furred and finished, apply primer and one brush or spray coat at not less than 1 gal./100 sq. ft..

3.7 CLEANING

- A. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

END OF SECTION 071113

SECTION 071353 - ELASTOMERIC SHEET WATERPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes, but is not limited to:
 - 1. EPDM rubber sheet waterproofing.
 - 2. Butyl rubber sheet waterproofing.
- B. Related Requirements include, but are not limited to:
 - 1. Division 03 Section "Cast-in-Place Concrete".
 - 2. Division 04 Section "Unit Masonry".
 - 3. Division 07 Section "Bentonite Waterproofing" for Contractor option to use bentonite waterproofing in lieu of elastomeric sheet waterproofing.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review waterproofing requirements including surface preparation, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, and tested physical and performance properties of waterproofing.
 - 2. Include manufacturer's written instructions for evaluating, preparing, and treating substrate.
- B. Shop Drawings: Show locations and extent of waterproofing and details of substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.
 - 1. Include setting drawings showing layout, sizes, sections, profiles, and joint details of pedestal-supported concrete pavers.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Field quality-control reports.
- C. Sample Warranties: For special warranties.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by waterproofing manufacturer.
- B. Mockups: Build mockups to set quality standards for installation.
 - 1. Build for each typical waterproofing installation including accessories to demonstrate surface preparation, crack and joint treatment, corner treatment, and protection.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended in writing by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.
 - 1. Do not apply waterproofing in snow, rain, fog, or mist.
- B. Maintain adequate ventilation during preparation and application of waterproofing materials.

1.8 WARRANTY

- A. Manufacturer's Warranty: Manufacturer's standard materials-only warranty in which manufacturer agrees to furnish replacement waterproofing material for waterproofing that does not comply with requirements or that fails to remain watertight within specified warranty period.
 - 1. Warranty Period: 10 years from date of Substantial Completion.
- B. Installer's Special Warranty: Specified form, signed by Installer, covering Work of this Section, for warranty period of two years.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Source Limitations for Waterproofing System: Obtain waterproofing materials, protection course, and molded-sheet drainage panels from single source from single manufacturer.

2.2 SHEET WATERPROOFING

- A. EPDM Rubber Sheet: ASTM D 6134, Type I, 60-mil- thick flexible sheet, unreinforced, formed from EPDM.
 - 1. Basis of Design Product: Carlisle Coatings & Waterproofing Inc.; Sure-Seal EPDM.
- B. Butyl Rubber Sheet: ASTM D 6134, Type II, 90-mil- thick flexible sheet, unreinforced, formed from isobutylene-isoprene rubber.
 - 1. Basis of Design Product: Carlisle Coatings & Waterproofing Inc.; Sure-Seal Butyl.

2.3 AUXILIARY MATERIALS

- A. General: Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.

1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.
- B. Concealed Sheet Flashing: Same material, construction, and thickness as sheet waterproofing or 60-mil- thick, uncured EPDM, as required by manufacturer.
- C. Exposed Sheet Flashing: 60-mil- thick EPDM, cured or uncured, as required by manufacturer.
- D. Bonding Adhesives: For bonding waterproofing sheets and sheet flashings to substrates and projections.
- E. Splicing Cement and Cleaner: Single-component butyl splicing cement and solvent-based splice cleaner.
 1. Butyl Gum Tape: 30-mil- thick-by-6-1/4-inch- wide, uncured butyl with polyethylene release film.
- F. Lap Sealant: Single-component sealant.
- G. In-Seam Sealant: Single-component sealant.
- H. Water-Cutoff Mastic: Butyl mastic sealant.
- I. Waterproofing and Sheet-Flashing Accessories: Provide sealants, pourable sealers, cone and vent flashings, inside and outside corner flashings, termination reglets, and other accessories recommended by waterproofing manufacturer for intended use.
- J. Metal Termination Bars: Manufacturer's standard aluminum bars, approximately 1 inch wide, prepunched, with fasteners.
- K. Protection Course: One of the following:
 1. Semirigid sheets of asphalt-impregnated organic mat, mineral surface, with a nominal thickness of 1/8 inch.
 2. Protection Course: Fan folded, with a core of extruded-polystyrene board insulation, a nominal thickness of 1/4 inch, and a compressive strength of not less than 8 psi.

2.4 MOLDED-SHEET DRAINAGE PANELS

- A. At the Contractor's option, provide one of the following three types of Molded-Sheet Drainage Panels.
- B. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panel: Composite subsurface drainage panel consisting of a studded, nonbiodegradable, molded-plastic-sheet drainage core; with a nonwoven, needle-punched geotextile facing with an apparent opening size not exceeding No. 70 sieve laminated to one side of the core and a polymeric film bonded to the other side; and with a vertical flow rate of 9 to 15 gpm per ft..
 1. Basis of Design Product: Carlisle Coatings & Waterproofing Inc.; CCW MiraDRAIN 6000, CCW MiraDRAIN 6000XL, CCW MiraDRAIN 6200, or CCW MiraDRAIN 6200XL.
- C. Woven-Geotextile-Faced, Molded-Sheet Drainage Panel: Composite subsurface drainage panels consisting of a studded, nonbiodegradable, molded-plastic-sheet drainage core; with a woven-geotextile facing with an apparent opening size not exceeding No. 40 sieve laminated to one side of the core; and with a horizontal flow rate not less than 2.8 gpm per ft..
 1. Basis of Design Product: Carlisle Coatings & Waterproofing Inc.; CCW MiraDRAIN 9000 or CCW MiraDRAIN 9900.

- D. High-Capacity, Molded-Sheet Collector-Panel System: Composite subsurface collector-panel system by same manufacturer as primary molded-sheet drainage panels; consisting of a high-profile, studded, nonbiodegradable, molded-plastic-sheet drainage core; with a woven-geotextile facing with an apparent opening size not exceeding No. 40 sieve laminated to one side of the core; and with a vertical flow rate of 9 to 15 gpm per ft.
 - 1. Basis of Design Product: Carlisle Coatings & Waterproofing Inc.; CCW QuickDRAIN.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the waterproofing.
 - 1. Verify that concrete has cured and aged for minimum time period recommended in writing by waterproofing manufacturer.
 - 2. Verify that substrate is visibly dry and within the moisture limits recommended in writing by manufacturer. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

- A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.
- B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids.
- E. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.
- F. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions.

3.3 FULLY ADHERED SHEET INSTALLATION

- A. Install fully adhered sheets over entire area to receive waterproofing according to manufacturer's written instructions and recommendations in ASTM D 5843.
- B. Accurately align sheets and maintain uniform side and end laps of minimum dimensions required. Stagger end laps.
- C. Apply bonding adhesive to substrates at required rate and allow it to partially dry.
- D. Apply bonding adhesive to sheets and firmly adhere sheets to substrates. Do not apply bonding adhesive to splice area of sheet.
- E. Install fully adhered sheets and auxiliary materials to tie into existing waterproofing.

- F. Repair tears, voids, and lapped seams in waterproofing that do not comply with requirements. Slit and flatten fishmouths and blisters. Patch with sheet waterproofing extending beyond repaired areas in all directions.
- G. Horizontal Application: Apply sheets with side laps shingled with slope of deck where possible.

3.4 PARTIALLY ADHERED SHEET INSTALLATION

- A. Install partially adhered sheets over entire area to receive waterproofing according to manufacturer's written instructions.
- B. Accurately align sheets and maintain uniform side and end laps of minimum dimensions required. Stagger end laps.
- C. Apply bonding adhesive to the following areas of substrates and to each sheet at required rate and allow to partially dry:
 - 1. Upper 25 percent of length of each sheet and 18 inches around perimeter of each sheet.
- D. Firmly adhere sheets to substrate. Do not apply bonding adhesive to splice area of sheet.
- E. Install partially adhered sheets and auxiliary materials to tie into existing waterproofing.
- F. Repair tears, voids, and lapped seams in waterproofing that do not comply with requirements. Slit and flatten fishmouths and blisters. Patch with sheet waterproofing extending beyond repaired areas in all directions.

3.5 COMPARTMENTED, LOOSELY LAID SHEET INSTALLATION

- A. Install compartmented, loosely laid sheets over entire area to receive waterproofing according to manufacturer's written instructions.
- B. Accurately align sheets and maintain uniform side and end laps of minimum dimensions required. Stagger end laps.
- C. Apply continuous beads of water-cutoff mastic, of size recommended in writing by waterproofing manufacturer, to substrates in a 60-by-60-inch grid pattern before installing sheet.
- D. Apply sheets with side laps shingled with slope of deck where possible.
- E. Spread sealant bed over deck drain flange at deck drains and securely seal sheet waterproofing in place with clamping ring.
- F. Install compartmented, loosely laid sheets and auxiliary materials to tie into existing waterproofing.
- G. Repair tears, voids, and lapped seams in waterproofing that do not comply with requirements. Slit and flatten fishmouths and blisters. Patch with sheet waterproofing extending beyond repaired areas in all directions.

3.6 SEAM INSTALLATION

- A. Cement Splice: Clean splice areas, apply splicing cement and in-seam sealant, and firmly roll side and end laps of overlapping sheets according to manufacturer's written instructions to produce a splice not less than 6 inches wide and to ensure a watertight seam installation. Apply lap sealant and seal edges of sheet terminations.

- B. Cement and Tape Splice: Clean splice areas, apply splicing cement and butyl gum tape, and firmly roll side and end laps of overlapping sheets according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal edges of sheet terminations.

3.7 SHEET-FLASHING INSTALLATION

- A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to waterproofing manufacturer's written instructions.
- B. Form wall flashings using exposed sheet flashing.
- C. Terminate and seal top of sheet flashings with mechanically anchored termination bars.

3.8 PROTECTION COURSE INSTALLATION

- A. Install protection course over waterproofing membrane according to manufacturer's written instructions and before beginning subsequent construction operations. Minimize exposure of membrane.
 - 1. Molded-sheet drainage panels may be used in place of a separate protection course for vertical applications when approved by waterproofing manufacturer.

3.9 MOLDED-SHEET DRAINAGE-PANEL INSTALLATION

- A. Place and secure molded-sheet drainage panels, with geotextile facing away from wall or deck substrate, according to manufacturer's written instructions. Use adhesives or other methods that do not penetrate waterproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.
 - 1. For vertical applications, install protection course before installing drainage panels.

3.10 FIELD QUALITY CONTROL

- A. Engage a site representative qualified by waterproofing membrane manufacturer to inspect substrate conditions, surface preparation; membrane application, flashings, protection, and drainage components, and to furnish daily reports to Architect.
- B. Flood Testing: Flood test each deck area for leaks, according to recommendations in ASTM D 5957, after completing waterproofing but before overlying construction is placed. Install temporary containment assemblies, plug or dam drains, and flood with potable water.

3.11 PROTECTION, REPAIR, AND CLEANING

- A. Do not permit foot or vehicular traffic on unprotected membrane.
- B. Protect waterproofing from damage and wear during remainder of construction period.
- C. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.
- D. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 071353

SECTION 071700 - BENTONITE WATERPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes, but is not limited to:
 - 1. Bentonite waterproofing.
 - 2. Molded-sheet drainage panels.
- B. Related Sections include, but are not limited to:
 - 1. Division 03 Section "Cast-in-Place Concrete" for forms, waterstops, and concrete placement.
 - 2. Division 07 Section "Elastomeric Sheet Waterproofing" for Contractor option to use elastomeric sheet waterproofing in lieu of bentonite waterproofing.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include installation details for interface with other work, product specifications and manufacturer's written installation instructions.

1.4 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain bentonite waterproofing system from single source from single manufacturer. Obtain accessory products used with bentonite waterproofing from sources acceptable to bentonite waterproofing manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in manufacturer's original unopened and undamaged containers.
- B. Store materials in a dry, well-ventilated space.
- C. Remove and replace bentonite materials that have been prematurely exposed to moisture.

1.7 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit bentonite waterproofing to be installed according to manufacturers' written instructions and warranty requirements.
 - 1. Do not apply waterproofing materials to surfaces where ice or frost is visible. Do not apply bentonite waterproofing materials in areas with standing water.
 - 2. Placing bentonite clay products in panel or composite form on damp surfaces is allowed if approved in writing by manufacturer.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agree(s) to repair or replace components of bentonite waterproofing system that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 BENTONITE PANELS

- A. Coated Panels: 3/16-inch-thick, corrugated kraft-paper panels specially coated to resist premature hydration due to incidental moisture; filled with a minimum of 1.0 lb/sq. ft. of bentonite.
 - 1. Product: CETCO; Volclay Type 1-C.

2.2 INSTALLATION ACCESSORIES

- A. Granular Bentonite: Sodium bentonite clay containing a minimum of 90 percent montmorillonite (hydrated aluminum silicate), with a minimum of 90 percent passing a No. 20 sieve.
- B. Bentonite Mastic: Trowelable consistency, bentonite compound, specifically formulated for application at joints and penetrations.
- C. Granular Bentonite Tubes: Manufacturer's standard 2-inch- diameter, water-soluble tube containing approximately 1.5 lb/ft. of bentonite; hermetically sealed; designed specifically for placing on wall footings at line of joint with exterior base of wall.
- D. Plastic Protection Sheet: Polyethylene sheeting complying with ASTM D 4397; thickness recommended by waterproofing manufacturer to suit application but at least 6 mils thick.
- E. Cement Grout Patching Material: Manufacturer's recommended grout mix compatible with substrate being patched.
- F. Masonry Fasteners: Case-hardened nails or hardened-steel, powder-actuated fasteners. Depending on manufacturer's written requirements, provide 1/2- or 1-inch- diameter washers under fastener heads.
- G. Sealants: As recommended in writing by waterproofing manufacturer. Comply with requirements specified in Division 07 Section "Joint Sealants."
- H. Tapes: Waterproofing manufacturer's recommended tape for joints between sheets, membranes, or panels.
- I. Adhesive: Water-based adhesive used to secure waterproofing to both vertical and horizontal surfaces.
- J. Protection Course: ASTM D 6506, semirigid sheets of fiberglass or mineral-reinforced-asphaltic core, pressure laminated between two asphalt-saturated fibrous liners.
 - 1. Thickness For Vertical Applications: 1/8" nominal.
 - 2. Thickness For Horizontal Applications: 1/4 inch, nominal.

- K. Molded-Sheet Drainage Panel: Provide one of the following:
 - 1. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panel: Manufactured composite subsurface drainage panels consisting of a nonwoven, needle-punched geotextile facing with an apparent opening size not exceeding No. 70 sieve laminated to one side with or without a polymeric film bonded to the other side of a studded, nonbiodegradable, molded-plastic-sheet drainage core, with a vertical flow rate of 9 to 15 gpm per foot.
 - 2. Woven-Geotextile-Faced, Molded-Sheet Drainage Panel: Manufactured composite subsurface drainage panels consisting of a woven-geotextile facing with an apparent opening size not exceeding No. 40 sieve laminated to one side with or without a polymeric film bonded to the other side of a studded, nonbiodegradable, molded-plastic-sheet drainage core, with a horizontal flow rate not less than 2.8 gpm per foot .

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrate preparations affecting performance of bentonite waterproofing.
- B. Verify that substrate is complete and that work that will penetrate waterproofing is complete and rigidly installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Coordinate work in the vicinity of waterproofing to ensure proper conditions for installing the waterproofing system and to prevent damage to waterproofing after installation.
- B. Formed Concrete Surfaces: Remove fins and projections. Fill voids, rock pockets, form-tie holes, and other defects with bentonite mastic or cement grout patching material according to manufacturer's written instructions.
- C. Horizontal Concrete Surfaces: Remove debris, standing water, oily substances, mud, and similar substances that could impair the bonding ability of concrete or the effectiveness of waterproofing. Fill voids, cracks greater than 1/8 inch, honeycomb areas, and other defects with bentonite mastic or cement grout patching material according to manufacturer's written instructions.
- D. Excavation Support and Protection System: If water is seeping, use plastic protection sheets or other suitable means to prevent wetting the bentonite waterproofing. Fill minor gaps and spaces 1/8 inch wide or wider with wood, metal, concrete, or other appropriate filling material. Cover or fill large voids and crevices with cement mortar according to manufacturer's written instructions.

3.3 INSTALLATION, GENERAL

- A. Install waterproofing and accessories according to manufacturer's written instructions.
 - 1. Apply granular bentonite around penetrations in horizontal surfaces and changes in plane according to manufacturer's details in preparation for granular bentonite tubes and mastic.
 - 2. Apply granular bentonite tubes, bentonite mastic, or both at changes of plane, construction joints in substrate, projections, and penetrations.

- B. Apply granular bentonite tubes continuously on footing against base of wall to be waterproofed according to manufacturer's written instructions.
- C. Protect waterproofing from damage and wetting before and during subsequent construction operations. Repair punctures, tears, and cuts according to manufacturer's written instructions.
- D. Install protection course before backfilling or placing overburden when recommended by waterproofing manufacturer.

3.4 BENTONITE PANEL INSTALLATION

- A. General: Install a continuous layer of bentonite waterproofing panels with ends and edges lapped a minimum of 1-1/2 inches unless otherwise indicated. Stagger joints in adjoining panel rows.
- B. Concrete Walls: Starting at bottom of wall, apply waterproofing panels with ends and edges lapped and with vertical joints staggered. Secure with fasteners or adhesive recommended in writing by manufacturer. Extend to bottom of footing, grade beam, or wall.
 - 1. Horizontal-to-Vertical Transitions: Install granular bentonite tubes immediately before backfilling and compact backfill over the joint.
 - 2. Cover waterproofing panels with a lapped course of plastic protection sheets; remove plastic sheets before backfilling.

3.5 MOLDED-SHEET DRAINAGE PANEL INSTALLATION

- A. Place and secure molded-sheet drainage panels, with geotextile facing away from wall or deck substrate. Use adhesives that do not penetrate waterproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.
 - 1. For vertical applications, install protection course before installing drainage panels.

END OF SECTION 071700

SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes, but is not limited to:
 1. Foam-plastic board insulation.
 2. Glass-fiber blanket insulation (also referred to as "batt" insulation).
 3. Vapor retarders.
- B. Related Sections include, but are not limited to:
 1. Division 04 Section "Unit Masonry" for insulation installed in cavity walls.
 2. Division 07 Section "EPDM Roofing" for insulation specified as part of roofing construction.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.
- B. Research/Evaluation Reports: For foam-plastic insulation, from ICC-ES.

1.5 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect foam-plastic board insulation as follows:
 1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
 2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site before installation time.
 3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 FOAM-PLASTIC BOARD INSULATION

- A. Extruded-Polystyrene Board Insulation: ASTM C 578, of one of the following types and minimum compressive strengths indicated below, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.
 - 1. Type X, 15 psi.
 - 2. Type IV, 25 psi.
 - 3. Type VI, 40 psi.
 - 4. Type VII, 60 psi.
 - 5. Type V, 100 psi.
- B. Molded-Polystyrene Board Insulation: ASTM C 578, of one of the following types and minimum compressive strengths indicated below, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.
 - 1. Type I, 10 psi.
 - 2. Type II, 15 psi.
 - 3. Type VIII, 20 psi.
- C. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

2.2 GLASS-FIBER BLANKET INSULATION

- A. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
- B. Reinforced-Foil-Faced, Glass-Fiber Blanket Insulation: ASTM C 665, Type III (reflective faced), Class A (faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier), faced with foil scrim, foil-scrim kraft, or foil-scrim polyethylene.
- C. Foil-Faced, Glass-Fiber Blanket Insulation: ASTM C 665, Type III (reflective faced), Class B (faced surface with a flame-propagation resistance of 0.12 W/sq. cm); Category 1 (membrane is a vapor barrier), faced with foil scrim, foil-scrim kraft, or foil-scrim polyethylene.
- D. Sustainability Requirements: Provide glass-fiber blanket insulation as follows:
 - 1. Free of Formaldehyde: Insulation manufactured with 100 percent acrylic binders and no formaldehyde.
 - 2. Low Emitting: Insulation tested according to ASTM D 5116 and shown to emit less than 0.05-ppm formaldehyde.

2.3 INSULATION FASTENERS

- A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position indicated with self-locking washer in place.
 - 1. Plate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - 2. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation indicated.
- B. Adhesively Attached, Angle-Shaped, Spindle-Type Anchors: Angle welded to projecting spindle; capable of holding insulation of specified thickness securely in position indicated with self-locking washer in place.

1. Angle: Formed from 0.030-inch- thick, perforated, galvanized carbon-steel sheet with each leg 2 inches square.
 2. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation indicated.
- C. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick galvanized-steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches square or in diameter.
1. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in the following locations:
 - a. Crawl spaces.
 - b. Ceiling plenums.
 - c. Attic spaces.
 - d. Where indicated.
- D. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates indicated without damaging insulation, fasteners, and substrates.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean substrates of substances that are harmful to insulation or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.3 INSTALLATION OF BELOW-GRADE INSULATION

- A. On vertical footing and foundation wall surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.
 1. If not otherwise indicated, extend insulation a minimum of 24 inches below exterior grade line.
- B. On horizontal surfaces under slabs, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.
 1. If not otherwise indicated, extend insulation a minimum of 24 inches inward from exterior walls.

3.4 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

- A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
- B. Glass-Fiber or Foil-Faced Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
 - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
 - 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 - 3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
 - 4. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
 - 5. Vapor-Retarder-Faced Blankets: Tape joints and ruptures in vapor-retarder facings, and seal each continuous area of insulation to ensure airtight installation.
 - a. Exterior Walls: Set units with facing placed toward interior of construction.
- C. Where glass-fiber blankets are indicated for sound attenuation above ceilings, install blanket insulation over entire ceiling area in thicknesses indicated. Extend insulation 48 inches up either side of partitions.

3.5 INSTALLATION OF INSULATION IN CEILINGS FOR SOUND ATTENUATION

- A. Where glass fiber blankets are indicated for sound attenuation above ceilings, install blanket insulation over entire ceiling area in thickness indicated. Extend insulation 48 inches up both sides of partitions.

3.6 INSTALLATION OF INSULATION FOR CONCRETE SUBSTRATES

- A. Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors as follows:
 - 1. Fasten insulation anchors to concrete substrates with insulation anchor adhesive according to anchor manufacturer's written instructions. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness, and application indicated.
 - 2. After adhesive has dried, install board insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation below indicated thickness.
 - 3. Where insulation will not be covered by other building materials, apply capped washers to tips of spindles.

3.7 INSTALLATION OF CURTAIN-WALL INSULATION

- A. Install board insulation in curtain-wall construction where indicated on Drawings according to curtain-wall manufacturer's written instructions.
 - 1. Hold insulation in place by securing metal clips and straps or integral pockets within window frames, spaced at intervals recommended in writing by insulation manufacturer to hold insulation securely in place without touching spandrel glass. Maintain cavity width of dimension indicated between insulation and glass.

2. Install insulation where it contacts perimeter fire-containment system to prevent insulation from bowing under pressure from perimeter fire-containment system.

3.8 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 072100

SECTION 075323 - EPDM ROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes, but is not limited to:
 1. Adhered (EPDM) roofing system.
 2. Vapor retarder.
 3. Roof insulation.
- B. Related Requirements include, but are not limited to:
 1. Division 06 Section "Rough Carpentry" for wood nailers, curbs, and blocking.
 2. Division 07 Section "Sheet Metal Flashing and Trim" for metal roof flashings and counterflashings.
 3. Division 07 Section "Roof Accessories" for manufactured roof items.
 4. Division 07 Section "Joint Sealants" for joint sealants, joint fillers, and joint preparation.

1.3 DEFINITIONS

- A. EPDM: Ethylene-Propylene-Diene-Monomer.
- B. Roofing Terminology: Definitions in ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" apply to work of this Section.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Roofing Conference: Conduct conference at Project site.
 1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
 2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
 3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
 5. Review structural loading limitations of roof deck during and after roofing.
 6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
 7. Review governing regulations and requirements for insurance and certificates if applicable.
 8. Review temporary protection requirements for roofing system during and after installation.
 9. Review roof observation and repair procedures after roofing installation.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. For adhesives and sealants used inside the weatherproofing system, documentation including printed statement of VOC content.
 - 2. Laboratory Test Reports: For adhesives and sealants used inside the weatherproofing system, documentation indicating that products comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services) "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work, including:
 - 1. Base flashings and membrane terminations.
 - 2. Tapered insulation, including slopes.
 - 3. Roof plan showing orientation of steel roof deck and orientation of roofing and fastening spacings and patterns for mechanically fastened roofing.
 - 4. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and manufacturer.
- B. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
 - 1. Submit evidence of complying with performance requirements.
- C. Product Test Reports: For components of roofing system, tests performed by manufacturer and witnessed by a qualified testing agency.
- D. Research/Evaluation Reports: For components of roofing system, from ICC-ES.
- E. Field quality-control reports.
- F. Sample Warranties: For manufacturer's special warranties.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roofing system to include in maintenance manuals.

1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is UL listed or FM Global approved for roofing system identical to that used for this Project.
- B. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
 - 1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

1.10 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.11 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.
 - 1. Special warranty includes membrane roofing, base flashings, roof insulation, fasteners, cover boards, roofing accessories, and other components of roofing system.
 - 2. Warranty Period: 20 years from date of Substantial Completion.
- B. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering Work of this Section, including all components of roofing system such as membrane roofing, base flashing, roof insulation, fasteners, cover boards, substrate boards, vapor retarders, roof pavers, and walkway products, for the following warranty period:
 - 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain components including roof insulation and fasteners for roofing system from same manufacturer as membrane roofing or manufacturer approved by membrane roofing manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing and base flashings shall remain watertight.
 - 1. Accelerated Weathering: Roofing system shall withstand 2000 hours of exposure when tested according to ASTM G 152, ASTM G 154, or ASTM G 155.

2. Impact Resistance: Roofing system shall resist impact damage when tested according to ASTM D 3746 or ASTM D 4272.
- B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.
 - C. Roofing System Design: Tested by a qualified testing agency to resist the following uplift pressures:
 1. Corner Uplift Pressure: 28 lbf/sq. ft.
 2. Perimeter Uplift Pressure: 28 lbf/sq. ft.
 3. Field-of-Roof Uplift Pressure: 19 lbf/sq. ft.
 - D. FM Global Listing: Roofing, base flashings, and component materials shall comply with requirements in FM Global 4450 or FM Global 4470 as part of a roofing system, and shall be listed in FM Global's "RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Global markings.
 1. Fire/Windstorm Classification: Class 1A-60.
 2. Hail-Resistance Rating: MH.
 - E. Energy Star Listing: Roofing system shall be listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for low-slope roof products.
 - F. Exterior Fire-Test Exposure: ASTM E 108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - G. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated. Identify products with appropriate markings of applicable testing agency.

2.3 EPDM ROOFING

- A. EPDM: ASTM D 4637, Type I, nonreinforced, uniform, flexible EPDM sheet.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carlisle SynTec Incorporated.
 - b. Firestone Building Products.
 - c. GAF Materials Corporation.
 - d. GenFlex Roofing Systems.
 - e. Johns Manville.
 - f. Mule-Hide Products Co., Inc.
 - g. Versico Incorporated.
 2. Thickness: 60 mils, nominal.
 3. Exposed Face Color: White on black.

2.4 AUXILIARY ROOFING MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing.
 1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
 2. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content:
 - a. Plastic Foam Adhesives: 50 g/L.
 - b. Gypsum Board and Panel Adhesives: 50 g/L.

- c. Multipurpose Construction Adhesives: 70 g/L.
 - d. Fiberglass Adhesives: 80 g/L.
 - e. Single-Ply Roof Membrane Adhesives: 250 g/L.
 - f. Single-Ply Roof Membrane Sealants: 450 g/L.
 - g. Nonmembrane Roof Sealants: 300 g/L.
 - h. Sealant Primers for Nonporous Substrates: 250 g/L.
 - i. Sealant Primers for Porous Substrates: 775 g/L.
 - j. Other Adhesives and Sealants: 250 g/L.
3. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. Sheet Flashing: 60-mil- thick EPDM, partially cured or cured, according to application.
- C. Protection Sheet: Epichlorohydrin or neoprene nonreinforced flexible sheet, 55- to 60-mil- thick, recommended by EPDM manufacturer for resistance to hydrocarbons, non-aromatic solvents, grease, and oil.
- D. Bonding Adhesive: Manufacturer's standard.
- E. Seaming Material: Provide one of the following:
- 1. Single-component, butyl splicing adhesive and splice cleaner.
 - 2. Manufacturer's standard, synthetic-rubber polymer primer and 3-inch- wide minimum, butyl splice tape with release film.
- F. Lap Sealant: Manufacturer's standard, single-component sealant, colored to match membrane roofing.
- G. Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.
- H. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.
- I. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening membrane to substrate, and acceptable to roofing system manufacturer.
- J. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, molded pipe boot flashings, preformed inside and outside corner sheet flashings, reinforced EPDM securement strips, T-joint covers, in-seam sealants, termination reglets, cover strips, and other accessories.
- 1. Provide white flashing accessories for white EPDM membrane roofing.
- 2.5 VAPOR RETARDER
- A. Vapor Retarder: Provide one of the following:
- 1. Polyethylene Film: ASTM D 4397, 6 mils thick, minimum, with maximum permeance rating of 0.13 perm.
 - a. Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
 - b. Adhesive: Manufacturer's standard lap adhesive, FM Global approved for vapor-retarder application.

2. Laminated Sheet: Polyethylene laminate, two layers, reinforced with cord grid, with maximum permeance rating of 0.06 perm.
 - a. Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
3. Self-Adhering-Sheet Vapor Retarder: ASTM D 1970, polyethylene film laminated to layer of rubberized asphalt adhesive, minimum 40-mil- total thickness; maximum permeance rating of 0.1 perm; cold applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor-retarder manufacturer.
4. Self-Adhering-Sheet Vapor Retarder: Polyethylene film laminated to layer of butyl rubber adhesive, minimum 30-mil- total thickness; maximum permeance rating of 0.1 perm; cold applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor-retarder manufacturer.

2.6 ROOF INSULATION

- A. General: Preformed roof insulation boards manufactured or approved by EPDM roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated and that produce FM Global-approved roof insulation.
- B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.
- C. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches unless otherwise indicated.
- D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.7 INSULATION ACCESSORIES

- A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with roofing.
- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.
- C. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer, one of the following types:
 1. Modified asphaltic, asbestos-free, cold-applied adhesive.
 2. Bead-applied, low-rise, one-component or multicomponent urethane adhesive.
 3. Full-spread spray-applied, low-rise, two-component urethane adhesive.
- D. Cover Board: If required by roofing membrane manufacturer, provide one of the following:
 1. ASTM C 208, Type II, Grade 2, cellulosic-fiber insulation board, 1/2 inch thick.
 2. DOC PS 2, Exposure 1, oriented strand board, 7/16 inch thick.
 3. ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/2 inch thick.
 4. ASTM C 1278/C 1278M, cellulosic-fiber reinforced, water-resistant gypsum substrate, 1/2 inch thick.
- E. Protection Mat: Woven or nonwoven polypropylene, polyolefin, or polyester fabric, water permeable and resistant to UV degradation, type and weight as recommended by roofing system manufacturer for application.

2.8 ASPHALT MATERIALS

- A. Roofing Asphalt: One of the following:
 1. ASTM D 312, Type III
 2. ASTM D 312, Type IV
 3. ASTM D 6152, SEBS modified.

- B. Asphalt Primer: ASTM D 41/D 41M.

2.9 WALKWAYS

- A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, solid-rubber, slip-resisting, surface-textured walkway pads or rolls, approximately 3/16 inch thick and acceptable to roofing system manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work:
 1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
 2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
 3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Division 05 Section "Steel Decking."
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

3.3 ROOFING INSTALLATION, GENERAL

- A. Install roofing system according to roofing system manufacturer's written instructions.
- B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.
- C. Install roofing and auxiliary materials to tie in to existing roofing to maintain weathertightness of transition and to not void warranty for existing roofing system.

3.4 VAPOR-RETARDER INSTALLATION

- A. Polyethylene Film: Loosely lay polyethylene-film vapor retarder in a single layer over area to receive vapor retarder, side and end lapping each sheet a minimum of 2 inches and 6 inches, respectively. Continuously seal side and end laps with tape or adhesive.

- B. Laminate Sheet: Loosely lay laminate-sheet vapor retarder in a single layer over area to receive vapor retarder, side and end lapping each sheet a minimum of 2 inches and 6 inches, respectively. Continuously seal side and end laps with tape.
- C. Self-Adhering-Sheet Vapor Retarder: Prime substrate if required by manufacturer. Install self-adhering-sheet vapor retarder over area to receive vapor retarder, side and end lapping each sheet a minimum of 3-1/2 inches and 6 inches, respectively. Seal laps by rolling.
- D. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into roofing system.

3.5 INSULATION INSTALLATION

- A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.
- B. Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.
- C. Install tapered insulation under area of roofing to conform to slopes indicated.
- D. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches or greater, install two (2) or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.
- E. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.
- F. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.
 1. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
- G. Mechanically Fastened Insulation: Install each layer of insulation and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
 1. Fasten insulation according to requirements in FM Global's "RoofNav" for specified Windstorm Resistance Classification.
 2. Fasten insulation to resist uplift pressure at corners, perimeter, and field of roof.
- H. Loosely Laid Insulation: Loosely lay insulation units over substrate.
- I. If required by membrane manufacturer, install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction. Loosely butt cover boards together.
 1. Fasten cover boards according to requirements in FM Global's "RoofNav" for specified Windstorm Resistance Classification.
 2. Fasten cover boards to resist uplift pressure at corners, perimeter, and field of roof.

3.6 ADHERED MEMBRANE ROOFING INSTALLATION

- A. Adhere roofing over area to receive roofing according to membrane roofing system manufacturer's written instructions. Unroll membrane roofing and allow to relax before installing.

- B. Start installation of roofing in presence of roofing system manufacturer's technical personnel.
- C. Accurately align roofing, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- D. Bonding Adhesive: Apply to substrate and underside of roofing at rate required by manufacturer, and allow to partially dry before installing roofing. Do not apply to splice area of roofing.
- E. Hot Roofing Asphalt: Apply a solid mopping of hot roofing asphalt to substrate at temperature and rate required by manufacturer, and install fabric-backed roofing. Do not apply to splice area of roofing.
- F. In addition to adhering, mechanically fasten roofing securely at terminations, penetrations, and perimeters.
- G. Apply roofing with side laps shingled with slope of roof deck where possible.
- H. Adhesive Seam Installation: Clean both faces of splice areas, apply splicing cement, and firmly roll side and end laps of overlapping roofing according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of roofing terminations.
 - 1. Apply a continuous bead of in-seam sealant before closing splice if required by roofing system manufacturer.
- I. Tape Seam Installation: Clean and prime both faces of splice areas, apply splice tape, and firmly roll side and end laps of overlapping roofing according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of roofing terminations.
- J. Repair tears, voids, and lapped seams in roofing that do not comply with requirements.
- K. Spread sealant or mastic bed over deck-drain flange at roof drains, and securely seal membrane roofing in place with clamping ring.

3.7 BASE FLASHING INSTALLATION

- A. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing system manufacturer's written instructions.
- B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
- D. Clean splice areas, apply splicing cement, and firmly roll side and end laps of overlapping sheets to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.
- E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.8 WALKWAY INSTALLATION

- A. Flexible Walkways: Install walkway products in locations indicated. Adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.9 FIELD QUALITY CONTROL

- A. Testing Agency: Owner may engage a qualified testing agency to inspect substrate conditions, surface preparation, membrane application, flashings, protection, and drainage components, and to furnish reports to Architect.
- B. Flood Testing: Flood test each roofing area for leaks, according to recommendations in ASTM D 5957, after completing roofing and flashing but before overlying construction is placed. Install temporary containment assemblies, plug or dam drains, and flood with potable water.
 - 1. Flood to an average depth of 2-1/2 inches with a minimum depth of 1 inch and not exceeding a depth of 4 inches. Maintain 2 inches of clearance from top of base flashing.
 - 2. Flood each area for 48 hours.
 - 3. After flood testing, repair leaks, repeat flood tests, and make further repairs until roofing and flashing installations are watertight.
- C. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.
- D. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.10 PROTECTING AND CLEANING

- A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
- B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements, repair substrates, and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 075323

ROOFING INSTALLER'S WARRANTY

- A. WHEREAS _____ of _____, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:
1. Owner: Lynchburg Department of Parks and Recreation.
 2. Address: 301 Grove Street, Lynchburg, VA 24501.
 3. Building Name/Type: Miller Center.
 4. Address: 301 Grove Street, Lynchburg, VA 24501.
 5. Area of Work: Addition and Existing Building.
 6. Acceptance Date: _____.
 7. Warranty Period: Two (2) years.
 8. Expiration Date: _____.
- B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,
- C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.
- D. This Warranty is made subject to the following terms and conditions:
1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
 - a. Lightning;
 - b. Peak gust wind speed exceeding 90 mph.
 - c. Fire;
 - d. Failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
 - e. Faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
 - f. Vapor condensation on bottom of roofing; and
 - g. Activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by owner.
 2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
 3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
 4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
 5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall

become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.

6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this _____ day of _____, 20__.

1. Authorized Signature: _____.
2. Name: _____.
3. Title: _____.

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes, but is not limited to:
 1. Manufactured through-wall flashing.
 2. Manufactured reglets with counterflashing.
 3. Formed roof-drainage sheet metal fabrications.
 4. Formed low-slope roof sheet metal fabrications.
- B. Related Requirements include, but are not limited to:
 1. Division 06 Section "Rough Carpentry" for wood nailers, curbs, and blocking.
 2. Division 07 Section "Roof Accessories" for set-on-type curbs roof hatches, and other manufactured roof accessory units.

1.3 COORDINATION

- A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.
- B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 1. Review construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 2. Review special roof details, roof drainage, roof-penetration flashing, equipment curbs, and condition of other construction that affect sheet metal flashing and trim.
 3. Review requirements for insurance and certificates if applicable.
 4. Review sheet metal flashing observation and repair procedures after flashing installation.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product, include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.
- B. Shop Drawings: For sheet metal flashing and trim.
 1. Include field measurements of existing sheet metal roof drainage items.
 2. Include plans, elevations, sections, and attachment details.
 3. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work.
 4. Include identification of material, thickness, weight, and finish for each item and location in Project.
 5. Include details for forming, including profiles, shapes, seams, and dimensions.

6. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
 7. Include details of termination points and assemblies.
 8. Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
 9. Include details of roof-penetration flashing.
 10. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings as applicable.
 11. Include details of special conditions.
 12. Include details of connections to adjoining work.
 13. Detail formed flashing and trim at scale of not less than 3 inches per foot.
- C. Samples for Initial Selection: For each type of sheet metal and accessory indicated with factory-applied finishes.
- D. Samples for Verification: For each type of exposed finish.
1. Sheet Metal Flashing: 12 inches long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.
- 1.6 INFORMATIONAL SUBMITTALS
- A. Qualification Data: For fabricator.
 - B. Product Test Reports: For each product, for tests performed by a qualified testing agency.
 - C. Sample Warranty: For special warranty.
- 1.7 CLOSEOUT SUBMITTALS
- A. Maintenance Data: For sheet metal flashing and trim, and its accessories, to include in maintenance manuals.
- 1.8 QUALITY ASSURANCE
- A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.
 - B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
 1. Build mockup of typical roof drainage, including through-wall scupper and collector box, including seams, attachments and accessories.
 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- 1.9 DELIVERY, STORAGE, AND HANDLING
- A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.

- B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.10 FIELD CONDITIONS

- A. Work of this section involves fabrication of sheet metal items to match existing construction. Verify dimensions and details of existing sheet metal roof drainage items by field measurements before fabrication and indicate measurements on Shop Drawings.

1.11 WARRANTY

- A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
- B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.
- B. Aluminum Sheet: ASTM B 209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with smooth, flat surface.
 - 1. Exposed Coil-Coated Finish: Provide one of the following:
 - a. Two-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - b. FEVE Fluoropolymer: AAMA 620. Two-coat fluoropolymer finish containing 100 percent fluorinated ethylene vinyl ether resin in color coat. Prepare, pretreat, and

apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

2. Color for exposed items: White.
3. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.

- C. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304, dead soft, fully annealed; with smooth, flat surface.

2.3 UNDERLAYMENT MATERIALS

- A. Felt: ASTM D 226/D 226M, Type II (No. 30), asphalt-saturated organic felt; nonperforated.
- B. Synthetic Underlayment: Laminated or reinforced, woven polyethylene or polypropylene, synthetic roofing underlayment; bitumen free; slip resistant; suitable for high temperatures over 220 deg F; and complying with physical requirements of ASTM D 226/D 226M for Type I and Type II felts.
- C. Self-Adhering, High-Temperature Sheet: Minimum 30 mils thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer according to written recommendations of underlayment manufacturer.
 1. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F or higher.
 2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F or lower.
- D. Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft. minimum.

2.4 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.
 1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
 - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
 - b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
 2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
 3. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
- C. Solder for Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.
- D. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.

- E. Elastomeric Sealant: ASTM C 920, elastomeric polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- F. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
- G. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.
- H. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.
- I. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.5 MANUFACTURED SHEET METAL FLASHING AND TRIM

- A. Ribbed, Sheet Metal Flashing Under Stone Coping: Manufacture through-wall sheet metal flashing for embedment in masonry, with ribs at 3-inch intervals along length of flashing to provide integral mortar bond.
 1. Stainless Steel: 0.016 inch thick.
- B. Reglets: Units of type, material, and profile required, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with factory-mitered and -welded corners and junctions and with interlocking counterflashing on exterior face, of same metal as reglet.
 1. Material: Stainless steel, 0.019 inch thick or aluminum, 0.024 inch thick.
 2. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
 3. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.
 4. Accessories:
 - a. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.
 - b. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing's lower edge.
 5. Finish: Manufacturer's standard color coating.

2.6 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
 1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
 2. Obtain field measurements for accurate fit before shop fabrication.
 3. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
 4. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

- B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
- C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
 - 1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
 - 2. Use lapped expansion joints only where indicated on Drawings.
- D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.
- E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- F. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.
- G. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints where necessary for strength.
- H. Do not use graphite pencils to mark metal surfaces.

2.7 ROOF-DRAINAGE SHEET METAL FABRICATIONS

- A. Downspouts: Fabricate round downspouts to dimensions indicated, complete with mitered elbows. Furnish with metal hangers from same material as downspouts and anchors.
 - 1. Fabricated Hanger Style: Fig 1-35H according to SMACNA's "Architectural Sheet Metal Manual."
 - 2. Fabricate from Aluminum: 0.024 inch thick.
- B. Parapet Scuppers: Fabricate scuppers to dimensions required, with closure flange trim to exterior, 4-inch- wide wall flanges to interior, and base extending 4 inches beyond cant or tapered strip into field of roof. Fabricate from Aluminum: 0.032 inch thick.
- C. Conductor Heads: Fabricate conductor heads with flanged back and stiffened top edge and of dimensions and shape required, complete with outlet tubes, exterior flange trim, and built-in overflows. Fabricate from Aluminum: 0.032 inch thick.

2.8 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Roof Edge Flashing (Gravel Stop) and Fascia Cap: Fabricate in minimum 96-inch- long, but not exceeding 12-foot- long sections. Furnish with 6-inch- wide, joint cover plates. Shop fabricate interior and exterior corners.
 - 1. Joint Style: Butted with expansion space and 6-inch- wide, concealed backup plate.
 - 2. Fabricate from Aluminum: 0.050 inch thick.
- B. Roof-to-Wall Transition Expansion-Joint Cover: Fabricate from Aluminum: 0.050 inch thick.
- C. Counterflashing: Shop fabricate interior and exterior corners. Fabricate from Aluminum: 0.032 inch thickness.
- D. Flashing Receivers: Fabricate from the Aluminum: 0.032 inch minimum thickness.

2.9 WALL SHEET METAL FABRICATIONS

- A. Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch- long, but not exceeding 12-foot- long, sections, under copings, and at shelf angles. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches beyond each side of wall openings; and form with 2-inch- high, end dams. Fabricate from one of the following materials:
1. Stainless Steel: 0.016 inch thick.
 2. Zinc-Tin Alloy-Coated Stainless Steel: 0.015 inch thick.
 3. Copper-Clad Stainless Steel: 0.016 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.
1. Verify compliance with requirements for installation tolerances of substrates.
 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
 3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

- A. Felt Underlayment: Install felt underlayment, wrinkle free, using adhesive to minimize use of mechanical fasteners under sheet metal flashing and trim. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches.
- B. Synthetic Underlayment: Install synthetic underlayment, wrinkle free, according to manufacturers' written instructions, and using adhesive where possible to minimize use of mechanical fasteners under sheet metal.
- C. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Prime substrate if recommended by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps and edges with roller. Cover underlayment within 14 days.
- D. Apply slip sheet, wrinkle free, directly on substrate before installing sheet metal flashing and trim.

3.3 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.

2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
 3. Space cleats not more than 12 inches apart. Attach each cleat with at least two (2) fasteners. Bend tabs over fasteners.
 4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
 5. Torch cutting of sheet metal flashing and trim is not permitted.
 6. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
1. Coat concealed side of uncoated-aluminum and stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
 2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.
1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
 2. Use lapped expansion joints only where indicated on Drawings.
- D. Fasteners: Use fastener sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.
- E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- F. Seal joints as required for watertight construction.
1. Use sealant-filled joints unless otherwise indicated. Embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
 2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."
- G. Rivets: Rivet joints in uncoated aluminum where necessary for strength.

3.4 ROOF-DRAINAGE SYSTEM INSTALLATION

- A. General: Install sheet metal roof-drainage items to produce complete roof-drainage system according to cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.
- B. Downspouts: Join sections with 1-1/2-inch telescoping joints.
1. Provide hangers with fasteners designed to hold downspouts securely to walls. Locate hangers at top and bottom and at approximately 60 inches o.c.
 2. Provide elbows at base of downspout to direct water away from building.

- C. Parapet Scuppers: Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.
 1. Anchor scupper closure trim flange to exterior wall and seal with elastomeric sealant to scupper.
 2. Loosely lock front edge of scupper with conductor head.
 3. Seal with elastomeric sealant exterior wall scupper flanges into back of conductor head.
- D. Conductor Heads: Anchor securely to wall, with elevation of conductor head rim at minimum of 1 inch below scupper discharge.
- E. Expansion-Joint Covers: Install expansion-joint covers at locations and of configuration indicated. Lap joints minimum of 4 inches in direction of water flow.

3.5 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and cited sheet metal standard. Provide concealed fasteners where possible, and set units true to line, levels, and slopes. Install work with laps, joints, and seams that are permanently watertight and weather resistant.
- B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3-inch centers.
- C. Copings: Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated.
 1. Interlock exterior bottom edge of coping with continuous cleat anchored to substrate at 16-inch centers.
 2. Anchor interior leg of coping with washers and screw fasteners through slotted holes at 24-inch centers.
- D. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints minimum of 4 inches. Secure in waterproof manner by means of interlocking folded seam or blind rivets and sealant unless otherwise indicated.

3.6 WALL FLASHING INSTALLATION

- A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.
- B. Through-Wall Flashing: Installation of through-wall flashing is specified in Division 04 Section "Unit Masonry".
- C. Reglets: Installation of reglets is specified in Division 04 Section "Unit Masonry."

3.7 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.8 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean off excess sealants.
- C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended by sheet metal flashing and trim manufacturer. Maintain sheet metal flashing and trim in clean condition during construction.
- D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 076200

SECTION 077200 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes, but is not limited to:
 1. Roof curbs.
 2. Roof hatches.
 3. Preformed flashing sleeves.
 4. Downspout nozzles.
- B. Related Sections include, but are not limited to:
 1. Division 05 Section "Metal Fabrications" for metal vertical ladders for access to roof hatches.
 2. Division 07 Section "Sheet Metal Flashing and Trim" for shop- and field-formed metal flashing, roof-drainage systems, roof expansion-joint covers, and miscellaneous sheet metal trim and accessories.

1.3 PERFORMANCE REQUIREMENTS

- A. General Performance: Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of roof accessory indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For roof accessories. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.

1.5 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.

1.7 COORDINATION

- A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

- B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1.8 WARRANTY

- A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finishes or replace roof accessories that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 METAL MATERIALS

- A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation.
- B. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, AZ50 coated.
- C. Aluminum Sheet: ASTM B 209, manufacturer's standard alloy for finish required, with temper to suit forming operations and performance required.
 - 1. Exposed Coil-Coated Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Two-Coat Fluoropolymer Finish: AAMA 620. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.
 - 2. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of 0.5 mil.
- D. Aluminum Extrusions and Tubes: ASTM B 221, manufacturer's standard alloy and temper for type of use, finished to match assembly where used, otherwise mill finished.
- E. Copper Sheet: ASTM B 370, manufacturer's standard temper.
- F. Stainless-Steel Sheet and Shapes: ASTM A 240/A 240M or ASTM A 666, Type 304.

2.2 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.
- B. Insulation:
 - 1. Cellulosic-Fiber Board Insulation: ASTM C 208, Type II, Grade 1, thickness as indicated.
 - 2. Glass-Fiber Board Insulation: ASTM C 726, thickness as indicated.
 - 3. Polyisocyanurate Board Insulation: ASTM C 1289, thickness as indicated.
- C. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction, containing no arsenic or chromium, and complying with AWPA C2; not less than 1-1/2 inches thick.
- D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

- E. Underlayment:
 - 1. Felt: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
 - 2. Polyethylene Sheet: 6-mil- thick polyethylene sheet complying with ASTM D 4397.
 - 3. Slip Sheet: Building paper, 3-lb/100 sq. ft. minimum, rosin sized.

- F. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:
 - 1. Fasteners for Zinc-Coated or Aluminum-Zinc Alloy-Coated Steel: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A 153/A 153M or ASTM F 2329.
 - 2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
 - 3. Fasteners for Copper Sheet: Copper, hardware bronze, or passivated Series 300 stainless steel.
 - 4. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.

- G. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.

- H. Elastomeric Sealant: ASTM C 920, elastomeric polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.

- I. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.

- J. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.3 ROOF CURBS

- A. Roof Curbs: Internally reinforced roof-curb units with integral spring-type vibration isolators and capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings; with welded or mechanically fastened and sealed corner joints, and integrally formed deck-mounting flange at perimeter bottom.

- B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.

- C. Material: Zinc-coated (galvanized) or Aluminum-zinc alloy-coated steel sheet, 0.079 inch thick.

- D. Construction:
 - 1. Insulation: Factory insulated with 1-1/2-inch- thick cellulosic or glass-fiber board insulation.
 - 2. Liner: Same material as curb, of manufacturer's standard thickness and finish.
 - 3. Factory-installed wood nailer at top of curb, continuous around curb perimeter.
 - 4. Fabricate curbs to minimum height of 12 inches unless otherwise indicated.
 - 5. Top Surface: Level around perimeter with roof slope accommodated by sloping the deck-mounting flange.
 - 6. Sloping Roofs: Where roof slope exceeds 1:48, fabricate curb with perimeter curb height tapered to accommodate roof slope so that top surface of perimeter curb is level. Equip unit with water diverter or cricket on side that obstructs water flow.

2.4 ROOF HATCH

- A. Roof Hatches: Metal roof-hatch units with lids and insulated double-walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing and weathertight perimeter gasketing, and integrally formed deck-mounting flange at perimeter bottom.
- B. Type and Size: Single-leaf lid, 30 by 36 inches.
- C. Loads: Minimum 40-lbf/sq. ft. external live load and 20-lbf/sq. ft. internal uplift load.
- D. Hatch Material: Zinc-coated (galvanized) or Aluminum-zinc alloy-coated steel sheet, 0.079 inch thick.
- E. Construction:
 - 1. Insulation: Cellulosic-fiber, Glass-fiber, or Polyisocyanurate board.
 - 2. Hatch Lid: Opaque, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.
 - 3. Curb Liner: Manufacturer's standard, of same material and finish as metal curb.
 - 4. Fabricate curbs to minimum height of 12 inches unless otherwise indicated.
 - 5. Sloping Roofs: Where slope or roof deck exceeds 1:48, fabricate curb with perimeter curb height that is tapered to accommodate roof slope so that top surfaces of perimeter curb are level. Equip hatch with water diverter or cricket on side that obstructs water flow.
- F. Hardware: Stainless-steel spring latch with turn handles, butt- or pintle-type hinge system, and padlock hasps inside and outside.
- G. Ladder-Assist Post: Roof-hatch manufacturer's standard device for attachment to roof-access ladder.
 - 1. Operation: Post locks in place on full extension; release mechanism returns post to closed position.
 - 2. Height: 42 inches above finished roof deck.
 - 3. Material: Steel tube, Stainless steel, or Aluminum.
 - 4. Post: 1-5/8-inch- diameter pipe.
 - 5. Finish: Manufacturer's standard baked enamel or powder coat.
 - a. Color: As selected by Architect from manufacturer's full range of available colors.

2.5 PREFORMED FLASHING SLEEVES

- A. Exhaust Vent Flashing: Double-walled metal flashing sleeve or boot, insulation filled, with integral deck flange, 12 inches high, with removable metal hood and slotted or perforated metal collar.
 - 1. Metal: Aluminum sheet, 0.063 inch thick.
 - 2. Finish: Manufacturer's standard.
- B. Vent Stack Flashing: Metal flashing sleeve, uninsulated, with integral deck flange.

2.6 DOWNSPOUT NOZZLES

- A. Downspout Nozzle: "Lamb's Tongue" style downspout nozzle specifically designed for use as a drain component. Nozzle design shall divert water away from the building. Wall flange shall cover the rough opening. Machined nozzle shall slide over pipe.
 - 1. Material: Cast bronze nozzle and flange.
 - 2. Basis of Design Product: Jay R. Smith Mfg. Co. Series #1771.

2.7 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
- B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
- C. Verify dimensions of roof openings for roof accessories.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install roof accessories according to manufacturer's written instructions.
 - 1. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.
 - 2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
 - 3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
 - 4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.
- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
 - 1. Coat concealed side of uncoated aluminum and stainless-steel roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
 - 2. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet, or install a course of polyethylene sheet.
 - 3. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof accessories for waterproof performance.
- C. Roof Curb Installation: Install each roof curb so top surface is level.
- D. Roof-Hatch Installation:
 - 1. Install roof hatch so top surface of hatch curb is level.
 - 2. Verify that roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.
 - 3. Attach ladder-assist post according to manufacturer's written instructions.
- E. Preformed Flashing-Sleeve Installation: Secure flashing sleeve to roof membrane according to flashing-sleeve manufacturer's written instructions.

- F. Seal joints with elastomeric or butyl sealant as required by roof accessory manufacturer.

3.3 REPAIR AND CLEANING

- A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A 780.
- B. Touch up factory-primed surfaces with compatible primer ready for field painting according to Division 09 Section "Exterior Painting".
- C. Clean exposed surfaces according to manufacturer's written instructions.
- D. Clean off excess sealants.
- E. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 077200

SECTION 078413 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes, but is not limited to:
 - 1. Penetrations in fire-resistance-rated walls.
 - 2. Penetrations in horizontal assemblies.
 - 3. Penetrations in smoke barriers.
- B. Applications of Penetration Firestopping include, but are not limited to:
 - 1. Metallic pipes, conduit, or tubing.
 - 2. Nonmetallic pipe, conduit, or tubing.
 - 3. Electrical cables.
 - 4. Insulated pipes.
 - 5. Miscellaneous mechanical penetrants.
 - 6. Miscellaneous electrical penetrants.
 - 7. Groupings of penetrants.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. For penetration firestopping sealants and sealant primers, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. Penetration Firestopping Schedule: For each penetration firestopping system. Include location and design designation of qualified testing and inspecting agency.
 - 1. Format: Organize schedule in the following format for each system:
 - a. Location.
 - b. System Designation (UL, Intertek, or FM Global).
 - c. Product(s).
 - d. Type of fill materials.
 - e. F-Rating.
 - f. T-Rating.
 - g. L-Rating at Ambient.
 - h. L-Rating at 400 deg. F.
 - i. W-Rating.
 - 2. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping condition, submit illustration, with modifications marked, approved by penetration firestopping manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.

- B. Installer Certificates: From Installer indicating penetration firestopping has been installed in compliance with requirements and manufacturer's written recommendations.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for penetration firestopping.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."
- B. Installer Qualifications: A firm experienced in installing penetration firestopping similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its penetration firestopping products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.
- C. Fire-Test-Response Characteristics: Penetration firestopping shall comply with the following requirements:
 - 1. Penetration firestopping tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
 - 2. Penetration firestopping is identical to those tested per testing standard referenced in "Penetration Firestopping" Article. Provide rated systems complying with the following requirements:
 - a. Penetration firestopping products bear classification marking of qualified testing and inspecting agency.
 - b. Classification markings on penetration firestopping correspond to designations listed by one of the following:
 - 1) UL in its "Fire Resistance Directory."
 - 2) Intertek ETL SEMKO in its "Directory of Listed Building Products."
 - 3) FM Global in its "Building Materials Approval Guide."
- D. Preinstallation Conference: Conduct conference at Project site.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install penetration firestopping when ambient or substrate temperatures are outside limits permitted by penetration firestopping manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.
- B. Install and cure penetration firestopping per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.7 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping is installed according to specified requirements.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping.
- C. Notify Owner's testing agency at least seven days in advance of penetration firestopping installations; confirm dates and times on day preceding each series of installations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. A/D Fire Protection Systems Inc.
 2. Grace Construction Products.
 3. Hilti, Inc.
 4. Johns Manville.
 5. Nelson Firestop Products.
 6. NUCO Inc.
 7. Passive Fire Protection Partners.
 8. RectorSeal Corporation.
 9. Specified Technologies Inc.
 10. 3M Fire Protection Products.
 11. Tremco, Inc.; Tremco Fire Protection Systems Group.
 12. USG Corporation.

2.2 PENETRATION FIRESTOPPING

- A. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.
- B. Penetrations in Fire-Resistance-Rated Walls: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
1. Fire-resistance-rated walls include fire-barrier walls, smoke-barrier walls, and fire partitions.
 2. F-Rating: Not less than the fire-resistance rating of constructions penetrated.
- C. Penetrations in Horizontal Assemblies: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
1. Horizontal assemblies include floors, floor/ceiling assemblies, and ceiling membranes of roof/ceiling assemblies.
 2. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.
 3. T-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
- D. Penetrations in Smoke Barriers: Provide penetration firestopping with ratings determined per UL 1479.
1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at 0.30-inch wg at both ambient and elevated temperatures.
- E. W-Rating: Provide penetration firestopping showing no evidence of water leakage when tested according to UL 1479.
- F. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

- G. VOC Content: Penetration firestopping sealants and sealant primers shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - 1. Sealants: 250 g/L.
 - 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 - 3. Sealant Primers for Porous Substrates: 775 g/L.
- H. Low-Emitting Materials: Penetration firestopping sealants and sealant primers shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- I. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.
 - 1. Permanent forming/damming/backing materials, including the following:
 - a. Slag-wool-fiber or rock-wool-fiber insulation.
 - b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
 - c. Fire-rated form board.
 - d. Fillers for sealants.
 - 2. Temporary forming materials.
 - 3. Substrate primers.
 - 4. Collars.
 - 5. Steel sleeves.

2.3 FILL MATERIALS

- A. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.
- B. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.
- C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.
- D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized-steel sheet.
- E. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.
- F. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.
- G. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.
- H. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant

additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.

- I. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.
- J. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:
 - 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and sloped surfaces, unless indicated firestopping limits use of nonsag grade for both opening conditions.

2.4 MIXING

- A. For those products requiring mixing before application, comply with penetration firestopping manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning: Clean out openings immediately before installing penetration firestopping to comply with manufacturer's written instructions and with the following requirements:
 - 1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping.
 - 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping. Remove loose particles remaining from cleaning operation.
 - 3. Remove laitance and form-release agents from concrete.
- B. Priming: Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- C. Masking Tape: Use masking tape to prevent penetration firestopping from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing firestopping's seal with substrates.

3.3 INSTALLATION

- A. General: Install penetration firestopping to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

- B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
 - 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestopping.
- C. Install fill materials for firestopping by proven techniques to produce the following results:
 - 1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
 - 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 - 3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

- A. Identify penetration firestopping with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of firestopping edge so labels will be visible to anyone seeking to remove penetrating items or firestopping. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
 - 1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
 - 2. Contractor's name, address, and phone number.
 - 3. Designation of applicable testing and inspecting agency.
 - 4. Date of installation.
 - 5. Manufacturer's name.
 - 6. Installer's name.

3.5 FIELD QUALITY CONTROL

- A. Owner may engage a qualified testing agency to perform tests and inspections.
- B. Where deficiencies are found or penetration firestopping is damaged or removed because of testing, repair or replace penetration firestopping to comply with requirements.
- C. Proceed with enclosing penetration firestopping with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

- A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping is without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping and install new materials to produce systems complying with specified requirements.

END OF SECTION 078413

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes, but is not limited to:
 1. Silicone joint sealants.
 2. Urethane joint sealants.
 3. Polysulfide joint sealants.
 4. Latex joint sealants.
 5. Solvent-release-curing joint sealants.
 6. Preformed joint sealants.
 7. Acoustical joint sealants.
- B. Related Sections include, but are not limited to:
 1. Division 04 Section "Unit Masonry" for masonry control and expansion joint fillers and gaskets.
 2. Division 08 Section "Glazing" for glazing sealants.
 3. Division 09 Section "Gypsum Board" for sealing perimeter joints.
 4. Division 09 Section "Tiling" for sealing tile joints.
 5. Division 09 Section "Acoustical Panel Ceilings" for sealing edge moldings at perimeters with acoustical sealant.

1.3 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
 1. For interior sealants and sealant primers, include printed statement of VOC content and documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. Samples for Initial Selection: Manufacturer's color samples consisting of actual strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Joint-Sealant Schedule: Include the following information:
 1. Joint-sealant application, joint location, and designation.
 2. Joint-sealant manufacturer and product name.
 3. Joint-sealant formulation.
 4. Joint-sealant color.

1.4 INFORMATIONAL SUBMITTALS

- A. Warranties: Sample of special warranties.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

- B. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.
- C. Product Testing: Test joint sealants using a qualified testing agency.
 - 1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.
 - 2. Test according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C 920 for adhesion and cohesion under cyclic movement, adhesion-in-peel, and indentation hardness.

1.6 PROJECT CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
 - 2. When joint substrates are wet.
 - 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 - 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.7 WARRANTY

- A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Two (2) years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Two (2) years from date of Substantial Completion.
- C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
 - 1. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
 - 2. Disintegration of joint substrates from natural causes exceeding design specifications.
 - 3. Mechanical damage caused by individuals, tools, or other outside agents.
 - 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. VOC Content of Interior Sealants: Interior sealants and sealant primers shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Architectural Sealants: 250 g/L.
 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 3. Sealant Primers for Porous Substrates: 775 g/L.
- C. Low-Emitting Interior Sealants: Interior sealants and sealant primers shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- D. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
- E. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range of available colors
- F. Manufacturers: Subject to compliance with requirements, provide products by one or more of the following manufacturers:
1. BASF Building Systems.
 2. Bostic, Inc.
 3. Dow Corning Corp.
 4. GE Advanced Materials.
 5. Pecora Corporation.
 6. Sika Corporation, Construction Products Division.
 7. Tremco, Inc.
 8. W.R. Meadows, Inc.

2.2 SILICONE JOINT SEALANTS

- A. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, for use NJ. Provide class 100/50, Class 50, or Class 25 as applicable.
- B. Single-Component, Nonsag, Acid-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.
- C. Single-Component, Nonsag, Traffic-Grade, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use T.
- D. Single-Component, Pourable, Traffic-Grade, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade P, Class 100/50, for Use T.
- E. Multicomponent, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type M, Grade NS, Class 50, for Use NT.
- F. Multicomponent, Pourable, Traffic-Grade, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type M, Grade P, Class 100/50, for Use T.
- G. Mildew-Resistant, Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.
- H. Mildew-Resistant, Single-Component, Acid-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.

2.3 URETHANE JOINT SEALANTS

- A. Single-Component, Nonsag, Urethane Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use NT. Provide Class 100/50, Class 50, or Class 25 as applicable.
- B. Single-Component, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use T.
- C. Single-Component, Pourable, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type S, Grade P, Class 25, for Use T.
- D. Multicomponent, Nonsag, Urethane Joint Sealant: ASTM C 920, Type M, Grade NS, for Use NT. Provide Class 50 or Class 25 as applicable.
- E. Multicomponent, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type M, Grade NS, for Use T. Provide Class 50 or Class 25 as applicable.

2.4 POLYSULFIDE JOINT SEALANTS

- A. Single-Component, Nonsag, Polysulfide Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.
- B. Multicomponent, Nonsag, Polysulfide Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25, for Use NT.
- C. Multicomponent, Nonsag, Traffic-Grade, Polysulfide Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25, for Use T.
- D. Multicomponent, Pourable, Traffic-Grade, Polysulfide Joint Sealant: ASTM C 920, Type M, Grade P, Class 25, for Use T.

2.5 LATEX JOINT SEALANTS

- A. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

2.6 SOLVENT-RELEASE-CURING JOINT SEALANTS

- A. Acrylic-Based Joint Sealant: ASTM C 1311.
- B. Butyl-Rubber-Based Joint Sealant: ASTM C 1311.

2.7 ACOUSTICAL JOINT SEALANTS

- A. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product shall effectively reduce airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

2.8 JOINT SEALANT BACKING

- A. General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

- B. Cylindrical Sealant Backings, ASTM C 1330, any of the following types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
 - 1. Type C (closed-cell material with a surface skin).
 - 2. Type O (open-cell material).
 - 3. Type B (bicellular material with a surface skin)
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.9 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 - 2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
 - a. Concrete.
 - b. Masonry.
 - c. Unglazed surfaces of ceramic tile.
 - d. Stucco and plaster.
 - 3. Remove laitance and form-release agents from concrete.

4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
 - a. Metal.
 - b. Glass.
 - c. Porcelain enamel.
 - d. Glazed surfaces of ceramic tile.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 1. Do not leave gaps between ends of sealant backings.
 2. Do not stretch, twist, puncture, or tear sealant backings.
 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 1. Place sealants so they directly contact and fully wet joint substrates.
 2. Completely fill recesses in each joint configuration.
 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 1. Remove excess sealant from surfaces adjacent to joints.
 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.
 4. Provide flush joint profile where indicated per Figure 8B in ASTM C 1193.
 5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 8C in ASTM C 1193.

- a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

G. Acoustical Sealant Installation: At sound-rated assemblies and elsewhere as indicated, seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations.

3.4 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.6 JOINT-SEALANT APPLICATIONS

- A. Exterior joints in horizontal traffic surfaces.
 - 1. Joint Locations:
 - a. Isolation and contraction joints in cast-in-place concrete slabs.
 - b. Joints in stone paving units, including steps.
 - c. Joints between different materials listed above.
 - 2. Silicone Joint Sealant, one of the following:
 - a. Single component, nonsag, traffic grade, neutral curing.
 - b. Single component, pourable, traffic grade, neutral curing.
 - c. Multicomponent, pourable, traffic grade, neutral curing.
 - 3. Urethane Joint Sealant, one of the following:
 - a. Single component, nonsag, traffic grade.
 - b. Single component, pourable, traffic grade.
 - c. Multicomponent, nonsag, traffic grade, Class 50 Multicomponent, nonsag, traffic grade, Class 25.
 - 4. Polysulfide Joint Sealant, one of the following:
 - a. Multicomponent, nonsag, traffic grade.
 - b. Multicomponent, pourable, traffic grade.
- B. Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
 - 1. Joint Locations:
 - a. Construction joints in cast-in-place concrete.
 - b. Control and expansion joints in unit masonry.
 - c. Joints in dimension stone cladding.
 - d. Joints in exterior stucco and plaster systems.
 - e. Joints between different materials listed above.
 - f. Perimeter joints between materials listed above and frames of doors windows and louvers.
 - g. Control and expansion joints in overhead surfaces.
 - 2. Silicone Joint Sealant, one of the following:
 - a. Single component, nonsag, neutral curing.
 - b. Single component, nonsag, acid curing.
 - c. Multicomponent, nonsag, neutral curing.

3. Urethane Joint Sealant, one of the following:
 - a. Single component, nonsag.
 - b. Multicomponent, nonsag.
 4. Polysulfide Joint Sealant, one of the following:
 - a. Single component, nonsag.
 - b. Multicomponent, nonsag.
- C. Interior joints in horizontal traffic surfaces.
1. Joint Locations:
 - a. Isolation joints in cast-in-place concrete slabs.
 - b. Control and expansion joints in stone flooring.
 - c. Control and expansion joints in tile flooring.
 2. Silicone Joint Sealant, one of the following:
 - a. Single component, nonsag, traffic grade, neutral curing.
 - b. Single component, pourable, traffic grade, neutral curing.
 - c. Multicomponent, pourable, traffic grade, neutral curing.
 3. Urethane Joint Sealant, one of the following:
 - a. Single component, nonsag, traffic grade.
 - b. Single component, pourable, traffic grade.
 - c. Multicomponent, nonsag, traffic grade.
 4. Polysulfide Joint Sealant, one of the following:
 - a. Multicomponent, nonsag, traffic grade.
 - b. Multicomponent, pourable, traffic grade.
- D. Interior joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Locations:
 - a. Control and expansion joints on exposed interior surfaces of exterior walls.
 - b. Perimeter joints of exterior openings where indicated.
 - c. Tile control and expansion joints.
 - d. Vertical joints on exposed surfaces of interior unit masonry walls and partitions.
 - e. Perimeter joints between interior wall surfaces and frames of interior doors windows and elevator entrances.
 2. Joint Sealant, one of the following:
 - a. Latex.
 - b. Acrylic based.
 - c. Butyl rubber based.
- E. Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Sealant Location:
 - a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
 - b. Tile control and expansion joints where indicated.
 2. Joint Sealant, one of the following:
 - a. Mildew resistant, single component, nonsag, neutral curing, Silicone.
 - b. Single component, nonsag, mildew resistant, acid curing.
- F. Interior acoustical joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Location: Acoustical joints where indicated.
 - a. Other joints as indicated.
 2. Joint Sealant: Acoustical.

END OF SECTION 079200

SECTION 080152 - REPAIR AND RESTORATION OF HISTORIC WOOD WINDOWS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes, but is not limited to:
 - 1. Wood window repair.
 - 2. Reglazing.
 - 3. Window hardware repair, refinishing, and replacement.
- B. Related Sections include, but are not limited to:
 - 1. Division 06 Section "Finish Carpentry."
 - 2. Division 08 Section "Storm Windows."
 - 3. Division 09 Section "Interior Painting."
 - 4. Division 09 Section "Exterior Painting."

1.3 DEFINITIONS

- A. Wood Window Component Terminology: As identified in AWI's "Architectural Woodwork Quality Standards." Wood window components for historic treatment work include the following classifications:
 - 1. Frame Components: Head, jamb, and sill.
 - 2. Sash Components: Stile and rails, parting bead, stop, and muntins.
 - 3. Exterior Trim: Exterior casing, brick mould, and drip cap.
 - 4. Interior Trim: Casing, stool, and apron.
- B. Glazing: Includes glass, glazing points, glazing tapes, glazing sealants, and glazing compounds.
- C. Window: Includes window frame and sash, unless otherwise indicated by the context.

1.4 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified historic treatment specialist to perform preconstruction testing on historic wood windows.
 - 1. Select sizes and configurations of existing work to adequately demonstrate capability of products to comply with requirements.
 - 2. Test historic treatment methods for effectiveness and compliance with specified requirements.
 - 3. Notify Architect seven days in advance of the dates and times when testing will be performed.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include recommendations for application and use. Include test data substantiating that products comply with requirements.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified historic treatment specialist.
- B. Historic Treatment Program: Submit before work begins.

1.7 QUALITY ASSURANCE

- A. Historic Treatment Specialist Qualifications: A qualified historic wood window specialist.
- B. Historic Treatment Program: Prepare a written plan for historic treatment of wood windows, including each phase or process, protection of surrounding materials during operations, and control of spills during on-site repair and other processes. Describe, in detail, materials, methods, and equipment to be used for each phase of work. Show compliance with indicated methods and procedures related to historic treatment of wood windows specified in this and other Sections.
- C. Mockups: Build mockups to demonstrate aesthetic effects and set quality standards for materials and execution and for fabrication and installation. Prepare mockups so they are inconspicuous or reversible.
 - 1. Locate mockups in locations that enable viewing under same conditions as the completed Work.
 - 2. Wood Window Repair: Prepare one entire window unit to serve as mockup to demonstrate sample repairs of wood window members including frame, sash, glazing, and hardware.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- D. AWI Quality Standard: Comply with applicable requirements in AWI's "Architectural Woodwork Quality Standards" for construction, finishes, grades of wood windows, and other requirements.
- E. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to historic treatment of wood windows including, but not limited to, the following:
 - a. Construction Schedule: Verify availability of materials, personnel, equipment, and facilities needed to make progress and avoid delays.
 - b. Materials, material application, sequencing, tolerances, and required clearances.

1.8 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with historic treatment of wood windows only when existing and forecasted weather conditions are within the environmental limits set by each manufacturer's written instructions and specified requirements.
- B. Concealed and undocumented historic items, relics, and similar objects encountered during historic treatment remain Owner's property. Carefully dismantle and salvage each item or object.
 - 1. Coordinate with Owner's historical adviser, who will establish special procedures for dismantling and salvaging.

1.9 SEQUENCING AND SCHEDULING

- A. Perform historic treatment of wood windows in the following sequence:
 - 1. Stamp each window frame with permanent opening-identification number in inconspicuous location.

2. Tag existing window sash with opening-identification numbers and remove for on-site or off-site shop repair. Indicate on tags the locations on window of these components such as top sash and bottom sash.
3. Allow installation of temporary protection and security at window openings according to Division 01 Section "Temporary Facilities and Controls."
4. Remove window, dismantle hardware, and tag hardware with window opening-identification numbers.
5. Sort units by condition, separating those that need extensive repair.
6. Clean surfaces.
7. General Wood-Repair Sequence:
 - a. Remove peeling paint to bare wood.
 - b. Rack frames slightly; inject adhesive into mortise and tenon joints.
 - c. Repair wood by consolidation, member replacement, partial member replacement, and patching.
 - d. Sand, prime, fill, sand again, and prime surfaces again for refinishing.
8. Repair, refinish, and replace hardware if required. Reinstall essential operating hardware.
9. Install glazing.
10. Allow removal of temporary protection and security at window openings according to Division 01 Section "Temporary Facilities and Controls."
11. Reinstall units.
12. Apply finish coats according to Division 09 Section "Interior Painting."
13. Install remaining hardware and weather stripping.

PART 2 - PRODUCTS

2.1 REPLACEMENT WOOD MATERIALS

- A. Wood: Clear fine-grained lumber; kiln dried to a moisture content of 6 to 12 percent at time of fabrication; free of visible finger joints, blue stain, knots, pitch pockets, and surface checks larger than 1/32 inch deep by 2 inches wide.
 1. Species: Ponderosa pine.
- B. Frame Heads and Jambs: Ponderosa pine, eastern white pine, or Idaho white pine.
- C. Sills: White oak.
- D. Sash Components: Ponderosa pine, eastern white pine, or Idaho white pine.
- E. Interior Trim: Ponderosa pine, eastern white pine, or Idaho white pine.

2.2 WOOD REPAIR MATERIALS

- A. Wood Consolidant: Ready-to-use product designed to penetrate, consolidate, and strengthen soft fibers of wood materials that have deteriorated due to weathering and decay and designed specifically to enhance the bond of wood-patching compound to existing wood.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Abatron, Inc.; LiquidWood.
 - b. ConServ Epoxy LLC; Flexible Epoxy Consolidant 100.
 - c. Wood Care Systems; ROTFIX.
- B. Wood-Patching Compound: Two-part epoxy-resin wood-patching compound; knife-grade formulation as recommended by manufacturer for type of wood repair indicated, tooling time required for the detail of work, and site conditions. Compound shall be designed for filling voids in damaged wood materials that have deteriorated due to weathering and decay. Compound shall be capable of filling deep holes and spreading to feather edge.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Abatron, Inc.; LiquidWood with WoodEpoxy.
 - b. Advanced Repair Technology, Inc.; Primatrate with Flex-Tec HV.
 - c. ConServ Epoxy LLC; Flexible Epoxy Consolidant 100 with Flexible Epoxy Patch 200.
 - d. Polymeric Systems, Inc.; QuickWood.
 - e. West System Inc.; West System.
 - f. Wood Care Systems; ROTFIX with SCULPWOOD.

2.3 GLAZING MATERIALS

- A. Glass: Uncoated clear float-glass units according to Division 08 Section "Glazing." Use salvaged glass units to the greatest extent possible.
- B. Glazing Systems for Single Glass Units: Primer as recommended by glazing material manufacturer, with one of the following:
 1. Oil-based glazing putty or glazing compound and glazing points.
 2. Tape glazing.
 3. Sealant glazing.

2.4 WINDOW HARDWARE

- A. Replacement Window Hardware: Replace existing damaged or missing window hardware with new hardware manufactured by one of the following:
 1. Ball and Ball.
 2. Blaine Window Hardware Inc.
 3. Bronze Craft Corporation (The).
 4. Custom Trades International, Inc.
 5. Parrett Manufacturing, Inc.
 6. Phelps Company.
- B. Material and Design:
 1. Material: Solid bronze or cast or wrought aluminum.
 2. Design: Match existing hardware.
 3. Replacement Window Hardware: Match existing window hardware of the following types:
 - a. Window lock.
 - b. Window latch.
 - c. Handle.
- C. Window Hardware Finishes: Comply with BHMA A156.18 for base material and finish requirements indicated by the following:
 1. BHMA 612: Satin bronze, clear coated, bronze base metal.
 2. BHMA 613: Dark-oxidized satin bronze, oil rubbed, bronze base metal.

2.5 WEATHER STRIPPING

- A. Compression-Type Weather Stripping: Compressible weather stripping designed for permanently resilient sealing under bumper or wiper action; completely concealed when window is closed.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. National Guard Products, Inc.
 - b. Pemko Manufacturing Co., Inc.; an ASSA ABLOY company.
 - c. Reese Enterprises, Inc.
 - d. Zero International, Inc.

2. Weather-Stripping Material: Match existing materials and profiles as much as possible unless otherwise indicated.
 - a. Cellular Elastomeric Gaskets: Preformed; complying with ASTM C 509.
 - b. Dense Elastomeric Gaskets: Preformed; complying with ASTM C 864.

- B. Sliding-Type Weather Stripping: Woven-pile weather stripping of wool, polypropylene, or nylon pile and resin-impregnated backing fabric; complying with AAMA 702/712.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. National Guard Products, Inc.
 - b. Pemko Manufacturing Co., Inc.; an ASSA ABLOY company.
 - c. Reese Enterprises, Inc.
 - d. Zero International, Inc.
 2. Weather Seals: Elastomeric preformed seal with integral barrier fin or fins of semirigid, polypropylene sheet or polypropylene-coated material.

- C. Metal Weather Stripping: Bronze or Zinc weather stripping; designed either as one piece to seal by sliding into a groove in the sash or as two pieces that interlock with each other; and completely concealed when wood window is closed.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Accurate Metal Weatherstrip Co. Inc.
 - b. Zero International, Inc.

2.6 MISCELLANEOUS MATERIALS

- A. Borate Preservative Treatment: Inorganic, borate-based solution, with disodium octaborate tetrahydrate as the primary ingredient; manufactured for preserving weathered and decayed wood from further damage by decay fungi and wood-boring insects; complying with AWPA P5; containing no boric acid.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Abatron, Inc.
 - b. Nisus Corporation.
 - c. Wood Care Systems.

- B. Cleaning Materials:
 1. Detergent Solution: Solution prepared by mixing 2 cups of tetrasodium polyphosphate, 1/2 cup of laundry detergent that contains no ammonia, 5 quarts of five percent (5%) sodium hypochlorite bleach, and 15 quarts of warm water for each 5 gal. of solution required.
 2. Mildewcide: Provide commercial proprietary mildewcide or a solution prepared by mixing 1/3 cup of household detergent that contains no ammonia, 1 quart of five percent (5%) sodium hypochlorite bleach, and 3 quarts of warm water.

- C. Adhesives: Wood adhesives for exterior exposure, with minimum 15- to 45-minute cure at 70 deg F, in gunnable and liquid formulations as recommended by adhesive manufacturer for each type of repair.

- D. Fasteners: Fasteners of same basic metal as fastened metal unless otherwise indicated. Use metals that are noncorrosive and compatible with each material joined.
 1. Match existing fasteners in material and type of fastener unless otherwise indicated.
 2. Use concealed fasteners for interconnecting wood components.
 3. Use concealed fasteners for attaching items to other work unless exposed fasteners are unavoidable.

4. For exposed fasteners, use Phillips-type machine screws of head profile flush with metal surface unless otherwise indicated.
 5. Finish exposed fasteners to match finish of metal fastened unless otherwise indicated.
- E. Anchors, Clips, and Accessories: Fabricate anchors, clips, and window accessories of aluminum, nonmagnetic stainless steel, or hot-dip zinc-coated steel complying with requirements in ASTM B 633 for SC 3 (Severe) service condition.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect adjacent materials from damage by historic treatment of wood windows.
- B. Clean existing wood windows of mildew, algae, moss, plant material, loose paint, grease, dirt, and other debris by scrubbing with bristle brush or sponge and detergent solution. Scrub mildewed areas with mildewcide. After cleaning, rinse thoroughly with fresh water. Allow to dry before repairing or painting.
- C. Condition replacement wood members to prevailing conditions at installation areas before installing.

3.2 HISTORIC TREATMENT PROCEDURES, GENERAL

- A. General: Have historic treatment of wood windows directed by a qualified historic treatment specialist. Ensure that historic treatment specialist's field supervisors are present when historic treatment of wood windows begins and during its progress. In treating historic items, disturb them as minimally as possible and as follows:
 1. Follow the historic treatment sequence in "Sequencing and Scheduling" Article.
 2. Apply each product according to manufacturer's written instructions unless otherwise indicated.
 3. Stabilize and repair wood windows to reestablish structural integrity and weather resistance while maintaining the existing form of each item.
 4. Stop the progress of deterioration by removing coatings and applying borate preservative treatment before repair.
 5. Repair items in place where possible and retain as much original material as possible.
 6. Make historic treatment of materials reversible whenever possible.
 7. Install temporary protective measures to protect wood window work that is indicated to be completed later.
- B. Mechanical Abrasion: Where mechanical abrasion is needed for the work, use only the gentlest mechanical methods, such as scraping and natural-fiber bristle brushing, that will not abrade wood substrate, reducing clarity of detail. Do not use abrasive methods such as sanding, wire brushing, or power tools except as indicated as part of the historic treatment program and as approved by Architect.
- C. Repair and Refinish Existing Hardware: Dismantle window hardware; repair and refinish it to match finish samples.
- D. Repair Wood Windows: Match existing materials and features, retaining as much original material as possible to perform repairs.
 1. Unless otherwise indicated, repair wood windows by consolidating, patching, splicing, or otherwise reinforcing wood with new wood matching existing wood or with salvaged, sound, original wood.
 2. Where indicated, repair wood windows by limited replacement matching existing material.

- E. Replace Wood Window Units: Where indicated, duplicate and replace units with salvaged, sound, original wood or with new wood matching existing wood. Use surviving prototypes to create patterns for duplicate replacements.
 1. Do not use substitute materials unless otherwise indicated.
 2. Compatible substitute materials may be used.
- F. Protection of Openings: Where sash or windows are indicated for removal, cover resultant openings with temporary enclosures so that openings are weathertight during repair period.
- G. Identify removed windows, sash, and members with numbering system corresponding to window locations to ensure reinstallation in same location. Key windows, sash, and members to Drawings showing location of each removed unit.

3.3 GLAZING

- A. Remove cracked and damaged glass and glazing materials from openings and prepare surfaces for reglazing.
- B. Install new glass with indicated glazing system and according to Division 08 Section "Glazing."
- C. Disposal of Removed Glass: Remove from Owner's property and legally dispose of it unless suitable to be re-used.

3.4 WOOD WINDOW PATCH-TYPE REPAIR

- A. General: Patch wood members that are damaged and exhibit depressions, holes, or similar voids, and that have limited rotted or decayed wood.
 1. Remove sash from windows before performing patch-type repairs at meeting or sliding surfaces unless otherwise indicated. Reglaze units prior to reinstallation.
 2. Verify that surfaces are sufficiently clean and free of paint residue prior to patching.
 3. Treat wood members with wood consolidant prior to application of patching compound. Coat wood surfaces by brushing, applying multiple coats until wood is saturated and refuses to absorb more. Allow treatment to harden before filling void with patching compound.
 4. Remove rotted or decayed wood down to sound wood.
- B. Apply borate preservative treatment to accessible surfaces either before applying wood consolidant or after removing rotted or decayed wood. Apply treatment liberally by brush to joints, edges, and ends; top, sides, and bottom.
- C. Apply wood-patching compound to fill depressions, nicks, cracks, and other voids created by removed or missing wood.
 1. Prime patch area with application of wood consolidant or manufacturer's recommended primer.
 2. Mix only as much patching compound as can be applied according to manufacturer's written instructions.
 3. Apply patching compound in layers as recommended by manufacturer until the void is completely filled.
 4. Finish patch surface to match contour of adjacent wood member. Sand patching compound smooth and flush, matching contour of existing wood member.
 5. Clean spilled compound from adjacent materials immediately.

3.5 WOOD WINDOW MEMBER-REPLACEMENT REPAIR

- A. General: Replace parts of wood window members at locations where damage is too extensive to patch.

1. Remove sash from windows before performing member-replacement repairs unless otherwise indicated.
 2. Verify that surfaces are sufficiently clean and free of paint residue prior to repair.
 3. Remove broken, rotted, and decayed wood down to sound wood.
 4. Custom fabricate new wood to replace missing wood; either replace entire wood member or splice new wood part into existing member. Fabricate replacement members according to AWI Section 1000 requirements for Premium Grade.
 5. Secure new wood using finger joints or multiple dowels with adhesive and nailing to ensure maximum structural integrity at each splice. Use only concealed fasteners. Fill nail holes and patch surface to match surrounding wood.
- B. Apply borate preservative treatment to accessible surfaces after replacements are made. Apply treatment liberally by brush to joints, edges, and ends; top, sides, and bottom.
- C. Repair remaining depressions, holes, or similar voids with patch-type repairs.
- D. Clean spilled materials from adjacent surfaces immediately.
- E. Glazing: Reglaze units prior to reinstallation.
1. Mill new and existing glazed members to accommodate new glass thickness.
 2. Provide replacement glazing stops coordinated with glazing system indicated.
 3. Provide glazing stops to match contour of sash frames.
- F. Reinstall units removed for repair into original openings.
- G. Weather Stripping: Replace nonfunctioning and install missing weather stripping to ensure full-perimeter and meeting rail weather stripping for each operable sash.
- 3.6 ADJUSTMENT
- A. Adjust existing and replacement operating sash, hardware, weather stripping, and accessories for a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts.
- 3.7 CLEANING AND PROTECTION
- A. Protect window surfaces from contact with contaminating substances resulting from construction operations. Monitor window surfaces adjacent to and below exterior concrete and masonry during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances contact window surfaces, remove contaminants immediately according to glass manufacturer's written recommendations.
- B. Clean exposed surfaces immediately after historic treatment of wood windows. Avoid damage to coatings and finishes. Remove excess sealants, glazing and patching materials, dirt, and other substances.
- C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

END OF SECTION 080152

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes hollow-metal work.
- B. Related Requirements include, but are not limited to:
 - 1. Division 08 Section "Door Hardware" for door hardware for hollow-metal doors.
 - 2. Division 08 Section "Glazing" for glass in hollow metal doors and frames.

1.3 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.
- B. For the purposes of this project, the terms "Hollow Metal" and "Steel" may be used interchangeably when referring to work of this section.

1.4 COORDINATION

- A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product include construction details, material descriptions, core descriptions, fire-resistance ratings, temperature-rise ratings, and finishes.
- B. Shop Drawings: Include the following:
 - 1. Elevations of each door type.
 - 2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
 - 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 - 4. Locations of reinforcement and preparations for hardware.
 - 5. Details of each different wall opening condition.
 - 6. Details of anchorages, joints, field splices, and connections.
 - 7. Details of accessories.
 - 8. Details of moldings, removable stops, and glazing.
 - 9. Details of conduit and preparations for power, signal, and control systems.
 - 10. Results of field measurements.
- C. Schedule: Provide a schedule of hollow-metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.

1.6 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency.
- B. Oversize Construction Certification: For assemblies required to be fire rated and exceeding limitations of labeled assemblies.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum 4-inch- high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

1.8 PROJECT CONDITIONS

- A. Field Measurements: Work of this section involves installation of salvaged existing doors in new frames and installation of new frames in existing openings. Verify dimensions and details of existing doors and openings by field measurements prior to fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Amweld International, LLC.
 - 2. Ceco Door Products; an Assa Abloy Group company.
 - 3. Curries Company; an Assa Abloy Group company.
 - 4. Custom Metal Products.
 - 5. Philipp Manufacturing Co (The).
 - 6. Pioneer Industries, Inc.
 - 7. Republic Doors and Frames.
 - 8. Steelcraft; an Ingersoll-Rand company.
- B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

2.2 REGULATORY REQUIREMENTS

- A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings and temperature-rise limits indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
 - 1. Smoke- and Draft-Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.

2.3 INTERIOR DOORS AND FRAMES

- A. Construct interior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Commercial Doors and Frames: NAAMM-HMMA 861.
 - 1. Physical Performance: Level A according to SDI A250.4.
 - 2. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches
 - c. Face: Uncoated, cold-rolled steel sheet, minimum thickness of 0.042 inch.
 - d. Edge Construction: Continuously welded with no visible seam.
 - e. Core: Steel stiffened.
 - 3. Frames:
 - a. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch for door openings 48 inches or less, or window frames; minimum thickness of 0.067 inch for door openings greater than 48 inches .
 - b. Construction: Face welded.
 - 4. Exposed Finish: Prime.

2.4 EXTERIOR HOLLOW-METAL DOORS AND FRAMES

- A. Construct exterior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Commercial Doors and Frames: NAAMM-HMMA 861.
 - 1. Physical Performance: Level A according to SDI A250.4.
 - 2. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches
 - c. Face: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum G60 A60 coating.
 - d. Edge Construction: Continuously welded with no visible seam.
 - e. Core: Steel stiffened.
 - f. Thermal-Rated Doors: Provide doors fabricated with thermal-resistance value (R-value) of not less than 2.1 deg F x h x sq. ft./Btu when tested according to ASTM C 1363.
 - 3. Frames:
 - a. Materials: Metallic-coated steel sheet, minimum thickness of 0.067 inch , with minimum G60 A60 coating.
 - b. Construction: Face welded.
 - 4. Exposed Finish: Prime.

2.5 FRAME ANCHORS

- A. Jamb Anchors:
 - 1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
 - 2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
 - 3. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.

4. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch-diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.
- B. Floor Anchors: Formed from same material as frames, minimum thickness of 0.042 inch. For monolithic concrete slabs, provide clip-type anchors with two holes to receive fasteners.

2.6 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.
- D. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.
 1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
- E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- F. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.
- G. Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143/C 143M.
- H. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
- I. Glazing: Comply with requirements in Division 08 Section "Glazing."
- J. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.7 FABRICATION

- A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Hollow-Metal Doors:
 1. Steel-Stiffened Door Cores: Provide minimum thickness 0.026 inch, steel vertical stiffeners of same material as face sheets extending full-door height, with vertical webs spaced not more than 6 inches apart. Spot weld to face sheets no more than 5 inches o.c. Fill spaces between stiffeners with glass- or mineral-fiber insulation.

2. Fire Door Cores: As required to provide fire-protection and temperature-rise ratings indicated.
 3. Vertical Edges for Single-Acting Doors: Bevel edges 1/8 inch in 2 inches.
 4. Top Edge Closures: Close top edges of doors with inverted closures, except provide flush closures at exterior doors of same material as face sheets.
 5. Bottom Edge Closures: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets.
 6. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
 7. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.
- C. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
1. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 3. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
 4. Floor Anchors: Weld anchors to bottoms of jambs with at least four (40 spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
 5. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 16 inches from top and bottom of frame. Space anchors not more than 32 inches o.c., to match coursing, and as follows:
 - 1) Two anchors per jamb up to 60 inches high.
 - 2) Three anchors per jamb from 60 to 90 inches high.
 - 3) Four anchors per jamb from 90 to 120 inches high.
 - 4) Four anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
 - b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches high.
 - 2) Four anchors per jamb from 60 to 90 inches high.
 - 3) Five anchors per jamb from 90 to 96 inches high.
 - 4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
 - c. Compression Type: Not less than two anchors in each frame.
 - d. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.
 6. Head Anchors: Two anchors per head for frames more than 42 inches wide and mounted in metal-stud partitions.
 7. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
 - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
- D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.

- E. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.
 - 1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
 - 2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.
 - 3. Include provisions for security hardware such as door contacts, position switches, and similar devices. Coordinate with Owner's security system contractor.

- F. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with mitered hairline joints.
 - 1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow-metal work.
 - 2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
 - 3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
 - 4. Provide loose stops and moldings on inside of hollow-metal work.
 - 5. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

- G. Fixed Transom Louver: Horizontal, nondrainable-blade storm resistant aluminum louver.
 - 1. Basis of Design Product: Construction Specialties, Inc. RS-5300.
 - 2. Louver Depth: 5 inches.
 - 3. Blade Profile: Integral center baffle.
 - 4. Frame and Blade Nominal Thickness: Not less than 0.060 inches for blades and 0.080 inches for frames.
 - 5. Free Area: Not less than 7.5 sq.ft. for 48-inch wide by 48-inch high louver.
 - 6. Screen Type and Location: Insect screen on inside face of fixed louver.
 - 7. Screen Material: One of the following:
 - a. Aluminum: 18-by-16 mesh, 0.012-inch wire.
 - b. Stainless Steel: 18-by-18 mesh, 0.009-inch wire.
 - 8. Finish: Factory primed for field painting.

2.8 STEEL FINISHES

- A. Shop Prime Finish: Clean, pretreat, and apply manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

2.9 ACCESSORIES

- A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- B. Grout Guards: Formed from same material as frames, not less than 0.016 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

- B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.
- B. Hollow-Metal Frames: Install hollow-metal frames of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.
 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. At fire-rated openings, install frames according to NFPA 80.
 - b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
 - c. Install frames with removable stops located on secure side of opening.
 - d. Install door silencers in frames before grouting.
 - e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - f. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - g. Field apply bituminous coating to backs of frames that will be filled with grout containing antifreezing agents.
 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
 3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.
 4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
 5. Concrete Walls: Solidly fill space between frames and concrete with mineral-fiber insulation.
 6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 7. In-Place Metal or Wood-Stud Partitions: Secure slip-on drywall frames in place according to manufacturer's written instructions.
 8. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:

- a. Squareness: Plus or minus 1/16 inch , measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch , measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch , measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch , measured at jambs at floor.
- C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.
- 1. Non-Fire-Rated Steel Doors:
 - a. Between Door and Frame Jambs and Head: 1/8 inch plus or minus 1/32 inch .
 - b. Between Edges of Pairs of Doors: 1/8 inch to 1/4 inch plus or minus 1/32 inch .
 - c. At Bottom of Door: 3/8 inch plus or minus 1/32 inch.
 - d. Between Door Face and Stop: 1/16 inch to 1/8 inch plus or minus 1/32 inch.
 - 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
 - 3. Smoke-Control Doors: Install doors and gaskets according to NFPA 105.
- D. Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow-metal manufacturer's written instructions.
- 1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow-metal work immediately after installation.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- D. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 081113

SECTION 081416 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes, but is not limited to:
 - 1. Solid-core doors and transom panels with wood-veneer faces.
 - 2. Shop priming flush wood doors.
 - 3. Factory fitting flush wood doors to frames and factory machining for hardware.
- B. Related Requirements include, but are not limited to:
 - 1. Division 08 Section "Hollow Metal Doors and Frames."
 - 2. Division 08 Section "Wood Stile and Rail Doors."
 - 3. Division 08 Section "Door Hardware."
 - 4. Division 08 Section "Glazing" for glass view panels in flush wood doors.
 - 5. Division 09 Section "Interior Painting" for field finishing doors.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of door. Include details of core and edge construction, louvers, and trim for openings. Include factory-priming specifications.
 - 1. Product Data Adhesives and Composite Wood Products: Documentation indicating that product contains no urea formaldehyde.
 - 2. Laboratory Test Reports for Adhesives: Documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
 - 3. Laboratory Test Reports for Paints and Coatings: Documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
 - 4. Laboratory Test Reports for Composite Wood Products: Documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:
 - 1. Dimensions and locations of blocking.
 - 2. Dimensions and locations of mortises and holes for hardware.
 - 3. Dimensions and locations of cutouts.
 - 4. Undercuts.
 - 5. Fire-protection ratings for fire-rated doors.

1.4 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For special warranty.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in cardboard cartons and wrap bundles of doors in plastic sheeting.
- C. Mark each door on bottom rail with opening number used on Shop Drawings.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during remainder of construction period.
- B. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 70 percent during remainder of construction period.

1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
 - b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
 - 2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
 - 3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 FLUSH WOOD DOORS, GENERAL

- A. Quality Standard: In addition to requirements specified, comply with AWI's, AWMAC's, and WI's "Architectural Woodwork Standards."
 - 1. Provide AWI Quality Certification Labels indicating that doors comply with requirements of grades specified.
 - 2. Contract Documents contain selections chosen from options in quality standard and additional requirements beyond those of quality standard. Comply with those selections and requirements in addition to quality standard.
- B. Low-Emitting Materials:
 - 1. Fabricate doors with adhesives and composite wood products that do not contain urea formaldehyde.
 - 2. Fabricate doors with adhesives and composite wood products that comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. WDMA I.S.1-A Performance Grade: Heavy Duty.

- D. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
 - 1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
 - 2. Cores: Provide core specified or mineral core as needed to provide fire-protection rating indicated.
 - 3. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
 - 4. Pairs: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.

- E. Particleboard-Core Doors:
 - 1. Particleboard: ANSI A208.1, Grade LD-1 or Grade LD-2, made with binder containing no urea-formaldehyde.
 - 2. Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware and as follows:
 - a. 5-inch top-rail blocking, in doors indicated to have closers.
 - b. 5-inch bottom-rail blocking, in doors indicated to have kick, mop, or armor plates.
 - c. 5-inch midrail blocking, in doors indicated to have exit devices.
 - 3. Provide doors with glued-wood-stave or structural-composite-lumber cores instead of particleboard cores for doors indicated to receive exit devices.

- F. Structural-Composite-Lumber-Core Doors:
 - 1. Structural Composite Lumber: WDMA I.S.10.
 - a. Screw Withdrawal, Face: 700 lbf.
 - b. Screw Withdrawal, Edge: 400 lbf.

- G. Mineral-Core Doors:
 - 1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
 - 2. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as needed to eliminate through-bolting hardware and as follows:
 - a. 5-inch top-rail blocking.
 - b. 5-inch bottom-rail blocking, in doors indicated to have protection plates.
 - c. 5-inch midrail blocking, in doors indicated to have armor plates.
 - d. 4-1/2-by-10-inch lock blocks or 5-inch midrail blocking, in doors indicated to have exit devices.
 - 3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.
 - a. Screw-Holding Capability: 475 lbf per WDMA T.M.-10.

2.2 DOORS FOR OPAQUE FINISH

- A. Interior Solid-Core Doors:
 - 1. Grade: Premium.
 - 2. Faces: Any closed-grain hardwood of mill option.
 - 3. Exposed Vertical and Top Edges: Any closed-grain hardwood.
 - 4. Core: One of the following:
 - a. Particleboard
 - b. Glued wood stave

- c. Structural composite lumber.
- 5. Construction: Five or seven plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before veneering. Faces are bonded to core using a hot press.
- 6. Construction: Seven plies, either bonded or nonbonded.
- 7. WDMA I.S.1-A Performance Grade: Heavy Duty.

2.3 LIGHT FRAMES AND LOUVERS

- A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.
 - 1. Wood Species: Species compatible with door faces.
 - 2. Profile: Recessed tapered beads.
- B. Wood-Veneered Beads for Light Openings in Fire-Rated Doors: Manufacturer's standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire-protection rating indicated. Include concealed metal glazing clips where required for opening size and fire-protection rating indicated.
- C. Wood Louvers: Door manufacturer's standard solid-wood louvers unless otherwise indicated.
 - 1. Wood Species: Species compatible with door faces.

2.4 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
 - 1. Comply with NFPA 80 requirements for fire-rated doors.
- B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, BHMA-156.115-W, and hardware templates.
 - 1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
- C. Transom and Side Panels: Fabricate matching panels with same construction, exposed surfaces, and finish as specified for associated doors. Finish bottom edges of transoms and top edges of rabbeted doors same as door stiles.
 - 1. Provide factory-installed spring bolts for concealed attachment into jambs of metal door frames.
- D. Openings: Factory cut and trim openings through doors.
 - 1. Light Openings: Trim openings with moldings of material and profile indicated.
 - 2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Division 08 Section "Glazing."
 - 3. Louvers: Factory install louvers in prepared openings.

2.5 SHOP PRIMING

- A. Doors for Opaque Finish: Shop prime faces, all four edges, edges of cutouts, and mortises with one coat of wood primer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and installed door frames, with Installer present, before hanging doors.

1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For installation, see Division 08 Section "Door Hardware."

B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

1. Install fire-rated doors according to NFPA 80.
2. Install smoke- and draft-control doors according to NFPA 105.

C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.

1. Clearances: Provide 1/8 inch at heads, jambs, and between pairs of doors. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold unless otherwise indicated.
 - a. Comply with NFPA 80 for fire-rated doors.
2. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.
3. Bevel fire-rated doors 1/8 inch in 2 inches at lock edge; trim stiles and rails only to extent permitted by labeling agency.

D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081416

SECTION 081433 - STILE AND RAIL WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes, but is not limited to:
 - 1. Exterior stile and rail wood doors.
 - 2. Interior stile and rail wood doors and transom panels.
 - 3. Priming stile and rail wood doors.
 - 4. Fitting stile and rail wood doors to frames and machining for hardware.
 - 5. Prehanging doors in frames.
- B. Related Requirements include, but are not limited to:
 - 1. Division 08 Section "Hollow Metal Doors and Frames."
 - 2. Division 08 Section "Flush Wood Doors".
 - 3. Division 09 Section "Door Hardware".
 - 4. Division 09 Sections "Interior Painting" and "Exterior Painting" for field finishing stile and rail doors.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include details of construction and glazing.
 - 2. Include factory-finishing specifications.
 - 3. Product Data Adhesives and Composite Wood Materials: Documentation indicating that products contain no urea formaldehyde.
 - 4. Laboratory Test Reports for Adhesives: Documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
 - 5. Laboratory Test Reports for Paints and Coatings: Documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
 - 6. Laboratory Test Reports for Composite Wood Products: Documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. Shop Drawings: For stile and rail wood doors. Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data, including those for stiles, rails, panels, and moldings (sticking); and other pertinent data, including the following:
 - 1. Dimensions of doors for factory fitting.
 - 2. Locations and dimensions of mortises and holes for hardware.
 - 3. Undercuts.

- C. Samples for Verification: Corner sections of doors, approximately 8 by 10 inches, with door faces and edgings representing typical range of grain for each species of veneer and solid lumber required.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of door, from manufacturer.
- B. Sample Warranty: For special warranty.
- C. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in opaque plastic bags or cardboard cartons.
- C. Mark each door on bottom rail with opening number used on Shop Drawings.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 70 percent during remainder of construction period.

1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship, or have warped (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section, within specified warranty period.
 - 1. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
 - 2. Warranty shall be in effect during the following period of time from date of Substantial Completion:
 - a. Exterior Doors: Two years.
 - b. Interior Doors: Five years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain stile and rail wood doors from single manufacturer.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Algoma Hardwoods, Inc.
 - 2. Artistic Doors and Windows, Inc.
 - 3. Belentry Doors LLC.
 - 4. Dimension Millworks.
 - 5. Eggers Industries.
 - 6. Enjo Architectural Millwork.
 - 7. Harring Doors.
 - 8. Maiman Company (The).

9. Marshfield DoorSystems, Inc.
10. Pinecrest Inc.
11. Select Door.
12. Sun-Dor-Co.
13. VT Industries, Inc.
14. Woodtech Trading Company.

2.2 MATERIALS

- A. General: Use only materials that comply with referenced standards and other requirements specified.
 1. Assemble exterior doors including components, with wet-use adhesives complying with ASTM D 5572 for finger joints and with ASTM D 5751 for joints other than finger joints.
 2. Assemble interior doors and transoms, including components, with either dry-use or wet-use adhesives complying with ASTM D 5572 for finger joints and with ASTM D 5751 for joints other than finger joints.
- B. Low-Emitting Materials:
 1. Fabricate doors with adhesives and composite wood products that do not contain urea formaldehyde.
 2. Fabricate doors with adhesives and composite wood products that comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Panel Products: Any of the following unless otherwise indicated:
 1. Particleboard made from wood particles, with binder containing no urea-formaldehyde, complying with ANSI A208.1, Grade M-2.
 2. Particleboard made from straw, complying with ANSI A208.1, Grade M-2, except for density.
 3. Medium-density fiberboard made from wood fiber, with binder containing no urea-formaldehyde, complying with ANSI A208.2, Grade 130.
 4. Hardboard complying with ANSI A135.4.
 5. Veneer-core plywood, made with adhesive containing no urea-formaldehyde.
- D. Safety Glass: Provide products complying with testing requirements in 16 CFR 1201, for Category II materials, unless those of Category I are expressly indicated and permitted.

2.3 EXTERIOR STILE AND RAIL WOOD DOORS

- A. Exterior Stile and Rail Wood Doors: Exterior custom doors complying with the AWI's, AWMAC's, and WI's "Architectural Woodwork Standards" and with other requirements specified.
 1. Panel Designs: Indicated on Drawings. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
 2. Grade: Premium.
 3. Finish: Opaque.
 4. Wood Species and Cut for Opaque Finish: Idaho white, lodgepole, ponderosa, or sugar pine, plain sawed/sliced.
 5. Door Construction for Opaque Finish:
 - a. Stile and Rail Construction - One of the following:
 - 1) Clear softwood; may be edge glued for width and finger jointed.
 - 2) Veneered, structural composite lumber
 - 3) Veneered edge- and end-glued lumber.
 - b. Raised-Panel Construction - One of the following:
 - 1) Clear softwood lumber; edge glued for width.

- 2) Veneered, wood-based panel product.
6. Stile and Rail Widths: As indicated.
7. Raised-Panel Thickness: Manufacturer's standard, but not less than 1-5/8 inches for 2-1/4" thick doors.
8. Molding Profile (Sticking): As selected by Architect from manufacturer's full range of available profiles.
9. Glass: Uncoated, clear, insulating-glass units made from two lites of 3.0-mm-thick, fully tempered glass with 1/4-inch interspace, complying with Division 08 Section "Glazing." Provide true divided lite muntins, narrow profile.
10. Provide AWI Quality Certification Labels indicating that doors comply with requirements of grades specified.
11. Mark, label, or otherwise identify stile and rail wood doors as complying with WDMA I.S.6A and grade specified.

2.4 INTERIOR STILE AND RAIL WOOD DOORS

- A. Interior Stile and Rail Wood Doors: Interior custom doors complying with the AWI's, AWMAC's, and WI's "Architectural Woodwork Standards and with other requirements specified.
 1. Panel Designs: Indicated on Drawings. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
 2. Grade: Custom.
 3. Finish: Opaque.
 4. Wood Species and Cut for Opaque Finish: Idaho white, lodgepole, ponderosa, or sugar pine, plain sawed/sliced.
 5. Door Construction for Opaque Finish:
 - a. Stile and Rail Construction - One of the following:
 - 1) Clear softwood; may be edge glued for width and finger jointed.
 - 2) Veneered, structural composite lumber
 - 3) Veneered edge- and end-glued lumber.
 - b. Raised-Panel Construction:
 - 1) Clear softwood lumber; edge glued for width.
 - 2) Shaped, medium-density fiberboard.
 - c. Flat-Panel Construction:
 - 1) Veneered, wood-based panel product
 - 2) Medium-density fiberboard.
 6. Stile and Rail Widths: As indicated.
 7. Raised-Panel Thickness: Manufacturer's standard, but not less than 1-1/8 inches.
 8. Flat-Panel Thickness: 1/2 inch minimum.
 9. Molding Profile (Sticking): As selected by Architect from manufacturer's full range of available profiles.
 10. Glass: Uncoated fully tempered float glass, 5.0 mm thick, complying with Division 08 Section "Glazing."
 11. Provide AWI Quality Certification Labels indicating that doors comply with requirements of grades specified.
 12. Mark, label, or otherwise identify stile and rail wood doors as complying with WDMA I.S.6A and grade specified.

2.5 STILE AND RAIL WOOD DOOR FABRICATION

- A. Fabricate stile and rail wood doors in sizes indicated for field fitting.
- B. Factory fit doors to suit frame-opening sizes indicated, with the following uniform clearances and bevels unless otherwise indicated:
 1. Clearances: Provide 1/8 inch at heads, jambs, and between pairs of doors. Provide 3/8 inch from bottom of door to top of decorative floor finish or covering. Where threshold is

- shown or scheduled, provide not more than 1/4 inch from bottom of door to top of threshold.
2. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.
- C. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, BHMA-156.115-W, and hardware templates.
1. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before factory machining.
- D. Glazed Openings: Trim openings indicated for glazing with solid wood moldings, with one side removable. Miter wood moldings at corner joints.
- E. Transom and Side Panels: Fabricate panels to match adjoining doors in materials, finish, and quality of construction.
- F. Exterior Doors: Factory treat exterior doors after fabrication with water-repellent preservative to comply with WDMA I.S.4. Flash top of outswinging doors with manufacturer's standard metal flashing.
- 2.6 SHOP PRIMING
- A. Doors for Opaque Finish: Shop prime faces, all four edges, edges of cutouts, and mortises with one coat of wood primer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and installed door frames, with Installer present, before hanging doors.
1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
 2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Hardware: For installation, see Division 08 Section "Door Hardware."
- B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
- C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted with fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
1. Clearances: Provide 1/8 inch at heads, jambs, and between pairs of doors. Provide 1/4 inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide 3/8 inch from bottom of door to top of threshold unless otherwise indicated.
 2. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.
- D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

3.3 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.
- B. Finished Doors: Replace doors that are damaged or do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081433

SECTION 083113 - ACCESS DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes, but is not limited to access doors and frames for walls and ceilings.
- B. Related Requirements include, but are not limited to:
 - 1. Division 23 for heating and air-conditioning duct access doors.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, fire ratings, materials, individual components and profiles, and finishes.
- B. Product Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics according to the following test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - 1. NFPA 252 or UL 10B for fire-rated access door assemblies installed vertically.
 - 2. NFPA 288 for fire-rated access door assemblies installed horizontally.

2.2 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

- A. Source Limitations: Obtain each type of access door and frame from single source from single manufacturer.
- B. Flush Access Doors with Exposed Flanges:
 - 1. Assembly Description: Fabricate door to fit flush to frame. Provide manufacturer's standard-width exposed flange, proportional to door size.
 - 2. Locations: Wall and ceiling in spaces concealed from public view.
 - 3. Uncoated Steel Sheet for Door:
 - a. Thickness: Nominal 0.060 inch, 16 gage.
 - b. Finish: Factory prime.
 - 4. Metallic-Coated Steel Sheet for Door:
 - a. Thickness: Nominal 0.064 inch, 16 gage.
 - b. Finish: Factory prime.
 - 5. Frame Material: Same material, thickness, and finish as door.
 - 6. Hinges: Manufacturer's standard.
 - 7. Hardware: Latch.

- C. Flush Access Doors with Concealed Flanges:
1. Assembly Description: Fabricate door to fit flush to frame. Provide frame with gypsum board beads for concealed flange installation.
 2. Locations: Wall and ceiling in spaces exposed to public view, unless otherwise indicated.
 3. Uncoated Steel Sheet for Door:
 - a. Thickness: Nominal 0.060 inch, 16 gage.
 - b. Finish: Factory prime.
 4. Metallic-Coated Steel Sheet for Door:
 - a. Thickness: Nominal 0.064 inch, 16 gage.
 - b. Finish: Factory prime.
 5. Frame Material: Same material and thickness as door.
 6. Hinges: Manufacturer's standard.
 7. Hardware: Latch.
- D. Recessed Access Doors:
1. Assembly Description: Fabricate door in the form of a pan recessed 5/8 inch for gypsum board infill. Provide frame with gypsum board bead for concealed flange installation.
 2. Locations: Where indicated.
 3. Uncoated Steel Sheet for Door:
 - a. Thickness: Nominal 0.060 inch, 16 gage.
 - b. Finish: Factory prime.
 4. Metallic-Coated Steel Sheet for Door:
 - a. Thickness: Nominal 0.064 inch, 16 gage.
 - b. Finish: Factory prime.
 5. Frame Material: Same material and thickness as door.
 6. Hinges: Manufacturer's standard.
 7. Hardware: Latch.
- E. Fire-Rated, Flush Access Doors with Exposed Flanges:
1. Assembly Description: Fabricate door to fit flush to frame, with a core of mineral-fiber insulation enclosed in sheet metal. Provide self-latching door with automatic closer and interior latch release. Provide manufacturer's standard-width exposed flange, proportional to door size.
 2. Locations: Wall and ceiling in spaces concealed from public view.
 3. Fire-Resistance Rating: Not less than that of adjacent construction.
 4. Uncoated Steel Sheet for Door:
 - a. Thickness: Nominal 0.036 inch, 20 gage.
 - b. Finish: Factory prime.
 5. Metallic-Coated Steel Sheet for Door:
 - a. Thickness: Nominal 0.040 inch, 20 gage.
 - b. Finish: Factory prime.
 6. Frame Material: Same material, thickness, and finish as door.
 7. Hinges: Manufacturer's standard.
 8. Hardware: Latch.
- F. Fire-Rated, Flush Access Doors with Concealed Flanges:
1. Assembly Description: Fabricate door to fit flush to frame, with a core of mineral-fiber insulation enclosed in sheet metal. Provide self-latching door with automatic closer and interior latch release. Provide frame with gypsum board beads for concealed flange installation.
 2. Locations: Wall and ceiling in spaces exposed to public view.
 3. Fire-Resistance Rating: Not less than that of adjacent construction.
 4. Uncoated Steel Sheet for Door:
 - a. Thickness: Nominal 0.036 inch, 20 gage.
 - b. Finish: Factory prime.
 5. Metallic-Coated Steel Sheet for Door:

- a. Thickness: Nominal 0.040 inch, 20 gage.
- b. Finish: Factory prime.
- 6. Frame Material: Same material, thickness, and finish as door.
- 7. Hinges: Manufacturer's standard.
- 8. Hardware: Latch.

- G. Latch: Cam latch, slam latch, or self-latching bolt operated by screwdriver by knurled knob by hex-head wrench with interior release.

2.3 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.
- C. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A 879/A 879M, with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.
- D. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 or A60 metallic coating.
- E. Frame Anchors: Same type as door face.
- F. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

2.4 FABRICATION

- A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access doors to types of supports indicated.
 - 1. For concealed flanges with drywall bead, provide edge trim for gypsum board securely attached to perimeter of frames.
 - 2. Provide mounting holes in frames for attachment of units to metal or wood framing.
 - 3. Provide mounting holes in frame for attachment of masonry anchors.
- D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling.
- E. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.
 - 1. For recessed panel doors, provide access sleeves for each locking device. Furnish plastic grommets and install in holes cut through finish.

2.5 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Steel and Metallic-Coated-Steel Factory Prime Finish: Apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.
- B. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.3 ADJUSTING

- A. Adjust doors and hardware, after installation, for proper operation.
- B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION 083113

SECTION 083473 - METAL SOUND CONTROL DOOR ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes metal sound control door assemblies at Auditorium 213.
- B. Alternate No. 2: Work of the Section is to be provided as Alternate No. 2 to the base contract. Refer to Division 01 Section "Alternates."

1.3 COORDINATION

- A. Coordinate installation of anchorages for sound control door assemblies. Furnish setting drawings, templates, and directions for installing anchorages. Deliver sleeves, inserts, anchor bolts, and items with integral anchors to Project site in time for installation.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include sound ratings, construction details, material descriptions, core descriptions, and finishes.
- B. Shop Drawings: For sound control door assemblies. Include the following:
 - 1. Elevations of each door design.
 - 2. Details of sound control seals, door bottoms, and thresholds.
 - 3. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
 - 4. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 - 5. Locations of reinforcements and preparations for hardware.
 - 6. Details of each different wall opening condition.
 - 7. Details of anchorages, joints, field splices, and connections.
 - 8. Details of accessories.
 - 9. Details of moldings and removable stops.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer.
- B. Product Certificates: For each type of sound control door assembly.
 - 1. Provide certification that the door construction utilized has been tested at an independent laboratory in accordance with ASTM E90, and that the STC rating determined in accordance with ASTM E413, is not less than that specified in Part 2 of this Section. The laboratory referenced in the certification must be qualified under the National Voluntary Accreditation Program (NVLAP) of the U.S. Bureau of Standards. Certification must reference laboratory name, test report number, and date of test; substitution of test data not in accordance with ASTM E90 and E413 will not be acceptable.
- C. Product Test Reports: For each sound control door assembly, for tests performed either by manufacturer and witnessed by a qualified testing agency or by a qualified testing agency.

- D. Sample Warranty: For manufacturer's special warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For sound control door assemblies to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Provide work of this Section designed and furnished by one manufacturer. Use a manufacturer who is ISO9001:2000 certified and has been engaged in the manufacture of Sound Control Door systems for at least five (5) years immediately prior to the start of this work, and who has a history of successful production acceptable to the Architect.
- B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver doors and frames palletized, wrapped, or crated to provide protection during transit and Project-site storage. Avoid the use of nonvented plastic.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store doors and frames vertically under cover at Project site with head up. Place on minimum 4-inch- high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

1.9 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of sound control door assemblies that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure to meet sound rating requirements.
 - b. Faulty operation of sound seals.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal use or weathering.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Sound Rating: Provide sound control door assemblies identical to those of assemblies tested as sound-retardant units by an acoustical testing agency, and have the following minimum rating:
 - 1. STC Rating: 53 as calculated by ASTM E 413 when tested in an operable condition according to ASTM E 90.

2.2 STEEL SOUND CONTROL DOORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Industrial Acoustics Company.
 - 2. Krieger Specialty Products Company.

3. Overly Door Company.
- B. Source Limitations: Obtain steel sound control door assemblies, including doors, frames, sound control seals, hinges, thresholds, and other items essential for sound control, from single source from single manufacturer.
- C. Doors: Flush-design sound control doors, 2-1/4 inches thick, of seamless construction; with manufacturer's standard sound-retardant core as required to provide STC rating indicated. Construct doors with smooth, flush surfaces without visible joints or seams on exposed faces or stile edges. Fabricate according to NAAMM-HMMA 865.
 1. Interior Doors: Fabricate from cold-rolled steel sheet unless otherwise indicated, 0.048-inch nominal thickness or thicker as required to achieve STC rating indicated.
 2. Core: Manufacturer's standard sound control core.
 3. Top and Bottom Channels: Closed with continuous channels of same material as face sheets, spot welded to face sheets not more than 6 inches o.c.
 4. Hardware Reinforcement: Same material as face sheets.
- D. Materials:
 1. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B, suitable for exposed applications.
 2. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- E. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.
 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

2.3 SOUND CONTROL FRAMES

- A. Frames: Fabricate sound control door frames with corners mitered, reinforced, and continuously welded the full depth and width of frame. Fabricate according to NAAMM-HMMA 865.
 1. Weld frames according to NAAMM-HMMA 820.
 2. Interior Frames: Fabricate from cold-rolled steel sheet unless otherwise indicated, 0.075-inch nominal thickness or thicker as required to provide STC rating indicated.
 3. Hardware Reinforcement: Fabricate according to NAAMM-HMMA 865 of same material as face sheets.
 4. Head Reinforcement: Metallic-coated steel channel or angle stiffener, 0.108-inch nominal thickness.
 5. Stud Wall Type Jamb Anchors: Designed to engage stud, welded to back of frames; not less than 0.048-inch nominal-thickness uncoated steel unless otherwise indicated.
 6. Plaster Guards: Metallic-coated steel sheet, not less than 0.026 inch thick.
- B. Materials:
 1. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B, suitable for exposed applications.
 2. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
 3. Mineral-Fiber Insulation: Insulation composed of rock-wool fibers, slag-wool fibers, or glass fibers.
- C. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.
 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10 acceptance criteria; recommended by primer manufacturer

for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

2.4 HARDWARE

- A. Sound Control Door Hardware: Manufacturer's standard sound control system, including head and jamb seals, door bottoms, cam-lift hinges, and thresholds, as required by testing to achieve STC rating indicated.
1. Head and Jamb Seals: One of the following:
 - a. Neoprene Compression Seals: One-piece units consisting of closed-cell sponge neoprene seal held in place by metal retainer, with retainer cover of same material as door frame; attached to door frame with concealed screws.
 - b. Silicone Compression Seals: One-piece units consisting of silicone compression bulb and stabilizer flange; attached to door frame adhesively.
 - c. Magnetic Seals: One-piece units consisting of closed-cell sponge neoprene seal and resiliently mounted magnet held in place by metal retainer, with retainer cover of same material as door frame; attached to door frame with concealed screws.
 2. Automatic Door Bottoms: Neoprene or silicone gasket, held in place by metal housing, that automatically drops to form seal when door is closed; mounted to bottom edge of door with screws.
 - a. Mounting: Mortised or semimortised into bottom of door as required by testing to achieve STC rating indicated.
 3. Door Bottoms: Neoprene or silicone gasket held in place by metal housing; mortised into bottom edge of door.
 4. Cam-Lift Hinges: Full-mortise template type that raises door 1/2 inch when door is fully open; with hardened pin; fabricated from stainless steel.
 5. Thresholds: Flat, smooth, unfluted type as recommended by manufacturer; fabricated from aluminum.
 - a. Finish: Color anodic finish.
 - b. Color: Medium bronze As selected by Architect from full range of industry colors.
- B. Other Hardware: Comply with requirements in Division 08 Section "Door Hardware."

2.5 SOUND CONTROL ACCESSORIES

- A. Grout: Comply with ASTM C 476, with a slump of not more than 4 inches as measured according to ASTM C 143/C 143M.
- B. Corrosion-Resistant Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.6 FABRICATION

- A. Steel Sound Control Door Fabrication: Sound control doors to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal.
1. Seamless Edge Construction: Fabricate doors with faces joined at vertical edges by welding; welds shall be ground, filled, and dressed to make them invisible and to provide a smooth, flush surface.
 2. Hardware Preparation: Factory prepare sound control doors to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping.
 - a. Reinforce doors to receive nontemplated mortised and surface-mounted door hardware.

- b. Locate door hardware as indicated, or if not indicated, according to NAAMM-HMMA 831, "Recommended Hardware Locations for Custom Hollow Metal Doors and Frames."
 3. Tolerances: Fabricate doors to tolerances indicated in NAAMM-HMMA 865.
- B. Sound Control Frame Fabrication: Fabricate sound control frames to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
1. Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated from same thickness metal as frames.
 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 3. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
 4. Stud Wall Type Jamb Anchors: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - a. Three anchors per jamb up to 60 inches in height.
 - b. Four anchors per jamb from 60 to 90 inches in height.
 - c. Two anchors per head for frames more than 42 inches wide and mounted in metal-stud partitions.
 5. Hardware Preparation: Factory prepare sound control frames to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping.
 - a. Reinforce frames to receive nontemplated mortised and surface-mounted door hardware.
 - b. Locate hardware as indicated, or if not indicated, according to NAAMM-HMMA 831, "Recommended Hardware Locations for Custom Hollow Metal Doors and Frames."
 6. Plaster Guards: Weld guards to frame at back of hardware cutouts and glazing-stop screw and sound control seal preparations to close off interior of openings in frames to be grouted.
 7. Tolerances: Fabricate frames to tolerances indicated in NAAMM-HMMA 865.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations of sound control door frame connections before frame installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

- B. Prior to installation, adjust and securely brace sound control door frames to the following tolerances:
 - 1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - 2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - 3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - 4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.
- C. Drill and tap doors and frames to receive nontemplated mortised and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Install sound control door assemblies plumb, rigid, properly aligned, and securely fastened in place; comply with manufacturer's written instructions.
- B. Frames: Install sound control door frames in sizes and profiles indicated.
 - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. Remove temporary braces only after frames or bucks have been properly set and secured.
 - b. Check squareness, twist, and plumbness of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - c. Apply corrosion-resistant coating to backs of frames to be filled with mortar, grout, and plaster containing antifreezing agents.
 - 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
 - 3. Metal-Stud Partitions: Fully fill frames with mineral-fiber insulation.
 - 4. Grouted Frames: Solidly fill space between frames and substrate with grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
 - 5. Installation Tolerances: Adjust sound control door frames for squareness, alignment, twist, and plumbness to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.
- C. Doors: Fit sound control doors accurately in frames, within clearances indicated below. Shim as necessary.
 - 1. Jambs: 1/8 inch.
 - 2. Head with Cam-Lift Hinges: As required by manufacturer, but not more than 3/8 inch.
 - 3. Sill: Manufacturer's standard.
- D. Sound Control Seals: Where seals have been factory prefitted and preinstalled and subsequently removed for shipping, reinstall seals and adjust according to manufacturer's written instructions.
- E. Cam-Lift Hinges: Install hinges according to manufacturer's written instructions.

- F. Thresholds: Set thresholds in full bed of sealant complying with requirements in Division 07 Section "Joint Sealants."

3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and adjust seals, door bottoms, and other sound control hardware items immediately before final inspection. Leave work in complete and proper operating condition.
- B. Remove and replace defective work, including defective or damaged sound seals and doors and frames that are warped, bowed, or otherwise unacceptable.
 - 1. Adjust gaskets, gasket retainers, and retainer covers to provide contact required to achieve STC rating.
- C. Grouted Frames: Clean grout off sound control door frames immediately after installation.
- D. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible, rust-inhibitive, air-drying primer.

END OF SECTION 083473

SECTION 084113 - STOREFRONT ENTRANCE DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes exterior manual-swing entrance doors.
- B. Related Requirements include, but are not limited to:
 - 1. Division 08 Section "Glazed Aluminum Curtain Walls" for aluminum support framing.
 - 2. Division 08 Section "Door Hardware."
 - 3. Division 08 Section "Automatic Door Opener."
 - 4. Division 08 Section "Glazing."

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: Include plans, elevations, sections, full-size details, and attachments to other work.
 - 1. Submit shop drawings for this section concurrently with those for Division 08 Section "Glazed Aluminum Curtain Walls".
- C. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.
- D. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Energy Performance Certificates: For entrance doors, from manufacturer.
- C. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For storefront entrance doors to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of storefront entrance doors that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Noise or vibration created by wind and thermal and structural movements.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - d. Failure of operating components.
 - 2. Warranty Period: Five years from date of Substantial Completion.
- B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Comply with performance requirements specified, as determined by testing of storefront entrance doors representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
 - 1. Failure includes the following:
 - a. Glass breakage.
 - b. Noise or vibration created by wind and thermal and structural movements.
 - c. Loosening or weakening of fasteners, attachments, and other components.
 - d. Failure of operating units.
- B. Structural Loads: As indicated on Drawings
- C. Air Infiltration: Test according to ASTM E 283 for infiltration at entrance doors as follows:
 - 1. Pair of Doors: Maximum air leakage of 1.0 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft..
 - 2. Single Doors: Maximum air leakage of 0.5 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft..

2.2 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. EFCO Corporation.
 - 2. Kawneer North America - cited as design standard.
 - 3. Oldcastle BuildingEnvelope.
 - 4. TRACO.
 - 5. Tubelite.
 - 6. United States Aluminum.
 - 7. YKK AP America Inc.

- B. Source Limitations: Obtain all components of storefront entrance doors and accessories from single manufacturer.

2.3 ENTRANCE DOORS

- A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.
 - 1. Door Construction: 1-3/4-inch overall thickness, with minimum 0.125-inch-thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
 - a. Thermal Construction: High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior.
 - 2. Door Design: Wide stile; 5-inch nominal width.
 - 3. Glazing Stops and Gaskets: Beveled, snap-on, extruded-aluminum stops and preformed gaskets.
 - a. Provide nonremovable glazing stops on outside of door.

2.4 ENTRANCE DOOR HARDWARE

- A. Entrance Door Hardware: Hardware not specified in this Section is specified in Division 08 Section "Door Hardware."
 - 1. Coordinate door hardware with automatic door opener for one leaf.
 - 2. Coordinate door hardware with Owner's security and access control systems.
- B. General: Provide entrance door hardware for each entrance door to comply with requirements in this Section.
 - 1. Entrance Door Hardware Sets: Provide quantity, item, size, finish or color indicated.
 - 2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
 - 3. Opening-Force Requirements for Egress Doors: Not more than 15 lbf to release the latch and not more than 30 lbf to set the door in motion and not more than 15 lbf to open the door to its minimum required width.
- C. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of entrance door hardware are indicated in "Entrance Door Hardware Sets" Article. Products are identified by using entrance door hardware designations as follows:
 - 1. References to BHMA Standards: Provide products complying with these standards and requirements for description, quality, and function.
- D. Offset Pivot Hinges: BHMA A156.4, Grade 1. Provide top, bottom, and intermediate offset pivots at each door leaf.
- E. Panic Exit Devices: BHMA A156.3, Grade 1, listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.
- F. Cylinders: As specified in Division 08 Section "Door Hardware."
- G. Strikes: Provide strike with black-plastic dust box for each latch or lock bolt; fabricated for aluminum framing.
- H. Operating Trim: BHMA A156.6.

- I. Closers: BHMA A156.4, Grade 1, with accessories required for a complete installation, sized as required by door size, exposure to weather, and anticipated frequency of use; adjustable to comply with field conditions and requirements for opening force.
- J. Weather Stripping: Manufacturer's standard replaceable components.
 - 1. Compression Type: Made of ASTM D 2000, molded neoprene, or ASTM D 2287, molded PVC.
 - 2. Sliding Type: AAMA 701/702, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.
- K. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.
- L. Silencers: BHMA A156.16, Grade 1.
- M. Thresholds: BHMA A156.21, raised thresholds beveled with a slope of not more than 1:2, with maximum height of 1/2 inch.

2.5 GLAZING

- A. Glazing: Comply with Division 08 Section "Glazing."
- B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.
- C. Glazing Sealants: As recommended by manufacturer.

2.6 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- C. Fabricate components that, when assembled, have the following characteristics:
 - 1. Profiles that are sharp, straight, and free of defects or deformations.
 - 2. Accurately fitted joints with ends coped or mitered.
 - 3. Physical and thermal isolation of glazing from framing members.
 - 4. Accommodations for thermal and mechanical movements of glazing to maintain required glazing edge clearances.
 - 5. Provisions for field replacement of glazing.
 - 6. Fasteners and connection devices that are concealed from view to greatest extent possible.
- D. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
 - 1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
 - 2. At exterior doors, provide weather sweeps applied to door bottoms.
- E. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

- F. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.7 ALUMINUM FINISH

- A. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2604 and containing not less than 70 percent PVDF or FEVE resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 1. Color: White.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General:
 - 1. Comply with manufacturer's written instructions.
 - 2. Do not install damaged components.
- B. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.
 - 1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
 - 2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.3 MAINTENANCE SERVICE

- A. Entrance Door Hardware:
 - 1. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of entrance door hardware.
 - 2. Initial Maintenance Service: Beginning at Substantial Completion, provide twelve months' full maintenance by skilled employees of entrance door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper entrance door hardware operation at rated speed and capacity. Use parts and supplies that are the same as those used in the manufacture and installation of original equipment.

3.4 ENTRANCE DOOR HARDWARE SETS

- A. Provide the following for each leaf of exterior pair of doors.
 - 1 set Offset Pivot Hinges (top, bottom, and intermediate).
 - 1 ea Panic exit device, concealed vertical rod, crash bar style.
 - 1 ea Vertical pull bar, 24-inch height.
 - 1 ea Electric strike.
 - 1 set Weatherstripping
 - 1 ea Closer

END OF SECTION 084113

SECTION 084413 - GLAZED ALUMINUM CURTAIN WALLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes glazed aluminum curtain walls.
- B. Related Requirements include, but are not limited to:
 - 1. Division 06 Section "Architectural Fiberglass" for insert panels glazed into curtain wall framing.
 - 2. Division 07 Section "Joint Sealants."
 - 3. Division 08 Section "Storefront Entrance Doors."
 - 4. Division 08 Section "Glazing."

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 - 2. Product Data for Glazing Sealants used inside the Weatherproofing System: Documentation including printed statement of VOC content.
 - 3. Laboratory Test Reports Glazing Sealants used inside the Weatherproofing System: Documentation indicating that products comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. Shop Drawings: For glazed aluminum curtain walls. Include plans, elevations, sections, full-size details, and attachments to other work.
 - 1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
 - 2. Include full-size isometric details of each vertical-to-horizontal intersection of glazed aluminum curtain walls, showing the following:
 - a. Joinery, including concealed welds.
 - b. Anchorage.
 - c. Expansion provisions.
 - d. Glazing.
 - e. Flashing and drainage.
 - 3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
 - 4. Submit shop drawings for this section concurrently with those for Division 08 Section "Storefront Entrance Doors".
- C. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.
- D. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from 12-inch lengths of full-size components and showing details of the following:
 - 1. Joinery, including concealed welds.

2. Anchorage.
3. Expansion provisions.
4. Glazing.
5. Flashing and drainage.

- E. Delegated-Design Submittal: For glazed aluminum curtain walls indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Energy Performance Certificates: For glazed aluminum curtain walls, accessories, and components from manufacturer.
1. Basis for Certification: NFRC-certified energy performance values for each glazed aluminum curtain wall.
- C. Product Test Reports: For glazed aluminum curtain walls, for tests performed by manufacturer and witnessed by a qualified testing agency or performed by a qualified testing agency.
- D. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For glazed aluminum curtain walls to include in maintenance manuals.
- B. Maintenance Data for Structural Sealant: For structural-sealant-glazed curtain walls to include in maintenance manuals. Include ASTM C 1401 recommendations for post-installation-phase quality-control program.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.
- C. Structural-Sealant Glazing: Comply with ASTM C 1401 for design and installation of curtain wall assemblies.

1.7 WARRANTY

- A. Special Assembly Warranty: Manufacturer agrees to repair or replace components of glazed aluminum curtain wall that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Noise or vibration created by wind and thermal and structural movements.

- c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - d. Water penetration through fixed glazing and framing areas.
 - e. Failure of operating components.
 - 2. Warranty Period: 10 years from date of Substantial Completion.
- B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
- 1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Division 01 Section "Quality Requirements," to design glazed aluminum curtain walls.
- B. General Performance: Comply with performance requirements specified, as determined by testing of glazed aluminum curtain walls representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
- 1. Glazed aluminum curtain walls shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
 - 2. Failure also includes the following:
 - a. Thermal stresses transferring to building structure.
 - b. Glass breakage.
 - c. Noise or vibration created by wind and thermal and structural movements.
 - d. Loosening or weakening of fasteners, attachments, and other components.
 - e. Failure of operating units.
- C. Structural Loads: As indicated on Drawings.
- D. Deflection of Framing Members: At design wind pressure, as follows:
- 1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane not exceeding 1/175 of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.
 - 2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch, whichever is smaller.
 - a. Operable Units: Provide a minimum 1/16-inch clearance between framing members and operable units.
 - 3. Cantilever Deflection: Where framing members overhang an anchor point, as follows:
 - a. Perpendicular to Plane of Wall: No greater than 1/240 of clear span plus 1/4-inch for spans greater than 11 feet 8-1/4 inches or 1/175 times span, for spans less than 11 feet 8-1/4 inches.
- E. Structural: Test according to ASTM E 330 as follows:
- 1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.

2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
 3. Test Durations: As required by design wind velocity, but not less than 10 seconds.
- F. Air Infiltration: Test according to ASTM E 283 for infiltration as follows:
1. Fixed Framing and Glass Area: Maximum air leakage of 0.06 cfm/sq. ft. at a static-air-pressure differential of 6.24 lbf/sq. ft.
- G. Water Penetration under Static Pressure: Test according to ASTM E 331 as follows:
1. No evidence of water penetration through fixed glazing and framing areas when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 10 lbf/sq. ft..
- H. Water Penetration under Dynamic Pressure: Test according to AAMA 501.1 as follows:
1. No evidence of water penetration through fixed glazing and framing areas when tested at dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 10 lbf/sq. ft..
 2. Maximum Water Leakage: No uncontrolled water penetrating assemblies or water appearing on assemblies' normally exposed interior surfaces from sources other than condensation. Water leakage does not include water controlled by flashing and gutters, or water that is drained to exterior.
- I. Seismic Performance: Glazed aluminum curtain walls shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
1. Seismic Drift Causing Glass Fallout: Complying with criteria for passing based on building occupancy type when tested according to AAMA 501.6 at design displacement and 1.5 times the design displacement.
 2. Vertical Interstory Movement: Complying with criteria for passing based on building occupancy type when tested according to AAMA 501.7 at design displacement and 1.5 times the design displacement.
- J. Energy Performance: Certify and label energy performance according to NFRC as follows:
1. Thermal Transmittance (U-factor): Fixed glazing and framing areas shall have U-factor of not more than 0.57 Btu/sq. ft. x h x deg F as determined according to NFRC 100.
 2. Solar Heat Gain Coefficient: Fixed glazing and framing areas shall have a solar heat gain coefficient of no greater than 0.40 as determined according to NFRC 200.
 3. Condensation Resistance: Fixed glazing and framing areas shall have an NFRC-certified condensation resistance rating of no less than 35 as determined according to NFRC 500.
- K. Noise Reduction: Test according to ASTM E 90, with ratings determined by ASTM E 1332, as follows:
1. Outdoor-Indoor Transmission Class: Minimum 30.
- L. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:
1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
 2. Thermal Cycling: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.
 - a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg F.
 - b. Low Exterior Ambient-Air Temperature: 0 deg F.
- M. Structural-Sealant Joints:
1. Designed to carry gravity loads of glazing.

2. Designed to produce tensile or shear stress of less than 20 psi.
- N. Structural Sealant: Capable of withstanding tensile and shear stresses imposed by structural-sealant-glazed curtain walls without failing adhesively or cohesively. When tested for preconstruction adhesion and compatibility, cohesive failure of sealant shall occur before adhesive failure.
1. Adhesive failure occurs when sealant pulls away from substrate cleanly, leaving no sealant material behind.
 2. Cohesive failure occurs when sealant breaks or tears within itself but does not separate from each substrate because sealant-to-substrate bond strength exceeds sealant's internal strength.

2.2 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. EFCO Corporation.
 2. Kawneer North America – cited as design standard.
 3. Oldcastle, Inc.
 4. TRACO.
 5. Tubelite.
 6. United States Aluminum.
 7. YKK AP America Inc.
- B. Basis of Design Product: Kawneer 1600® Wall System 2.
- C. Source Limitations: Obtain all components of curtain wall system, including framing, venting windows, entrances, and accessories, from single manufacturer.

2.3 FRAMING

- A. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
1. Construction: Thermally broken
 2. Sightline: 2-1/2 inches.
 3. Depth: 6 inches.
 4. Glazing System: Retained mechanically with gaskets on two sides and structural sealant on two sides.
 5. Glazing Plane: Front.
 6. Finish: High-performance organic finish.
 7. Fabrication Method: Field-fabricated stick system.
- B. Pressure Caps: Manufacturer's standard aluminum components that mechanically retain glazing.
1. Include snap-on aluminum trim that conceals fasteners.
- C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- D. Materials:
1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - a. Sheet and Plate: ASTM B 209.
 - b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
 - c. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.

- d. Structural Profiles: ASTM B 308/B 308M.
- 2. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.
 - a. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
 - b. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
 - c. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.4 OPAQUE INSERT PANELS

- A. Refer to Division 06 Section "Architectural Fiberglass" for flat and molded fiberglass insert panels glazed into the curtain wall system.

2.5 VENTING WINDOWS

- A. Aluminum Windows: AAMA/WDMA/CSA 101/I.S.2/A440, manufacturer's standard, with self-flashing mounting fins, and as follows:
 - 1. Window Type: Awning.
 - 2. Minimum Performance Class: CW.
 - 3. Minimum Performance Grade: 50.
 - 4. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by manufacturer for strength, corrosion resistance, and application of required finish, but not less than 0.064-inch thickness at any location for main frame and sash members.
 - a. Thermally Improved Construction: Fabricate window units with an integral, concealed, low-conductance thermal barrier; located between exterior materials and window members exposed on interior side; in a manner that eliminates direct metal-to-metal contact.
 - 5. Fasteners, Anchors, and Clips: Nonmagnetic stainless steel, aluminum, or other noncorrosive material, compatible with aluminum window members, trim, hardware, anchors, and other components of window units. Fasteners shall not be exposed, except for attaching hardware.
 - a. Reinforcement: Where fasteners screw-anchor into aluminum less than 0.128 inch thick, reinforce interior with aluminum or nonmagnetic stainless steel to receive screw threads, or provide standard, noncorrosive, pressed-in, spline grommet nuts.
 - 6. Hardware: Manufacturer's standard; of aluminum, stainless steel, die-cast steel, malleable iron, or bronze; including the following:
 - a. Spring-loaded, snap-type lock at jambs.
 - b. Steel or bronze operating arms.
 - 7. Sliding-Type Weather Stripping: Woven-pile weather stripping of wool, polypropylene, or nylon pile and resin-impregnated backing fabric; complying with AAMA 701/702.

B. Glazing: Same as adjacent glazed aluminum curtain-wall glazing.

C. Finish: Match adjacent glazed aluminum curtain-wall finish.

D. Basis of Design Product: Kawneer 8225TL Isolock® Windows.

2.6 ENTRANCES

- A. Entrances: Comply with Division 08 Section "Storefront Entrance Doors."

2.7 GLAZING

- A. Glazing: Comply with Division 08 Section "Glazing."
- B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.
- C. Glazing Sealants: As recommended by manufacturer.
- D. Sealants used inside the weatherproofing system shall have a VOC content of 250 g/L or less.
- E. Sealants used inside the weatherproofing system shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- F. Structural Glazing Sealants: ASTM C 1184, chemically curing silicone formulation that is compatible with system components with which it comes in contact, specifically formulated and tested for use as structural sealant and approved by structural-sealant manufacturer for use in curtain-wall assembly indicated.
 - 1. Color: As selected by Architect from manufacturer's full range of available colors.
- G. Weatherseal Sealants: ASTM C 920 for Type S; Grade NS; Class 25; Uses NT, G, A, and O; chemically curing silicone formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and structural-sealant-glazed curtain-wall manufacturers for this use.
 - 1. Color: Match structural sealant.

2.8 ACCESSORIES

- A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
 - 1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 - 2. Reinforce members as required to receive fastener threads.
 - 3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.
- B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
 - 1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.
- C. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.
- D. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

2.9 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

- C. Fabricate components that, when assembled, have the following characteristics:
 - 1. Profiles that are sharp, straight, and free of defects or deformations.
 - 2. Accurately fitted joints with ends coped or mitered.
 - 3. Physical and thermal isolation of glazing from framing members.
 - 4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 - 5. Provisions for field replacement of glazing from exterior.
 - 6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- D. Fabricate components to resist water penetration as follows:
 - 1. Internal guttering system or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.
 - 2. Pressure-equalized system or double barrier design with primary air and vapor barrier at interior side of glazed aluminum curtain wall and secondary seal weeped and vented to exterior.
- E. Curtain-Wall Framing: Fabricate components for assembly using manufacturer's standard assembly method.

2.10 ALUMINUM FINISH

- A. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2604 and containing not less than 70 percent PVDF or FEVE resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 1. Color: White.

2.11 SOURCE QUALITY CONTROL

- A. Structural Sealant: Perform quality-control procedures complying with ASTM C 1401 recommendations including, but not limited to, assembly material qualification procedures, sealant testing, and assembly fabrication reviews and checks.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare surfaces that will contact structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.

3.3 INSTALLATION

- A. General:
 - 1. Comply with manufacturer's written instructions.
 - 2. Do not install damaged components.

3. Fit joints to produce hairline joints free of burrs and distortion.
 4. Rigidly secure nonmovement joints.
 5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
 6. Where welding is required, weld components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
 7. Seal joints watertight unless otherwise indicated.
- B. Metal Protection:
1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with primer, applying sealant or tape, or installing nonconductive spacers as recommended by manufacturer for this purpose.
 2. Where aluminum is in contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.
- D. Install components plumb and true in alignment with established lines and grades.
- E. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.
- F. Install glazing as specified in Division 08 Section "Glazing."
1. Prepare surfaces that will contact structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.
- G. Install weatherseal sealant according to Division 07 Section "Joint Sealants" and according to sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind sealant as recommended by sealant manufacturer.

3.4 ERECTION TOLERANCES

- A. Erection Tolerances: Install glazed aluminum curtain walls to comply with the following maximum tolerances:
1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
 2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
 3. Alignment:
 - a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
 - b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
 - c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.
 4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner may engage a qualified testing agency to perform tests and inspections.
- B. Test Area: Perform tests on representative areas of glazed aluminum curtain walls.

- C. Field Quality-Control Testing: Perform the following test on representative areas of glazed aluminum curtain walls.
 - 1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.
 - a. Perform a minimum of two tests in areas as directed by Architect.
 - 2. Air Infiltration: ASTM E 783 at 1.5 times the rate specified for laboratory testing in "Performance Requirements" Article but not more than 0.09 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft..
 - a. Perform a minimum of two tests in areas as directed by Architect.
 - 3. Water Penetration: ASTM E 1105 at a minimum uniform and cyclic static-air-pressure differential of 0.67 times the static-air-pressure differential specified for laboratory testing in "Performance Requirements" Article, but not less than 6.24 lbf/sq. ft., and shall not evidence water penetration.
- D. Structural-Sealant Adhesion: Test structural sealant according to recommendations in ASTM C 1401, Destructive Test Method A, "Hand Pull Tab (Destructive)," Appendix X2.
 - 1. Test a minimum of two (2) areas on each building facade.
 - 2. Repair installation areas damaged by testing.
- E. Glazed aluminum curtain walls will be considered defective if they do not pass tests and inspections.
- F. Prepare test and inspection reports.

END OF SECTION 084413

SECTION 085369 - VINYL STORM WINDOWS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes, but is not limited to, magnetically attached storm windows for interior application.
- B. Related Sections include, but are not limited to:
 - 1. Division 07 Section "Joint Sealers."
 - 2. Division 08 Section "Repair and Restoration of Historic Wood Windows."

1.3 ACTION SUBMITTALS

- A. Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- B. Shop Drawings: Show dimensions, layout, profiles and product components; details of anchoring and fastening; sealants and weatherstripping; and recorded field measurements.
- C. Finish Samples: Submit color samples, that represent the allowable range of finish established from production material specified.
- D. Component Samples: Submit samples of anchors, fasteners, hardware, assembled corner sections and other materials and components.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualifications Data: For storm window manufacturer and installer.
- B. Operation and Maintenance Data: Include methods for maintaining installed products and precautions against cleaning materials and methods detrimental to finishes and performance.
- C. Sample Warranty.

1.5 PERFORMANCE REQUIREMENTS

- A. Air Infiltration: When tested in accordance with ASTM E 283084, the air infiltration rate shall not exceed 10 cubic ft. per minute, (CFM) per linear ft. of the neat sash crack at a pressure of 1.57 lbs. per square foot (PSF) at 25 mph. This test is conducted without a primary window in place.
- B. Uniform Loading: When tested in accordance with ASTM E 330-84, there shall be no disruptions or venting of the magnetic seal at a pressure of 3.1 pounds per square ft. at 35 mph. This test is conducted without a primary window installed.
- C. Concentrated Load/Sash Adherence: When tested in accordance with ANSI/AAMA 1002.10 the sash or the magnetic trim member shall not separate from glazing.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Obtain field measurements for each individual window opening prior to fabrication and indicate measurements on shop drawings.

1.7 QUALITY ASSURANCE

- A. Fabricator Qualifications: Storm window manufacturer shall have at least five years experience in custom manufacturing of interior magnetic storm windows, and shall have completed a minimum of five (5) different historical projects with a minimum of twenty-five units each. The manufacturer shall have available a mullion to fabricate multiple section units as required and shall supply all hardware, sub-frames and windows.
- B. Installer Qualifications: Storm window installer shall be either the window manufacturer or an installer acceptable to, and approved in writing by, the manufacturer. Installer shall have completed a minimum of three (3) different historical projects with a minimum of twenty-five years units each.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store materials protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.
 - 1. Store inside, if possible, in a clean, well-drained area free of dust and corrosive fumes.
 - 2. Stack vertically or on edge so that water cannot accumulate on or within materials. Use non-staining wood or plastic shims between components to provide water drainage and air circulation.
 - 3. Cover materials with tarpaulins or plastic hung on frames to provide air circulation.
 - 4. Keep water away from stored assemblies.

1.9 WARRANTY

- A. Manufacturer's Warranty: Submit warranty against defects in materials and workmanship for period of 5 years from the date of Substantial Completion.
 - 1. Magnets shall carry a minimum warranty of 20 years.
 - 2. Vinyl thermoplastic frame shall carry a minimum warranty of 20 years against becoming brittle.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Basis of Design: Climate Seal™ Storm Windows as manufactured by Environmental Window Solutions, LLC.
 - 1. Address: 8215 Carter Creed Drive, Unit 203, Charlotte, NC 28227
 - 2. Phone: (704) 200-2001
 - 3. Fax: (704) 973-9568
 - 4. Website: www.climate seal.com
 - 5. Units with 1/8-inch thick glazing: "Thermal" Series.
 - 6. Units with 1/4-inch thick glazing: "Acoustic" Series.
- B. Requests for substitutions will be considered in accordance with provisions of Division 01 Section "Product Requirements."

2.2 STORM WINDOWS

- A. General: Provide units that fit existing windows without gaps of more than 1/8 inch (3 mm) in each unit.
 - 1. Verify actual measurements of openings by field measurement before fabrication; show recorded measurements on shop drawings.
 - 2. Allow for out-of-square and irregular conditions.
 - 3. Verify frame and sill conditions of each opening before fabrication; provide appropriate fabrication details to suit existing conditions.
- B. Magnetically Attached Storm Windows: Interior mounted, removable panel magnetically secured and sealed at head, jambs and sill:
 - 1. Frame Sightline: 3/4 inch maximum, except at meeting stiles.
 - 2. Frame Thickness: 1 inch maximum.
 - 3. Style for Existing Casement Windows: Single panel.
 - 4. Style for Existing Double-Hung Windows: Two stacked panels with horizontal mullion supporting top panel; both panels magnetically attached.

2.3 COMPONENTS

- A. Subframe: Each interior storm window frame shall be held in place by the magnet attraction of the frame magnet to a carbon steel alloy subframe. The metal subframe shall be attached around the interior perimeter of the original interior window. The metal subframe shall be free of defects impairing the strength or the durability and shall be protected from corrosion using standard material coatings to prevent rust or corrosion caused by dissimilar metal contact.
- B. Frame: The storm window frame used to house the glazing shall be a vinyl thermoplastic with integral magnet. It shall have full mitered corners and an integral "bellows" gasket to allow for the natural movement of acrylic and polycarbonate and shall be designed to eliminate any "pop-off" conditions that may occur due to atmospheric conditions. It shall be free from surface discoloration and void of any structural distortion or blemishes. The frame shall be Ultra-violet stabilized to prevent discoloration.
 - 1. Enclosed with the vinyl frame shall be a continuous magnet with a minimum holding force of 12 to 14 pounds per lineal foot (+/- 10%).
 - 2. The frame shall be white.
 - 3. The top and sides shall be magnetic and the bottom shall be either magnetic or foam.
 - 4. Pull J-handles shall be installed on the vertical pieces.
- C. Glazing: Standard clear glazing shall be made from crystal-clear transparent virgin acrylic or polycarbonate glazing not less than .118 inch thick and free of visual aberrations.
 - 1. Where indicated, provide nominal 1/8-inch thick obscure glazing for visual privacy ("translucent") as selected by Architect from manufacturer's full range of available frosted or patterned acrylic.
 - 2. Where indicated, provide nominal 1/8-inch thick opaque white acrylic glazing for complete light blocking.
 - 3. Where indicated for acoustical windows, provide nominal 1/4-inch thick clear acrylic with matte/non-glare finish.
 - 4. Where indicated for acoustical windows with complete light blocking, provide nominal 1/4-inch thick opaque white acrylic.
- D. Fasteners: Zinc plated, cadmium plated or other non-corrosive metal.

2.4 ACCESSORIES

- A. Acoustical Jamb Liner: High-performance polyester panels at acoustical windows to dampen sound vibrations between the primary window frame and the storm window steel attachment angle.
 - 1. Thickness: 1 inch.
 - 2. Composition: 7.5 lbs per cubic foot density panels made from 100% polyester (60% PET-recycled fiber, 40% PET-virgin fiber).
 - a. Formaldehyde free
 - b. No binding agents
 - c. No chemical irritants
 - 3. Finish: Architecturally decorative tackable surface.
 - 4. Flammability: Class A Fire- Rated.
 - a. Flame Spread Index: 15.
 - b. Smoke Developed Index: 250
 - 5. Color: White.
 - 6. Product: "Poly Max™" Polyester Acoustical Panels as manufactured by Acoustical Surfaces, Inc.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

- A. Install storm windows in strict accordance with manufacturer's written installation instructions.
- B. Attach the subframe to the field substrate and seal in position so as to present a neat, weather-resistant application. Attachment shall be accomplished using a minimum "20-year type" caulk or double-faced tape. A screw or mechanical fastening device may also be employed if approved by the manufacturer.

3.4 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 085369

SECTION 085610 - ALUMINUM VERTICAL SLIDING SERVICE WINDOWS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes aluminum, medium-duty commercial vertical sliding service windows at Customer Service 233.
- B. Related Sections include, but are not limited to, the following:
 - 1. Division 06 Section "Interior Architectural Woodwork" for counters at transaction windows.
 - 2. Division 08 Section "Steel Doors and Frames" for hollow metal frame at transaction windows.

1.3 SUBMITTALS

- A. Product Data: Submit Manufacturer's technical product data substantiating that products comply with requirements.
- B. Shop Drawings: Submit for fabrication and installation of windows. Include details, elevations, and field measurements, and installation requirement of finish hardware and cleaning.
- C. Certification: Provide printed data in sufficient detail to indicate compliance with the contract documents.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver windows crated to provide protection during transit and job storage.
- B. Inspect windows upon delivery for damage. Unless minor defects can be made to meet the Architect's specifications and satisfaction, remove and replace damaged parts.
- C. Store windows at building site under cover in dry location.

1.5 PROJECT CONDITIONS

- A. Field measurements: Check opening by accurate field measurement before fabrication. Show recorded measurements on shop drawings.
- B. Coordinate fabrication schedule with construction progress to avoid delay of work.

1.6 WARRANTY

- A. All material and workmanship shall be warranted against defects for a period of one (1) year from the original date of purchase

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Basis of Design: Design is based on medium-duty commercial aluminum "SWB1014" series, vertical sliding service window manufactured by C.R. Laurence Co., Inc.
 - 1. Phone: 800-421-6144
 - 2. Website: www.crlaurence.com.
- B. Requests for substitutions will be considered in accordance with Division 01 Section "Product Requirements".

2.2 MATERIALS

- A. Frames: Aluminum frame modules shall be constructed of 6063-T5 extruded aluminum with poly-pile weather stripping and slide locks. Overall frame sizes are to be in accordance with the contract drawings.
- B. Finish: All aluminum to be anodized, duranodic bronze.
- C. Glazing: 1/4" thick tempered glass.
- D. For windows exceeding 1050 square inches, (width x height) provide concealed sash balance at top of window frame.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install windows in accordance with manufacturer's printed instructions and recommendations. Repair damaged units as directed (if approved by the manufacturer and the Architect) or replace with new units.

3.2 CLEANING AND PROTECTION

- A. Clean frame and glazing surfaces after installation, complying with requirements contained in the manufacturer's instructions. Remove excess glazing sealant compounds, dirt or other substances.
- B. Institute protective measures required throughout the remainder of the construction period to ensure that all the windows do not incur any damage or deterioration, other than normal weathering, at the time of acceptance.

END OF SECTION 085610

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to the section.

1.2 SUMMARY

- A. Section includes, but is not limited to:
 - 1. Commercial door hardware needed for a complete and operational system for following:
 - a. Swinging doors
 - b. Other doors indicated in schedules and plans
 - 2. Cylinders for doors specified in other Sections
 - 3. Electrified door hardware
 - 4. Electronic door hardware
- B. Products Supplied but not Installed under this Section include the products listed below. Coordinating and scheduling the purchase and delivery of these products remain requirements of this section.
 - 1. Cylinders for locks on storefront entrance doors
- C. Related Sections include, but are not limited to:
 - 1. Division 08 Section "Hollow Metal Doors and Frames" for door silencers provided as part of hollow metal frames.
 - 2. Division 08 Section "Flush Wood Doors".
 - 3. Division 08 Section "Wood Stile and Rail Doors".
 - 4. Division 08 Section "Metal Sound-Control Door Assemblies" (Alternate No. 2)
 - 5. Division 08 Section "Aluminum Storefront Doors" for hardware provided as part of storefront door assemblies.
 - 6. Division 08 Section "Automatic Door Opener."
 - 7. Division 28 Section "Fire-Alarm System" for connections to building fire alarm system.
- D. Door Hardware Allowance: A portion of the work of this section, electrified and/or electronic finish hardware items and accessories for coordination with the Owner's security and access control system, is covered by an allowance. Refer to Division 01 Section "Allowances" for amount.

1.3 SUBMITTALS

- A. Submittal Sequence:
 - 1. After Pre-Submittal Conference with Architect, submit Door Hardware Schedule at earliest possible date, particularly where approval of Door Hardware Schedule must precede fabrication of other work that is critical in Project construction schedule.
 - 2. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to coordinated review of Door Hardware Schedule.
- B. Product Data: Submit manufacturer's technical product fact sheets describing each item of hardware to be provided including material descriptions, dimensions of individual components and profiles, and finishes.
- C. Door Hardware Schedule:
 - 1. Submit door hardware schedule prepared by or under supervision of a DHI certified Architectural Hardware Consultant (AHC) or Certified Door Consultant (CDC) detailing fabrication and assembly of door hardware, as well as procedures and diagrams.

2. Coordinate Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 3. Format:
 - a. Comply with scheduling sequence and vertical form as described in DHI's Sequence and Format for the Hardware Schedule.
 - b. Horizontal hardware schedules are not acceptable.
 4. Organization:
 - a. Organize door hardware schedule into hardware sets indicating complete designations of every item needed for each door or opening.
 - b. Organize door hardware sets in same order as in Door Hardware Schedule contained in Part 3 of this specification.
 - c. Use same door opening number designations indicated on drawings.
 - d. For doors of different sizes or where hinges, locks, or closers are different, use a separate heading for each. Do not combine labeled openings with non-labeled openings.
 5. Content:
 - a. Type, style, function, size, label, hand, and finish for each door hardware item
 - b. Name and manufacturer of each item
 - c. Fastenings and other pertinent information
 - d. Location of each door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule
 - e. Explanation of abbreviations, symbols, and codes contained in schedule
 - f. Mounting locations for door hardware
 - g. Door and frame sizes and materials
 6. Include results of field measurements and Pre-submittal Conference with Architect.
- D. Shop Drawings:
1. Provide a copy with each hardware schedule submitted.
 - a. Electrical components shall be listed by opening in hardware submittals.
 2. Submit details of interface between electrified door hardware and following:
 - a. Fire alarm system
 - b. Access control system
 - c. Security system
 3. Provide description of each electrified door hardware function, including location, sequence of operation, and interface with other building control systems.
 4. Wiring Diagrams: Submit detail wiring for power, signal, and control systems for each opening that requires electrified hardware, except openings where only magnetic hold-opens are specified. Differentiate between manufacturer-installed and field-installed wiring. Include the following:
 - a. System schematic
 - b. Point-to-point wiring diagram
 - c. Riser diagram
 - d. Elevation of each door
- E. Samples: Submit samples of door hardware items if requested by Architect. Accepted samples may be incorporated into Work.
1. At the Contractor's option, samples may be delivered to the Project Site field office rather than to the Architect's office.
- F. Quality Assurance Submittals:
1. Mock-Up: Construct mock-up of new mortise lockset installation on existing door at project site and obtain Architect's approval prior to ordering locksets.
 2. Test Reports: Provide product test reports based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, indicating current products comply with requirements.
 3. Manufacturer's Instructions:
 - a. Submit instructions for installation and maintenance of operating parts and finish.

- b. Furnish templates and schedules needed for fabrication of hollow metal doors and frames and other items related to hardware.
- c. Submission for templates and template list shall follow procedures established by DHI publication For Processing Hardware Schedules and Templates.

G. Closeout Submittals:

1. Operation and Maintenance:
 - a. Provide operation and maintenance data for electrically operated and non-electrical hardware consisting of technical information as follows:
 - (1) Maintenance instructions for each item of hardware
 - (2) Catalog pages for each product
 - (3) Parts list for each product
 - (4) Copy of final hardware schedule
 - (5) Copy of final keying schedule
 - b. Provide complete operational descriptions of electronic components listed by opening in hardware submittals.
 - (1) Operational descriptions shall detail how each electronic component functions within opening incorporating conditions of ingress and egress.
 - (2) Provide complete point-to-point wiring diagrams for electronic components listed by opening in hardware submittals.
 - c. Include a copy of operational and maintenance descriptions in Operation and Maintenance Data Manual.
2. Warranties: Submit Special warranties specified in this Section.
3. Keying Schedule:
 - a. Prepare and submit a keying schedule using keyset symbols referenced in DHI manual *Keying Systems and Nomenclature*. Include schematic keying diagram and index each key set to unique door designations.
 - (1) Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
 - b. Provide one complete bitting list of key cuts.
 - c. Keying schedule shall be prepared by or under supervision of supplier, detailing Owner's final keying instructions for locks.
4. Deliver keys and bitting list in person to the Owner.

1.4 QUALITY ASSURANCE

A. Qualifications:

1. Door Hardware Supplier:
 - a. Door hardware supplier shall have warehousing facilities in Project's vicinity and shall employ a qualified Certified Architectural Hardware Consultant (AHC) available during course of Work to consult with Contractor, Architect, and Owner about door hardware and keying.
 - b. Electrified Door Hardware:
 - (1) Supplier shall be an experienced door hardware supplier who has completed projects with electrified door hardware similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance, and who is acceptable to manufacturer of primary materials.
 - (2) Supplier shall prepare data for electrified door hardware, including shop drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
2. Architectural Hardware Consultant shall be a person who is currently certified by Door and Hardware Institute as an Architectural Hardware Consultant (AHC) and who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project.
3. Installer: Door hardware shall be installed by an experienced installer who has completed door hardware similar in material, design, and extent to that indicated for this Project and

whose work has resulted in construction with a record of successful in-service performance.

- B. Regulatory Requirements:
 - 1. Hardware and installation shall comply with provisions and standards listed in IBC 2006.
 - 2. Accessibility Regulations:
 - a. Americans with Disabilities Act – ADA
 - b. ANSI A117.1 Standard for Accessible and Usable Buildings and Facilities
 - c. Accessibility Guidelines for Buildings and Facilities (ADAAG)
 - 3. National Fire Protection Association:
 - a. NFPA 80 Standard for Fire Doors and Windows
 - b. NFPA 101 Life Safety Code
 - c. NFPA 252 Standard Methods of Fire Tests of Door Assemblies
 - 4. Underwriters Laboratories Inc. (UL) Building Materials Directory.
 - a. UL 10C Positive Pressure Fire Tests of Door Assemblies
 - b. UL 1784 Air Leakage Tests of Door Assemblies
 - 5. ANSI/BHMA Standards
 - a. A115 Specifications for Steel Door and Frame Preparation for Hardware.
 - b. A156 Series.
 - c. A250.6 Hardware on Steel Doors (Reinforcement – Applications)
 - 6. Door and Hardware Institute (DHI) Publications:
 - a. Abbreviations and Symbols
 - b. Basic Architectural Hardware
 - c. Hardware for Labeled Fire Doors (with supplements)
 - d. Hardware Reinforcements on Steel Doors and Frames
 - e. Installation Guide for Doors and Hardware
- C. Certifications:
 - 1. Hardware used in labeled fire-rated openings shall bear identifying label or mark indicating listing by Underwriters Laboratories, Inc., ITS (Warnock Hersey International), or other nationally recognized organizations acceptable to authority having jurisdiction.
 - 2. Provide door hardware for fire-rated door assemblies complying with NFPA 80 for fire ratings indicated, based on testing in compliance with NFPA 252.
 - 3. Electrified door hardware shall be listed and labeled as defined in NFPA 70, Article 100.
- D. Pre-Submittal Conference: Conduct conference with Architect at the Project Site prior to submitting hardware schedule and product data.
 - 1. Review hardware sets as scheduled and discuss performance requirements, options, and functions to clarify intent of this section.
 - 2. Review and inspect existing doors and/or openings to remain that will be modified under this contract. Identify those doors or frames requiring further field measurement.
 - 3. Obtain additional direction from the Owner's security consultant.
- E. Pre-Installation Meetings:
 - 1. Conduct conference on-site to comply with requirements in Division 01 for Project Meetings.
 - 2. Topics to be discussed at meeting shall include:
 - a. Review items such as proper installation sequence, adjustments, attachment, and location of door hardware.
 - b. Review methods and procedures related to electrified door hardware including but not limited to following:
 - (1) Inspect and discuss electrical roughing-in and other preparatory work performed by other trades.
 - (2) Review sequence of operation for each type of electrified door hardware.
 - (3) Review required testing, inspecting, and certifying procedures.
 - c. Review and finalize construction schedule and verify availability of materials, installer's personnel, equipment, and facilities needed to make progress and avoid delays.

- F. Keying Conference:
1. Conduct conference on-site to comply with requirements in Division 01 for Project Meetings. Participants shall be Owner's representative, Contractor, hardware supplier, and lock manufacturer's representative.
 2. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including but not limited to following:
 - a. Function of building, flow of traffic, purpose of each area, degree of security needed, and plans for future expansion
 - b. Preliminary key system schematic diagram
 - c. Requirements for key control system
 - d. Address for delivery of keys
- G. Coordination:
1. Obtain and distribute templates for doors, frames, and other work specified to be factory prepared for installing door hardware to parties involved.
 2. Check shop drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with specified requirements.
- H. Means of Egress Doors: Latches shall not require more than 15 lbf to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.
- I. Accessibility Requirements: For door hardware on doors in an accessible route, comply with the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.
1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
 2. Comply with the following maximum opening-force requirements:
 - a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.
 - b. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
 3. Bevel raised thresholds with a slope of not more than 1:2.
 4. Adjust door closer sweep periods so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.

1.5 PROJECT CONDITIONS

- A. Work of this section involves installation of new finish hardware on existing doors and on salvaged doors in new locations. Verify dimensions and details of existing doors and frames by field measurements and indicate results of field investigation on door hardware schedule submittal.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Site.
- B. Tag each item or package separately with identification related to final Door Hardware Schedule, and include basic installation instructions with each item or package.

1.7 SPECIAL WARRANTY

- A. Provide written warranty, executed by manufacturer agreeing to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period. Failures include but are not limited to following:
1. Structural failures including excessive deflection, cracking, or breakage
 2. Faulty operation of operators and door hardware
 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering

- B. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of Contract Documents.

1.8 MAINTENANCE

- A. Extra Materials:
 - 1. Furnish three dozen extra screws and other fasteners of each size, type and finish used with the hardware items provided.
 - 2. Store extra materials on-site as directed by Owner.
- B. Maintenance Service:
 - 1. Beginning at Substantial Completion, provide 12 months' full maintenance by skilled employees of door hardware installer.
 - a. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as needed for proper door hardware operation.
 - b. Provide parts and supplies as used in manufacture and installation of original products.
 - 2. Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General Requirements:
 - 1. Hardware shall be of best grade, entirely free of imperfections in manufacture and finish, and shall satisfactorily perform various functions needed.
 - 2. Furnish necessary screws, bolts or others fastenings of suitable size and type to anchor hardware in position and match hardware as to material and finish. Provide Phillips flat-head screws except as otherwise indicated.
 - 3. Do not use through-bolts for installations where bolt head or nut opposite face is exposed in other work. Use of sex bolts shall not be allowed.
 - 4. Drawings show direction of slide, swing or hand of each door leaf. Furnish each item of hardware for proper installation and operation of door movement as indicated. Provide all items of hardware not definitely specified but needed for satisfactory installation and operation of hardware. Such items shall be of type and quality suitable for service needed and comparable to adjacent hardware.
 - 5. Finish: Provide US10B oil-rubbed bronze finish, typical. For items not manufactured in US10B, provide best possible match subject to Architect's approval.
- B. Substitutions: Manufacturers and model numbers listed are to establish a standard of quality and design. The Architect must approve all product substitutions. In accordance with Division 01 requirements, submit required data and physical samples of proposed substitutions to the Architect for review.

2.2 ACCEPTABLE MANUFACTURERS

- A. Hinges
 - 1. Bommer Industries, Inc.
 - 2. H. B. Ives
 - 3. Stanley
 - 4. McKinney Products Co.

- B. Continuous Hinges
 - 1. Pemko Manufacturing Co.
 - 2. Stanley
 - 3. Zero International

- C. Flush Bolts
 - 1. H.B. Ives
 - 2. Rockwood Manufacturing
 - 3. Trimco

- D. Cylinder & Keys: Medeco by Assa Abloy – no substitutions permitted.

- E. Dead Bolts:
 - 1. Corbin Russwin
 - 2. Sargent Manufacturing Co.
 - 3. Yale Commercial Locks and Hardware
 - 4. Best

- F. Locksets & Latchsets:
 - 1. Corbin Russwin
 - 2. Sargent Manufacturing Co.
 - 3. Yale Commercial Locks and Hardware
 - 4. Best

- G. Exit Devices:
 - 1. Corbin Russwin
 - 2. Precision
 - 3. Monarch
 - 4. Sargent Manufacturing Co.
 - 5. Von Duprin
 - 6. Yale Commercial Locks and Hardware

- H. Door Pulls:
 - 1. H.B. Ives
 - 2. Rockwood Manufacturing
 - 3. Hager

- I. Surface Closers:
 - 1. Yale

- J. Wall & Floor Stops:
 - 1. H. B. Ives
 - 2. Rockwood Manufacturing
 - 3. Trimco

- K. Protective Plates:
 - 1. H. B. Ives
 - 2. Rockwood Manufacturing
 - 3. Hager

- L. Thresholds:
 - 1. National Guard Products.
 - 2. Pemko
 - 3. Rixson
 - 4. Zero International

- M. Weatherstrip & Gasket:

1. National Guard Products
 2. Pemko
 3. Zero International
- N. Hold-open Magnets:
1. LCN
 2. Rixson
- O. Electric Strikes:
1. Adams Rite
 2. Folger Adam
 3. Hanchett Entry Systems
 4. Von Duprin
- P. Security Magnets: Schlage Electronic
- Q. Power Supplies:
1. Adams Rite
 2. Schlage Electronic
 3. Von Duprin
- R. Electric Switches: Schlage Electronic
- S. Door Position Switches
1. Sargent Manufacturing Co.
 2. Security Door Controls
 3. Sentrol
- T. Electromagnetic Locks
1. Folger Adam
 2. Securitron Security Hardware
 3. Sargent Manufacturing Co.

2.3 HINGES

- A. Butt Hinges: BHMA A156.1
1. Provide full mortise, template, 5-knuckle, button tip hinges with non-rising loose pins and ball type bearings.
 2. For out-swinging exterior doors, furnish stainless steel hinges with non-removable pins or security studs.
 3. For interior doors with locksets furnish non-removable pins.
 4. Furnish hinges in following quantities:
 - a. Doors up to 90" in height: three (3) hinges
 - b. Doors over 90" in height: Add one (1) hinge for every additional 30"
 5. Furnish hinge sizes not less than as follows:
 - a. For 1 3/4" Thick Doors: Standard weight
 - (1) Doors up to 3'-0" wide: 4 1/2 x 4 1/2 x 0.134 gauge
 - (2) Doors 3'-0" to 4'-0" wide: 5 x 4 1/2 x 0.146 gauge
 - b. For 2 1/4" Thick Doors: Heavy weight
 - (1) Doors up to 3'-0" wide: 4 1/2 x 4 1/2 x 0.180 gauge
 - (2) Doors 3'-0" to 4'-0" wide: 5 x 4 1/2 x 0.190 gauge
 6. Furnish hinges of sufficient throw where needed to clear trim or permit doors to swing 180 degrees.
 7. Continuous Hinges: BHMA A156.26; minimum 0.120-inch- thick, hinge leaves with minimum overall width of 4 inches ; fabricated to full height of door and frame and to template screw locations; with components finished after milling and drilling are complete.

8. Acceptable Products, Standard Weight Hinges:

	<u>Steel</u>	<u>Stainless Steel</u>
a. Bommer:	BB5000	BB5002
b. McKinney:	TA2714	TA2314
c. H. B. Ives:	5BB1	5BB1
d. Stanley:	FBB179	FBB191

9. Acceptable Products, Heavy Weight Hinges:

	<u>Steel</u>	<u>Stainless Steel</u>
a. Bommer:	BB5004	BB5006
b. McKinney:	T4A3786	T4A3386
c. H. B. Ives:	5BB1HW	5BB1HW
d. Stanley:	FBB168	FBB199

2.4 LOCKSETS AND LATCHSETS

A. General Requirements:

1. Shape of lever shall be easy to grasp with one hand and not require tight grasping, tight pinching, or twisting of wrist.
2. Locksets and latchsets shall not require more than 15 lbf to release latch. Locks shall not require use of a key, tool, or special knowledge for operation.
3. Provide manufacturer's standard wrought box strike for each latchset and lockset with curved lip extended to protect frame without catching clothing. Finish shall match hardware set.
4. Provide knurling or abrasive coating to lever on corridor side of openings leading to hazardous areas, such as electrical closets and mechanical equipment rooms as a tactile warning to visually impaired persons. Apply tactile warning on side of lever facing door only.
5. Provide all locks and cylinders with hi-security cylinders. Key system shall be 6-pin tumbler with cylinder parts from brass/bronze, stainless steel or nickel silver.

B. Mortise Locksets and Latchsets: Heavy duty, BHMA A156.13, Series 1000, Grade 1.

1. Backset: 2 3/4" or as needed to accommodate frame, door or other hardware.
2. Lever Trim: Accessible design, independent operation, spring-cage supported, and minimum 2" clearance from lever mid-point to face of door.
3. Locks shall have field adjustable, beveled armored front, with a 1/8-inch thickness minimum.
4. Latchbolt shall be solid one-piece 3/4-inch throw anti-friction stainless steel. Balance of inner parts shall be corrosion-resistant plated steel or stainless steel.
5. Deadbolt shall be a one-inch throw made of stainless steel and have two (2) hardened steel roller inserts.
6. Strike: Provide wrought boxes and strikes with proper lip length to protect trim but not to project more than 1/8-inch beyond trim, frame, or inactive leaf.
7. Power supplies for electrified mortise locks shall be furnished by the lockset manufacturer. Provide the least number of power supplies required to adequately serve doors with electrified mortise locks.
8. Basis of Design: Corbin Russwin ML 2000 Series Mortise Locksets with Vineyard Series "Merlot" lever trim and "L" escutcheons.

2.5 EXIT DEVICES

A. Exit Devices: ANSI/ BHMA A156.3, Grade 1

1. Exit devices shall be listed by UL for accident and hazard. Devices shall conform to applicable requirements of NFPA 80 and NFPA 101.
2. Shape of lever shall be easy to grasp with one hand and not require tight grasping, tight pinching, or twisting of wrist. Coordinate lever style and design with lever handle trim for locksets.

3. Exit devices shall not require more than 15 lbf to release latch. Locks shall not require use of a key, tool, or special knowledge for operation.
4. Furnish filler plates and shim kits as needed for flush mounting of devices on doors.
5. Provide "crash bar" style.
6. Furnish cylinder dogging on non-fire rated doors.
7. Surface strikes shall be roller type and come complete with a locking plate underneath to prevent movement. Devices shall have dead latching feature to prevent latchbolt tampering.
8. Devices shall not have exposed rivets or screws on back of device that could be visible through a glass light.
9. Outside trim shall be heavy-duty type fastened by means of concealed welded lugs and through-bolts from inside. Trim shall be forged brass with a minimum average thickness on escutcheon of 0.130". Pull plate with trim shall be brass with minimum average thickness of 0.090" and have forged pulls.
10. Lever trim shall be designed with a breakaway feature to allow trim to freely rotate while remaining securely locked, preventing damage to internal lock components from vandalism by excessive force.
11. Latch bolts shall have a self-lubricating coating that reduces friction and wear. Plated latch bolts are unacceptable.

2.6 DOOR CLOSERS

A. General Requirements:

1. Closers shall be sealed and filled with all-weather fluid. Provide stable hydraulic fluid to withstand a temperature range of 120 degrees F to minus 30 degrees F.
2. Size closers in compliance with requirements for accessibility for handicapped and recommendations of manufacturer. Provide barrier free and delayed action features as needed. Comply with following maximum opening-force requirements:
 - a. Interior Hinged Doors: 5.0 lbs.
 - b. Exterior Hinged Doors: 8.5 lbs.
 - c. Fire Doors: Minimum opening force allowable by authorities having jurisdiction

B. Surface Closers: BHMA A156.4, Grade 1

1. Surface mounted closers shall be full rack-and-pinion type closer with full complement bearings, single piece forged piston, chrome silicon steel spring, non-critical screw valves; back check, sweep and latch.
2. Furnish traditional "pot belly" style closers complete with necessary brackets and fasteners for top of door surface mounted units.
3. Closer products with any type of pressure relief valve system are not acceptable.
4. Closers shall be ISO 9000 certified. Units shall be stamped with date of manufacture code.
5. Closers shall be factory sized.
6. Locate closers on interior side of exterior doors and on non-public side of interior doors, unless otherwise specified.
7. Provide manufacturer's heaviest duty arm available at doors scheduled with parallel arm applications.
8. Provide plates, brackets and special templates when needed for interface with particular header door and wall conditions and adjacent hardware.
9. Closers shall be tested to 100 hours of salt spray test in compliance with ASTM B117; furnish data on request.
10. Acceptable Products: Yale 1900 Series.

2.7 FLUSHBOLTS

A. Flushbolts: BHMA A156.16

1. Provide minimum 1/2" diameter rods of brass or stainless steel, with minimum 12" long rods for doors up to 7'-0" in height. Provide longer rods as needed for doors exceeding 7'-0" in height.

2. Provide dustproof strikes for bottom flushbolt applications, except where special threshold construction provides non-recessed strike for bolt.
3. Acceptable Products:
 - a. Ives: FB458
 - b. Rockwood: 555
 - c. Trimco: 3917

2.8 PUSH PLATES, PULL BARS, AND GRIPS

- A. General Requirements: BHMA A156.6
 1. Provide concealed mounting where possible. Where exposed fasteners are used, they shall be countersunk.
 2. Push plates shall be beveled on four edges.
 3. Where applicable plates shall be prepared to receive cylinder locks or thumb turns as scheduled.
- B. Push Plates:
 1. Size: 8" x 16"
 2. Thickness (US GA): 18 gauge; .050"
 3. Acceptable Products:
 - a. Hager: 30S
 - b. Ives: 8200
 - c. Rockwood: 70C
- C. Pull Plates:
 1. Size: 4" x 16"
 2. Thickness (US GA): 18 gauge; .050"
 3. Pull Size: 1" diameter; 10" center-to-center
 4. Acceptable Products:
 - a. Hager: 34G
 - b. Ives: 8302-0
 - c. Rockwood: 110 x 70C
- D. Pull Bars: Offset "D" pull
 1. Size: 1" diameter
 2. Projection: 2 1/2"
 3. Mounting: 10" center-to-center
 4. Acceptable Products:
 - a. Hager: 11J
 - b. Rockwood: 151
 - c. Ives – 8190-0

2.9 DOOR PROTECTION DEVICES

- A. General Requirements: ANSI/ BHMA A156.6
 1. Fabricate protection plates (kick or mop) not more than 2" less than door width on stop side and not more than 2" less than door width on pull side, x height indicated.
 2. Protection plates shall be beveled on three edges.
 3. Furnish protection plates for concealed mounting where possible. Where exposed fasteners are used, they shall be countersunk.
 4. Metal Plates: Stainless steel
 - a. Thickness (US GA): 18 gauge; .050"
 5. Finish: BHMA #630 (US32D)
- B. Kick Plates:
 1. Size: 10"
 2. Acceptable Manufacturers:
 - a. Hager: 193S

- b. Ives: 8400
- c. Rockwood: Kick Plate

- C. Mop Plates:
 - 1. Size: 4"
 - 2. Acceptable Manufacturers:
 - a. Hager: 193S
 - b. Ives: 8400
 - c. Rockwood: Mop Plate

2.10 SEALS AND GASKETS

- A. General Requirements: ANSI/ BHMA A156.22
 - 1. Except as otherwise indicated, provide DHSI #105 weatherstripping at each edge of every exterior door leaf.
 - 2. Door Bottoms: Door sweeps used on exterior doors shall be NGP 101V or 100V.
 - 3. Meeting Stile Gasket: When a metal astragal is not permitted, due to operation of the hardware or code restrictions, provide a self-adhesive seal at the meeting stiles that does not restrict the opening and closing of the door leaves.
 - 4. Screw-on type weatherstrip on frames is unacceptable.

2.11 THRESHOLDS

- A. General Requirements: ANSI/ BHMA A156.21
 - 1. Except as otherwise indicated provide standard threshold units of type, size and profile as shown or scheduled.
 - 2. Metal: Extruded aluminum; 6063-T5 alloy
 - a. Finish: Clear anodized; BHMA #628 (US27)
 - 3. Acceptable Manufacturers:
 - a. NGP
 - b. Pemko
 - c. Zero

2.12 AUXILIARY HARDWARE

- A. Silencers: ANSI/ BHMA A156.16
 - 1. Furnish tamper proof resilient cushions designed to absorb shock and noise at openings without gaskets.
 - 2. Provide three (3) silencers per single door, and two (2) for pairs of doors.
- B. Wall Bumpers: 2 1/2" diameter; 1" nominal projection
 - 1. Acceptable Products:
 - a. Hager: 235W
 - b. Ives: WS402CCV
 - c. Rockwood: 403
- C. Interior Floor-Mounted Stops: Dome stops with risers; 1" height
 - 1. Finish: BHMA #626 (US26D)
 - 2. Acceptable Products:
 - a. Hager: 241F
 - b. Ives: FS13
 - c. Rockwood: 441

2.13 ACCESSORIES FOR PAIRS OF DOORS

- A. Astragals: BHMA 156.22.

2.14 ELECTRICALLY OPERATED HARDWARE

- A. General Requirements:
1. Electrically operated locking devices shall be connected to building fire and smoke/heat alarm systems. Activation of alarm system shall disengage electric locking mechanism allowing free, unrestricted egress through opening.
 2. Coordinate installation of electrically operated hardware to insure proper size wire is used to power load(s).
 - a. Voltage drop shall not exceed five percent (5%) of load's stated voltage.
 - b. Voltage drop shall be calculated by first determining resistance of load ($R=E/I$ voltage divided by AMP draw). Next, determine resistance of wire (per below chart). Divide this number by resistance of load. If result exceeds five percent (5%), wire thickness shall be increased.
 3. Furnish electrically operated hardware with power supply units, junction boxes, and other accessories needed for a complete, efficient installation.
- B. Basis of Design for Access Control System: Simplex "C Cure" 800 system with I-Star Pro controller.
- C. Electro-Magnetic Door Holders:
1. Provide wall-mounted units to hold door in open position and to release and automatically close under alarm conditions.
 2. Electromagnet shall be protected against transients and voltage surges up to 600 volts.
 3. Power Requirements: 24 V AC/DC nominal +10% -15% @ .110 amp maximum
 4. Acceptable Products:
 - a. LCN – SEM 1970/80 Series
 - b. Rixson: Model 989/990

2.15 CYLINDERS, KEYING SYSTEMS AND KEY CONTROL

- A. General Requirements: Meet with Owner to finalize keying requirements and obtain keying instructions in writing. Develop keying schedule in compliance with specific requirements determined in consultation with Owner.
- B. Cylinders:
1. Permanent cylinders shall be keyed by manufacturer and configured into sets or subsets, master keyed or great grand master keyed as directed by Owner.
 2. Permanent keys and cylinders shall be marked with applicable blind code for identification. These visual key control marks or codes shall not include actual key cuts.
 - a. Key and cylinder identification stamping shall be approved by Owner. Failure to properly comply with these requirements shall be cause for replacement of cylinders and keys involved at no additional cost to Owner.
 3. Equip locks and cylinders with patent protected, full size cylinders with six (6) nickel silver finger pins. Provide a minimum of six (6) pins with nickel silver bottom pins. Cylinders shall allow for multiplex master keying, configured to Owner's instructions.
- C. Key Material:
1. Provide manufacturer's standard embossed keys of nickel silver to ensure durability.
 2. Key Quantity: Furnish keys in following quantities:
 - a. Master Keys: six (6) per master group
 - b. Change Keys:
 - (1) Locks Keyed Alike: four (4) per set
 - (2) Locks Keyed Different: three (3) per lock
 - c. Key Blanks: six (6) per cylinder
 - d. Temporary Construction Master Keys: 12 total
 3. Deliver end user exclusive permanent key blanks and other security keys directly to Owner's representative from manufacturer by secure courier, return receipt requested.

Failure to properly comply with these requirements shall be cause for replacement of cylinders and keys involved at no additional cost to Owner.

D. Acceptable Manufacturer for Cylinders and Keys: Medeco.

2.16 FINISHES

- A. Protect mechanical finish on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Site Verification of Conditions:
 - 1. Examine doors and frames with Installer present for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
 - 2. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 3. Commencement of installation constitutes acceptance of conditions and responsibility for satisfactory performance.
- B. Surface Preparation for Steel Doors and Frames: Comply with DHI A115 Series
 - 1. Surface-Applied Door Hardware: Drill and tap doors and frames in compliance with SDI 109

3.2 INSTALLATION

- A. General Requirements:
 - 1. Install each door hardware item to comply with manufacturers' written instructions using manufacturers supplied fasteners.
 - 2. Securely install finish hardware items in compliance with accepted schedule and templates furnished with hardware.
 - 3. Install mortised items flush with adjacent surfaces.
 - 4. Install locksets, surface mounted closers, and trim after finishing of doors and frames is complete.
 - a. Where cutting and fitting is needed to install door hardware onto or into surfaces that are to be painted or finished in another way later, coordinate removal, storage, and reinstallation of door hardware with finishing work.
 - 5. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
 - 6. Drill and countersink units that are not factory-prepared for anchorage fasteners. Space fasteners and anchors in compliance with industry standards.
- B. Mounting Heights: Mount door hardware units at heights indicated in ANSI A250.6, unless otherwise specifically indicated or required to comply with governing regulations:
 - 1. DHI Publication Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames.
 - 2. DHI Publication Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames.

- C. Electrically Operated Hardware:
 - 1. Comply with manufacturer's instructions for wiring, grounding, and shielding.
 - 2. Verify locations of boxed power supplies with Architect prior to rough-in.
 - 3. Provide one (1) power supply for each door opening.
- D. Door Stops:
 - 1. Furnish door stops for every door leaf. Install floor-mounted or wall-mounted stops, as applicable. Provide overhead door holder where floor or wall stops cannot be used.
 - 2. Place door stops in such a position that they permit maximum door swing, but do not present a hazard or obstruction. Furnish floor strikes for floor holders of proper height to engage holders of doors.
 - 3. Install floor stops with risers as needed to accommodate finish flooring materials for proper relationship to door.
- E. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant in compliance with requirements specified in Division 07.

3.3 FIELD QUALITY CONTROL

- A. Owner may employ and pay for services of a qualified independent Architectural Hardware Consultant (AHC) to perform inspections and to prepare inspection reports.
- B. Inspection Service:
 - 1. After installation of door hardware is complete, independent AHC will inspect door hardware for proper application of finish hardware in compliance finish hardware schedule and keying schedule. In addition AHC will check hardware for adjustment and proper operation.
 - 2. AHC will prepare and submit to Contractor, Architect, and Owner, a written report of inspection stating whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted. Report will be submitted within three (3) days following site visits.

3.4 ADJUSTING

- A. Initial Adjustment:
 - 1. Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
 - 2. Adjust door closer sweep period so that from an open position of 70 degrees door will take at least 3 seconds to move to a point 3" from latch measured to leading edge of door.
- B. Final Adjustment:
 - 1. Return to Project during week prior to Substantial Completion and make final check and adjustment of hardware items.
 - 2. Adjust hardware so doors operate in perfect order. Test and adjust hardware for quiet, smooth operation, free of sticking, binding, or rattling. Adjust closers for proper, smooth operation.
 - 3. Adjust door control devices to compensate for final operation of heating and ventilating equipment.
- C. Six Month Adjustment: Approximately six months after Date of Substantial Completion, installer shall perform following:
 - 1. Examine and readjust each item of door hardware as necessary to ensure function of doors, door hardware and electrified door hardware.
 - 2. Consult with, and instruct, Owner's personnel on recommended maintenance procedures.

3. Replace door hardware items that have deteriorated or failed due to faulty design, materials, or installation.

3.5 CLEANING

- A. Carefully clean exposed hardware by methods not injurious to finish, immediately preceding occupancy. Replace defective, damaged, or missing hardware.
- B. Clean adjacent surfaces soiled by hardware installation.
- C. Clean operating items as needed to restore proper function and finish.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes.

3.7 PROTECTION

- A. Provide final protection and maintain conditions that ensure door hardware shall be without damage or deterioration at time of Substantial Completion.
- B. Protect door hardware items from abuse, corrosion and other damage until Owner accepts Project as complete.

3.8 HARDWARE SETS

A. Interior Door Openings

Hardware Set HW-1

Existing Classroom Door

- 1 ea Lockset (classroom function with auxiliary deadbolt)
 - 1 ea Oversize escutcheon/cover plate (at former lockset)
 - 1 ea Closer (parallel arm mounting)
 - 1 ea Flip-down door holder
- Remove existing lockset, deadbolt, and closer (where occurring)
All other hardware existing to remain.

Hardware Set HW-2

Oversize Classroom Door

- 1 ea Anchor Hinge
- 3 ea Hinges
- 1 ea Lockset (classroom function with auxiliary deadbolt)
- 1 ea Closer
- 1 ea Flip-down door holder
- 1 ea Door stop (wall bumper)

Hardware Set HW-3

Stairwell door (standard height)

- 3 ea Hinges
- 1 ea Exit device (rim type) passage set
- 1 ea Closer (parallel arm mounting)
- 1 ea Door stop (wall bumper)

Hardware Set HW-4, HW-4.1

Stairwell door (greater than 7'-6" tall)

- 4 ea Hinges
- 1 ea Exit device (rim type), passage set
- 1 ea Closer (parallel arm mounting at HW-4.1)
- 1 ea Door stop (wall bumper type)

Hardware Set HW-5

Stairwell door (oversize) with hold-open

- 1 ea Anchor hinge
- 2 ea Hinges
- 1 ea Exit device (rim type), with cylinder
- 1 ea Closer
- 1 ea Electro-magnetic door hold-open device, floor-mounted

Hardware Set HW-6

Pair existing oversize stairwell doors

- 2 ea Exit device (surface vertical rod type, upper rod only)
 - 2 ea Closers (parallel arm mounting)
 - 2 ea Electromagnetic door hold-open devices
- Remove existing deadbolt, flush bolts, and push plates.
All other hardware existing to remain.

Hardware Set HW-7

Public restroom entry door

- 3 ea Hinges at HW-7
- 1 ea Push plate
- 1 ea Pull plate with handle
- 1 ea Auxiliary deadbolt (Classroom function)
- 1 ea Closer
- 1 ea Mop plate
- 1 ea Door stop (wall bumper)

Hardware Set HW-8

Restroom with privacy latch

- 3 ea Hinges at HW-8
- 1 ea Privacy lock
- 1 ea Mop plate
- 1 ea Door stop (wall bumper)

Hardware Set HW-9

Janitor Closet Door

- 3 ea Hinges
- 1 ea Lockset (store room function)
- 2 ea Mop plates

Hardware Set HW-10, 10.1

Supply Closet, Storage Room single door standard height

- 3 ea Hinges
- 1 ea Lockset (store room function)
- 1 ea Door stop (wall bumper) at HW-10.1 only

Hardware Set HW-11

Supply Closet, double door

- 6 ea Hinges at HW-11
- 1 ea Lockset (store room function), active leaf
- 1 set Flush bolts (inactive leaf)

Hardware Set HW-12

Kitchen Pantry door

- 3 ea Hinges
- 1 ea Lockset (classroom function)
- 1 ea Door stop (wall bumper)
- 2 ea Mop plates
- 1 ea Flip-down door holder

Hardware Set HW-13

Pair Electrical Room doors, unequal leaves

- 8 ea Hinges
- 1 ea Exit device (rim type), active leaf
- 1 set Flush bolts (inactive leaf)

Hardware Set HW-14

Office door, Storage Room door

- 3 ea Hinges at HW-14
- 1 ea Lockset (classroom function)
- 1 ea Door stop (wall bumper type)

Hardware Set HW-15, HW-15.1

Existing Office or Storage room door(s)

- 1 ea Lockset (classroom function)
- 1 ea Threshold at HW-15.1 only
- 1 ea Soundstripping at HW-15.1 only

Remove existing lockset.
All other hardware existing to remain.

Hardware Set HW-16

Office door with Access Control

- 3 ea Hinges at HW-16
- 1 ea Electrified Lockset
- 1 ea Card reader device
- 1 ea Closer
- 1 ea Door stop (wall bumper type)
- 1 ea Power supply

Hardware Set HW-17

Existing Office door with Access Control

- 1 ea Electrified Lockset
- 1 ea Card reader device
- 1 ea Power supply

Remove existing cipher lock.
All other existing hardware to remain.

Hardware Set HW-18

Public entry pair of doors

- 6 ea Hinges at HW-18
- 2 ea Exit devices, concealed vertical rod type
- 2 ea Closers
- 2 ea Door stops (wall bumper type)
- 2 ea Flip-down door holders

Hardware Set HW-19

Existing Office door with access control

- 1 ea Lockset
- 1 ea Electric Strike
- 1 ea Card reader device
- 1 ea Closer

Remove existing lockset and strike
All other hardware existing to remain.

Hardware Set HW-20

Oversize Storage Room door

- 1 ea Anchor Hinge
- 2 ea Hinges
- 1 ea Lockset (store room function)
- 1 ea Flip-down door holder
- 1 ea Door stop (wall bumper)

Hardware Set HW-21

Neighborhood Center Vestibule door

- 3 ea Hinges
- 1 ea Push plate
- 1 ea Pull bar with plate
- 1 ea Closer

Hardware Set HW-22

Stairwell door from office suite

- 3 ea Hinges
- 1 ea Lockset (classroom function)
- 1 ea Closer (parallel arm mounting)
- 1 ea Door stop (wall bumper)

Hardware Set HW-23

Kitchen doors

- 3 ea Hinges
- 3 ea Lockset (classroom function)
- 1 ea Mop plate
- 1 ea Flip-down door holder
- 1 ea Door stop (hinge pin type)

Hardware Set HW-24

Concessions/Serving (door doors)

- 6 ea Hinges
- 2 ea Push plates
- 2 ea Pull bars with plates
- 2 ea Deadbolts (classroom function)
- 2 ea Flip-down door holders
- 2 ea Door stops (hinge pin type)

Hardware Set HW-25

Attic access door

- 3 ea Hinges
- 1 ea Lockset
- 1 set Soundstripping (four sides of frame)

Hardware Set HW-26

Existing door at Make-Up room

- 1 ea Privacy Latchset
- 1 ea Auxiliary deadbolt (classroom function)
- 1 ea Mop plate
- 1 ea Door stop (wall bumper)

Remove existing lockset.
All other hardware existing to remain.

Hardware Set HW-27

Stage Access door

- 3 ea Hinges
- 1 ea Lockset (classroom function)
- 1 ea Closer
- 1 ea Threshold
- 1 set Soundstripping
- 1 ea Door stop (wall bumper)
- 1 ea Flip-down door holder

Hardware Set HW-28

Stage side door

- 3 ea Hinges
- 2 ea Push plate
- 2 ea Pull bar with plate
- 1 ea Closer
- 1 ea Deadbolt (classroom function)
- 1 ea Threshold
- 1 set Soundstripping
- 1 ea Threshold
- 1 ea Flip-down door holder

Hardware Set HW-29

Existing Auditorium doors repositioned

- 2 ea Continuous piano hinges
 - 2 ea Flush bolts (at door bottom)
- Remove existing pivots and push plates.

Hardware Set HW-30

Auditorium doors (oversize)

- 2 ea Cam-lift hinges
- 2 ea Exit devices (rim type)
- 2 ea Closers (parallel arm mounting)
- 1 ea Threshold
- 1 set Soundstripping
- 1 ea Automatic door bottom
- 1 ea Door stop (floor-mounted dome type)
- 1 ea Flip down door holder

B. Exterior Door Openings

Hardware Set HW-101

Pair Mechanical Room doors

- 4 pr Hinges
- 1 ea Lockset (store room function), active leaf
- 1 set Flush bolts (inactive leaf)
- 1 ea Astragal (active leaf)
- 2 ea Flip-down door holders
- 1 set Weatherstripping
- 1 ea Threshold

Hardware Set HW-102

Elevator Equipment Room door

- 3 pr Hinges
- 1 ea Lockset (store room function)
- 1 ea Flip-down door holder
- 1 set Weatherstripping
- 1 ea Threshold

Hardware Set HW-103

Existing Storage Room door

- 1 ea Lockset (store room function)
- 1 set Weatherstripping

All other hardware existing to remain.

Hardware Set HW-104

Existing Neighborhood Center exterior door

- 1 ea Lockset
- 1 ea Escutcheon assembly/cover plate (at former deadbolt location)
- 1 set Weatherstripping
- 1 ea Threshold

Remove existing automatic door operator and deadbolt.
All other hardware existing to remain.

Hardware Set HW-105

Pair Aluminum and Glass Storefront doors

- 2 ea Exit devices (concealed vertical rod), lever handle trim, crash bar style
- 1 ea Threshold
- 1 ea Automatic Door opener
- 1 ea Card reader

Balance of hardware by door and frame supplier.

Provide additional hardware and coordinate door contacts and other access control devices with Owner's security system.

Hardware Set HW-106

Pair Custom Wood and Glass entrance doors

- 2 ea Anchor Hinges (one per leaf)
- 4 ea Hinges
- 2 ea Exit Devices (rim), lever handle trim, crash bar style
- 2 ea Closers
- 2 ea Kickplates
- 1 set Weatherstripping
- 1 ea Threshold

Hardware Set HW-107

Existing Kitchen Vestibule door

- 1 ea Lock cylinder
- 1 ea Lever style trim for existing exit device
- 1 set Weatherstripping

All other hardware existing to remain.

END OF SECTION 087100

SECTION 087113 - AUTOMATIC DOOR OPENER

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes, but is not limited to:
 - 1. Low-energy door operator for swinging door.
 - 2. Post for mounting exterior pushplate.
- B. Related Requirements include, but are not limited to:
 - 1. Division 08 Section "Storefront Entrance Doors."
 - 2. Division 08 Section "Glazed Aluminum Curtain Walls."
 - 3. Division 08 Section "Door Hardware."

1.3 DEFINITIONS

- A. AAADM: American Association of Automatic Door Manufacturers.
- B. Activation Device: A control that, when actuated, sends an electrical signal to the door operator to open the door.
- C. Safety Device: A control that, to avoid injury, prevents a door from opening or closing.
- D. For automatic door terminology, see BHMA A156.10 and BHMA A156.19 for definitions of terms.

1.4 COORDINATION

- A. Templates: Distribute for doors, frames, and other work specified to be factory prepared and reinforced for installing automatic door operators.
- B. Coordinate hardware for doors with operators to ensure proper size, thickness, hand, function, and finish.
- C. Electrical System Roughing-in: Coordinate layout and installation of automatic door operators with connections to power supplies and access-control system.

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for automatic door operators.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

- B. Shop Drawings: For automatic door operators.
 - 1. Include plans, elevations, sections, hardware mounting heights, and attachment details.
 - 2. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Indicate locations of activation and safety devices.
 - 4. Include diagrams for power, signal, and control wiring.
 - 5. Include plans, elevations, sections, and attachment details for guide rails.
- C. Samples: For each exposed product and for each color and texture specified, manufacturer's standard size.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Certificates: For each type of automatic door operator.
- C. Field quality-control reports.
- D. Sample Warranties: For manufacturer's special warranties.

1.8 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For automatic door operators, safety devices, and control systems, to include in maintenance manuals.

1.9 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer for installation and maintenance of units required for this Project.
 - 1. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.

1.10 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of automatic door operators that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Faulty or sporadic operation of automatic door operator, including controls.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering or use.
 - 2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Besam Entrance Solutions; Subsidiary of ASSA ABLOY Entrance Systems.
 - 2. Door Motion Technologies, Inc.
 - 3. DORMA Architectural Hardware; Div. of DORMA Group North America.
 - 4. DORMA Automatics; Div. of DORMA Group North America.
 - 5. Horton Automatics; a division of Overhead Door Corporation.
 - 6. Hunter Automatics Inc.

7. LCN Closers; an Ingersoll-Rand company.
8. Nabco Entrances Inc.
9. record-usa – cited as design standard.
10. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
11. Stanley Access Technologies, LLC; Div. of Stanley Security Solutions.

- B. Source Limitations: Obtain automatic door operators, including activation and safety devices, from single source from single manufacturer.

2.2 AUTOMATIC DOOR OPERATORS, GENERAL

- A. General: Provide operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for long-term, maintenance-free operation under normal traffic load for occupancy type indicated; and according to UL 325. Coordinate operator mechanisms with door operation, hinges, and activation and safety devices.
1. Wind Load: Provide door operators on exterior doors that will open and close doors and maintain them in fully closed position when subjected to wind load indicated on structural drawings.
- B. Electromechanical Operating System: Self-contained unit powered by permanent-magnet dc motor; with closing speed controlled mechanically by gear train and dynamically by braking action of electric motor, connections for power and activation- and safety-device wiring, and manual operation including spring closing when power is off.
- C. Cover for Surface-Mounted Operators: Fabricated from 0.125-inch- thick, extruded or formed aluminum; manufacturer's standard width; with enclosed end caps, provision for maintenance access, and fasteners concealed when door is in closed position.
- D. Brackets and Reinforcements: Fabricated from aluminum with nonstaining, nonferrous shims for aligning system components.
- E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.3 LOW-ENERGY DOOR OPERATORS

- A. Standard: BHMA A156.19.
- B. Performance Requirements:
1. Opening Force if Power Fails: Not more than 15 lbf required to release latch if provided, not more than 30 lbf required to manually set door in motion, and not more than 15 lbf required to fully open door.
 2. Entrapment-Prevention Force: Not more than 15 lbf required to prevent stopped door from closing or opening.
- C. Configuration: Operator to control single swinging door.
1. Traffic Pattern: One way.
 2. Operator Mounting: Surface.
- D. Operation: Power opening and power-assisted spring closing. Provide time delay for door to remain open before initiating closing cycle as required by BHMA A156.19. When not in automatic mode, door operator shall function as manual door closer, with or without electrical power.
- E. Operating System: Electromechanical.

- F. Microprocessor Control Unit: Solid-state controller.
- G. Features:
 - 1. Adjustable opening and closing speed.
 - 2. Adjustable opening and closing force.
 - 3. Adjustable backcheck.
 - 4. Adjustable hold-open time from zero to 30 seconds.
 - 5. Adjustable time delay.
 - 6. Adjustable acceleration.
 - 7. Obstruction recycle.
 - 8. On-off/hold-open switch to control electric power to operator.
- H. Activation Device: Push-plate switch on each side of door to activate door operator.
- I. Exposed Finish: Baked-enamel or powder-coat finish matching storefront door and curtainwall frame.
 - 1. Color: White.
- J. Basis of Design Product: record-usa 6100 series.

2.4 POST

- A. Free-standing exterior post assembly specifically designed to accommodate pushplate to activate automatic door.
 - 1. Dimensions:
 - a. Height: 41-1/2 inches.
 - b. Width: 6-1/4 inches.
 - c. Depth: 4-1/4 inches.
 - 2. Color: As selected by Architect from manufacturer's full range of available colors.
 - 3. Basis of Design Product: BEA Inc. "Bollard."
- B. Materials
 - 1. Post: Powder-coated carbon steel (inside and out)
 - 2. Cap: UV-resistant ABS plastic.
 - 3. Mounting Bracket: Stainless steel.
- C. Accessories: Provide all mounting hardware, screws, expansion anchors, washers, and nuts as recommended by manufacturer for complete installation.

2.5 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - 1. Extrusions: ASTM B 221.
 - 2. Sheet: ASTM B 209.
- B. Fasteners and Accessories: Corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

2.6 CONTROLS

- A. General: Provide controls, including activation and safety devices, according to BHMA standards; for condition of exposure; and for long-term, maintenance-free operation under normal traffic load for occupancy type indicated. Coordinate activation and safety devices with door operation and door operator mechanisms.

- B. Motion Sensors: Self-contained, K-band-frequency, microwave-scanner units; fully enclosed in plastic housing; adjustable to provide detection field sizes and functions required by BHMA A156.10.
 - 1. Provide capability for switching between bidirectional and unidirectional detection.
 - 2. For one-way traffic, sensor on egress side shall not be active when doors are fully closed.
- C. Presence Sensors: Self-contained, active-infrared scanner units; adjustable to provide detection field sizes and functions required by BHMA A156.10. Sensors shall remain active at all times.
- D. Photoelectric Beams: Pulsed infrared, sender-receiver assembly for recessed mounting. Beams shall not be active when doors are fully closed.
- E. Push-Plate Switch: Momentary-contact door control switch with flat push-plate actuator.
 - 1. Configuration: Rectangular push plate with 2-by-4-inch junction box.
 - a. Interior mounting: Recess mounted on door jamb.
 - b. Exterior mounting: Recess mounted in post.
 - 2. Push-Plate Material: Stainless steel as selected by Architect from manufacturer's full range.
 - 3. Message: International symbol of accessibility and "Push to Open."
- F. Electrical Interlocks: Unless units are equipped with self-protecting devices or circuits, provide electrical interlocks to prevent activation of operator when door is locked, latched, or bolted.

2.7 FABRICATION

- A. Factory fabricate automatic door operators to comply with indicated standards.
- B. Form aluminum shapes before finishing.
- C. Fabricate exterior components to drain condensation and water passing joints within operator enclosure to the exterior.
- D. Use concealed fasteners to greatest extent possible. Where exposed fasteners are required, use countersunk Phillips flat-head machine screws, finished to match operator.
- E. Provide metal cladding, completely covering visible surfaces before shipment to Project site. Fabricate cladding with concealed fasteners and connection devices, with accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion, and with allowance for thermal expansion at exterior doors.

2.8 ACCESSORIES

- A. Signage: As required by cited BHMA standard for type of door and its operation.
 - 1. Application Process: Silk-screened.
 - 2. Provide sign materials with instructions for field application when operators are installed.

2.9 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying strippable, temporary protective covering before shipping.
- B. Apply organic finishes to formed metal after fabrication unless otherwise indicated.

- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within range of approved Samples and are assembled or installed to minimize contrast.

2.10 ALUMINUM FINISHES

- A. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances, door and frame preparation and reinforcements, and other conditions affecting performance of automatic door operators.
- B. Examine roughing-in for electrical systems to verify actual locations of power connections before automatic door operator installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install automatic door operators according to manufacturer's written instructions and cited BHMA standard for type of door operation and direction of pedestrian travel, including signage, controls, wiring, remote power units if any, and connection to building's power supply.
 - 1. Do not install damaged components. Fit joints to produce hairline joints free of burrs and distortion.
 - 2. Install operators true in alignment with established lines and door geometry without warp or rack. Anchor securely in place.
- B. Controls: Install activation and safety devices according to manufacturer's written instructions and cited BHMA standard for operator type and direction of pedestrian travel. Connect control wiring according to Division 26 requirements for low voltage wiring.
- C. Access-Control System: Connect operators to Owner's access-control system.
- D. Signage: Apply on both sides of each door as required by cited BHMA standard for type of door operator and direction of pedestrian travel.

3.3 FIELD QUALITY CONTROL

- A. Certified Inspector: Owner may engage a Certified Inspector to test and inspect components, assemblies, and installations, including connections.
- B. Perform the following tests and inspections:
 - 1. Test and inspect each automatic door operator installation, using AAADM inspection forms, to determine compliance of installed systems with applicable BHMA standards.
- C. Automatic door operators will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

3.4 ADJUSTING

- A. Adjust automatic door operators to function smoothly, and lubricate as recommended by manufacturer; comply with requirements of applicable BHMA standards.
 - 1. Adjust operators on exterior doors for weathertight closure.
- B. After completing installation of automatic door operators, inspect exposed finishes on doors and operators. Repair damaged finish to match original finish.
- C. Readjust automatic door operators and controls after repeated operation of completed installation equivalent to three days' use by normal traffic (100 to 300 cycles).
- D. Occupancy Adjustment: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.5 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of automatic door operator Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
 - 1. Perform safety inspection after each adjustment or repair and at end of maintenance period. Furnish completed inspection reports to Owner.
 - 2. Perform maintenance, including emergency callback service, during normal working hours.
 - 3. Include 24-hour-per-day, 7-day-per-week, emergency callback service.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain automatic door operators.

END OF SECTION 087113

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
 - 1. Doors.
 - 2. Glazed curtain walls.
 - 3. Interior borrowed lites.
- B. Related Sections include, but are not limited to:
 - 1. Division 08 Section "Mirrors."

1.3 DEFINITIONS

- A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.
- C. Interspace: Space between lites of an insulating-glass unit.

1.4 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

1.5 ACTION SUBMITTALS

- A. Product Data: For each glass product and glazing material indicated.
 - 1. Product Data for Glazing Sealants used inside the Weatherstripping System: Documentation including printed statement of VOC content.
 - 2. Laboratory Test Reports for Glazing Sealants used inside the Weatherstripping System: Documentation indicating that they comply with the testing and product requirements of the California Department of Health Services :Standard Practice for the Testing of Volatile Organic Emissions for Various Sources Using Small-Scale Environmental Chambers."

- B. Shop Drawings: For translucent linear channel glazing system. Include elevation, connection and installation details, and interface with adjacent construction.
- C. Glass Samples: For each type of glass product other than clear monolithic vision glass; Minimum 6 inches square.
- D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturers of insulating-glass units with sputter-coated, low-e coatings.
- B. Product Certificates: For glass and glazing products, from manufacturer.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for the following:
 1. Insulating glass.
 2. Translucent linear channel glazing.
- D. Warranties: Sample of special warranties.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved and certified by coated-glass manufacturer.
- B. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.
- C. Source Limitations for Glass:
 1. Obtain insulating glass from single source from single manufacturer for each glass type.
 2. Obtain translucent linear channel glass system and framing system from single source from single manufacturer.
- D. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.
- E. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 1. GANA Publications: GANA's "Glazing Manual."
 2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- F. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- G. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall

indicate manufacturer's name, test standard, whether glazing is for use in fire doors or other openings, whether or not glazing passes hose-stream test, whether or not glazing has a temperature rise rating of 450 deg F , and the fire-resistance rating in minutes.

- H. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- B. Comply with insulating-glass manufacturer's written recommendations for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.9 PROJECT CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
 - 1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below 40 deg F .

1.10 WARRANTY

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form in which coated-glass manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
 - 1. Warranty Period: 10 years from date of Substantial Completion.
- B. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form in which insulating-glass manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
 - 1. Warranty Period: 10 years from date of Substantial Completion.
- C. Manufacturer's Special Warranty on Translucent Linear Channel Glazing System:
 - 1. Warrant installed units to be free from defects in material and workmanship for period of 10 years.
 - 2. Warranty shall include coverage of the framing finish against fading, cracking, warping, pitting, corrosion, peeling or blistering under normal use and service.

PART 2 - PRODUCTS

2.1 GLASS PRODUCTS, GENERAL

- A. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.

1. Minimum Glass Thickness for Exterior Lites: Not less than 6.0 mm.
- B. Strength:
1. Where float glass is indicated, provide annealed float glass, Kind HS heat-treated float glass, or Kind FT heat-treated float glass.
 2. Where heat-strengthened glass is indicated, provide Kind HS heat-treated float glass or Kind FT heat-treated float glass.
 3. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.
- C. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
1. For monolithic-glass lites, properties are based on units with lites 6.0 mm thick.
 2. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
 3. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F .
 4. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
 5. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.2 GLASS PRODUCTS

- A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.
- B. Ultraclear Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I, complying with other requirements specified and with visible light transmission not less than 91 percent.
- C. Heat-Treated Float Glass: ASTM C 1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.
1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
 2. For uncoated glass, comply with requirements for Condition A.
 3. For coated vision glass, comply with requirements for Condition C (other coated glass).
- D. Tempered Patterned (Obscure) Glass: ASTM C1048, Kind FT (fully tempered), Type II, translucent, random pattern/texture both sides.

2.3 TRANSLUCENT LINEAR CHANNEL GLAZING SYSTEM (G21)

- A. Glass: ASTM C1036, Type I, Class 1, Quality Q3, rolled glass, channel shape, cast.
1. Color: Standard with slight natural green cast.
 2. Surface Texture: Standard cast (lightly dimpled surface).
 3. Profile Width: 10.31 inches.
- B. Aluminum: ASTM B221, alloy 6063-TS for extrusions, ASTM B209, alloy 5005-H116 for sheets, or other alloys and temper recommended by manufacturer appropriate for specified finish.
1. Framing: Extruded units to profiles shown or as required to suit conditions indicated; integral pressure equalized offset drainage system.
 2. Nominal Thickness
 - a. Framing Members and Rails: 0.120 inch.
 - b. Sheets: 0.090 inch.
 - c. Glazing Stops and Similar Components: 0.050 inch.
- C. Vinyl: AAMA 303 external grade unplasticized PVC.

1. Vinyl Frame Line and Glass Support and Spacer: Per ASTM D638-03, ASTM D635, ASTM D2843, and ASTM D1929.
2. Extruded vinyl spacer engineered for snap-in application in manufacturer's standard aluminum frame to support and space glass amounts.

D. Accessories

1. Anchorage Devices: Manufacturer's standard formed or fabricated steel or aluminum assemblies or shapes, plates, bars or tubes.
 - a. Hot-dip galvanized steel assemblies after fabrication, ASTM A123, 2.0 ounce minimum coating.
2. Fasteners: Aluminum, non-magnetic stainless steel or other non-corrosive materials compatible with items being fastened.
 - a. Provide concealed fasteners wherever possible.
 - b. Exposed locations: Phillips flathead screws with finish matching item fastened.
 - c. Concealed Locations: Manufacturer's standard fasteners.
3. Protective Coatings: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 30 mil thickness for each coat; or alkyd type zinc chromate primer, FS TT-P-645.
4. Perimeter Joint Sealant and Backer Rod: Silicone-Glazing.
 - a. Colors: Standard colors as selected by Architect from manufacturer's full range of available colors.
 - b. Primer: If required by sealant manufacturer for applications show.
 - c. Sealant Backing, Bond Breaker Rod and Tape: Closed cell unless required by sealant manufacturer.
 - d. Acceptable Glazing and Products Manufacturers:
 - 1) Dow Corning, 1199
 - 2) Schnee Morehead, 5731
 - 3) General Electric Silglaze SCS 2801, SCS 1201 or SCS 101.
 - 4) Tremco Tremsil 600.
 - 5) Tremco Spectrem II.

E. Manufacturer: Subject to compliance with requirements, provide products by one of the following:

1. Pilkington Profilit™ channel glass system, supplied by Technical Glass Products - cited as design standard.
2. Bendheim Wall Systems Channel Glass by Lamberts.

2.4 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190, and complying with other requirements specified.

1. Sealing System: Dual seal, with one of the following primary and secondary sealing systems:
 - a. Polyisobutylene and polysulfide.
 - b. Polyisobutylene and silicone.
 - c. Polyisobutylene and hot-melt butyl.
 - d. Polyisobutylene and polyurethane.
2. Spacer: One of the following:
 - a. Aluminum with mill or clear anodic finish.
 - b. Aluminum with powdered metal paint finish in color selected by Architect.
 - c. Polypropylene covered stainless steel in color selected by Architect.
3. Desiccant: Molecular sieve or silica gel, or blend of both.

B. Glass: Comply with applicable requirements in "Glass Products" Article as indicated by designations in "Insulating-Glass Types" Article.

2.5 FIRE-PROTECTION-RATED GLAZING

- A. Fire-Protection-Rated Glazing, General: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252 for door assemblies.
- B. Monolithic Ceramic Glazing: Clear, ceramic flat glass; 3/16-inch nominal thickness.
 - 1. Basis of Design Product: Nippon Electric Glass Co., Ltd. (distributed by Technical Glass Products): Firelite.
- C. Laminated Ceramic Glazing: Laminated glass made from two plies of clear, ceramic flat glass; 5/16-inch total nominal thickness; complying with testing requirements in 16 CFR 1201 for Category II materials.
 - 1. Basis of Design Product: Nippon Electric Glass Co., Ltd. (distributed by Technical Glass Products): Firelite Plus.

2.6 GLAZING GASKETS

- A. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one of the following:
 - 1. Neoprene complying with ASTM C 864.
 - 2. EPDM complying with ASTM C 864.
 - 3. Silicone complying with ASTM C 1115.
 - 4. Thermoplastic polyolefin rubber complying with ASTM C 1115.
- B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned gaskets complying with ASTM C 509, Type II, black; of profile and hardness required to maintain watertight seal.
 - 1. Material: One of the following:
 - a. Neoprene.
 - b. EPDM.
 - c. Silicone.
 - d. Thermoplastic polyolefin rubber.
 - 2. Application: Use where soft compression gaskets will be compressed by inserting dense compression gaskets on opposite side of glazing or pressure applied by means of pressure-glazing stops on opposite side of glazing.

2.7 GLAZING SEALANTS

- A. General:
 - 1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
 - 2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
 - 3. Sealants used inside the weatherstripping system shall have a VOC content of not more than 250 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 4. Sealants used inside the weatherstripping system shall comply with the testing and product requirements of the California Department of Health Services "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
 - 5. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range of available colors.

- B. Glazing Sealant: Neutral-curing or acid-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Use NT.
- C. Glazing Sealants for Fire-Rated Glazing Products: Products that are approved by testing agencies that listed and labeled fire-resistant glazing products with which they are used for applications and fire-protection ratings indicated.

2.8 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
 - 1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
 - 2. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
- B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
 - 1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
 - 2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.9 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.
- G. Perimeter Insulation for Fire-Resistive Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

2.10 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.
- C. Grind smooth and polish exposed glass edges and corners.

2.11 FABRICATION OF ALUMINUM FRAMING FOR CHANNEL GLASS

- A. Aluminum Framing: Provide members of size, shape and profile indicated, designed to provide for glazing from exterior.
 - 1. Fabricate frame assemblies with mitered or coped joints.
 - 2. Maintain accurate relation of planes and angles, with hairline fit or contacting members.
 - 3. Seal horizontals and direct moisture accumulation to exterior.
 - 4. Provide spacers and other materials used internally or externally that are corrosive resistant, non-staining, non-bleeding and compatible with adjoining materials.
 - 5. Fabricate framing for expansion and contraction due to temperature changes without detriment to appearance or performance.
 - 6. Make provisions in framing for minimum edge clearance, nominal edge cover and nominal pocket width for thickness and type of glazing infill used in accordance with recommendations of manufacturer and Technical Manual.
- B. Welding: Comply with recommendations of American Welding Society (AWS).
 - 1. Use recommended electrodes and methods to avoid distortion and discoloration.
 - 2. Grind exposed welds smooth and flush with adjacent surfaces; restore mechanical finish.
- C. Finish: Fluorocarbon Coating: AAMA 2604.
 - 1. Resin: 70 percent polyvinylidene fluoride (PVDF)
 - 2. Substrate: Cleaned and Pre-Treated.
 - 3. Primer: Manufacturer's standard epoxy or acrylic coating.
 - 4. Topcoat: PVDF.
 - 5. Color: As selected by Architect from manufacturer's full range of available standard colors.

2.12 MONOLITHIC-GLASS TYPES

- A. Glass Type G-1: Clear float glass.
 - 1. Thickness: 6.0 mm.
- B. Glass Type G-2: Clear fully tempered float glass.
 - 1. Thickness: 6.0 mm.
 - 2. Provide safety glazing labeling.
 - 3. Application: Interior doors and borrowed lites (non-fire rated).
- C. Glass Type G-3: Clear fire-rated glass.
 - 1. Thickness: 3/16 inch.
 - 2. Application: Fire-rated interior transom panels.
- D. Glass Type G-4: Clear Fire-Rated Laminated Glass.
 - 1. Thickness: 5/16 inch.
 - 2. Provide safety glazing labeling.
 - 3. Application: Fire-rated interior doors.
- E. Glass Type G-5: Obscure Fully Tempered Float Glass
 - 1. Thickness: 6.0 mm.
 - 2. Provide safety glazing labeling.
 - 3. Application: Interior doors where indicated.

2.13 INSULATING-GLASS TYPES

- A. Glass Type G-11: Vision insulating solar control low-e glass.
 - 1. Overall Unit Thickness: 1 inch.
 - 2. Thickness of each Lite: 6.0 mm.
 - 3. Interspace Content: Air.
 - 4. Indoor Lite: Clear glass.
 - 5. Visible Light Transmittance: 64%
 - 6. Light to Solar Ratio: 2.37
 - 7. Shading Coefficient: 0.32
 - 8. Solar Heat Gain Coefficient (SHGC): 0.27
 - 9. Provide safety glazing labeling.
 - 10. Application: Exterior glazed aluminum curtain walls.
 - 11. Basis of Design Product: PPG Solarban ® 70XL.

- B. Glass Type G-12: Vision Insulating solar control low-e glass.
 - 1. Overall Unit Thickness: 3/4 inch.
 - 2. Thickness of each Lite: 4.0 mm.
 - 3. Interspace Content: Air.
 - 4. Indoor Lite: Clear glass.
 - 5. Outdoor Lite: Same as Glass Type G-11.
 - 6. Provide safety glazing labeling.
 - 7. Application: Exterior doors.

- C. Glass Type G-13: Insulating spandrel glass.
 - 1. Overall Unit Thickness: 1 inch.
 - 2. Thickness of each Lite: 6.0 mm.
 - 3. Interspace Content: Air.
 - 4. Indoor Lite: Opaque spandrel glass.
 - 5. Outdoor Lite: Same as glass type G-11:
 - 6. Application: Glazed aluminum curtain wall.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
 - 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 - 2. Presence and functioning of weep systems.
 - 3. Minimum required face and edge clearances.
 - 4. Effective sealing between joints of glass-framing members.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.
- C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- G. Provide spacers for glass lites where length plus width is larger than 50 inches .
 - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 - 2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- J. Set glass lites with proper orientation so that coatings face exterior or interior as specified.
- K. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- L. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until right before each glazing unit is installed.
- F. Apply heel bead of elastomeric sealant.
- G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 INSTALLATION OF TRANSLUCENT LINEAR CHANNEL GLAZING SYSTEM

- A. Install units in accordance with approved Shop Drawings, plumb, level, square, and free from warp or twist while maintaining dimensional tolerances and alignment with surrounding construction.
- B. Erect framing, vinyl spacer, and glass in accordance with manufacturer's printed installation instructions. Seal glass units continuously on both sides of glass between frame and glass and between linear glass units.
- C. Joint Sealants: Install perimeter joint sealant and backing materials between assemblies and adjacent construction.
- D. Erection Tolerances:
 - 1. Limit Variations from Plumb and Level:
 - a. 1/8 inch in 10 feet vertically.
 - b. 1/8 inch in 20 feet horizontally.
 - 2. Limit Variations from Theoretical Locations: 1/4-inch from any member at any location.
 - 3. Limit Offsets in Theoretical End-To-End and Edge-To-Edge Alignment: 1/16 inch from flush surfaces not more than 2 inches apart or out-of-flush by more than 1/4-inch .

3.8 CLEANING AND PROTECTION

- A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.
- C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.
- D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.
- E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION 088000

SECTION 088300 - MIRRORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes the following type of silvered flat glass mirrors:
 - 1. Wall mounted annealed monolithic glass mirrors at Multi-Use Classroom 210.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Mirrors. Include description of materials and process used to produce each type of silvered flat glass mirror specified that indicates sources of glass, glass coating components, edge sealer, and quality-control provisions.
 - 2. Product Data for Adhesives: Documentation including printed statement of VOC content.
 - 3. Laboratory Test Reports for Adhesives: Documentation indicating that they comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. Shop Drawings: Include mirror elevations, edge details, mirror hardware, and attachments to other work.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Product Certificates: For each type of mirror, from manufacturer.
- C. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For mirrors to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.
- B. Source Limitations for Mirrors: Obtain mirrors from single source from single manufacturer.
- C. Glazing Publications: Comply with the following published recommendations:
 - 1. GANA's "Glazing Manual" unless more stringent requirements are indicated. Refer to this publication for definitions of glass and glazing terms not otherwise defined in this Section or in referenced standards.
 - 2. GANA Mirror Division's "Mirrors, Handle with Extreme Care: Tips for the Professional on the Care and Handling of Mirrors."

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect mirrors according to mirror manufacturer's written instructions and as needed to prevent damage to mirrors from moisture, condensation, temperature changes, direct exposure to sun, or other causes.
- B. Comply with mirror manufacturer's written instructions for shipping, storing, and handling mirrors as needed to prevent deterioration of silvering, damage to edges, and abrasion of glass surfaces and applied coatings. Store indoors.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install mirrors until ambient temperature and humidity conditions are maintained at levels indicated for final occupancy.

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which mirror manufacturer agrees to replace mirrors that deteriorate within specified warranty period. Deterioration of mirrors is defined as defects developed from normal use that are not attributed to mirror breakage or to maintaining and cleaning mirrors contrary to manufacturer's written instructions. Defects include discoloration, black spots, and clouding of the silver film.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SILVERED FLAT GLASS MIRRORS

- A. Glass Mirrors, General: ASTM C 1503; manufactured using copper-free, low-lead mirror coating process.
- B. Clear Glass: Mirror Select Quality; ultraclear (low-iron) float glass with a minimum 91 percent visible light transmission.
 - 1. Nominal Thickness: 6.0 mm.

2.2 MISCELLANEOUS MATERIALS

- A. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- B. Edge Sealer: Coating compatible with glass coating and approved by mirror manufacturer for use in protecting against silver deterioration at mirrored glass edges.
- C. Mirror Mastic: An adhesive setting compound, asbestos-free, produced specifically for setting mirrors and certified by both mirror manufacturer and mastic manufacturer as compatible with glass coating and substrates on which mirrors will be installed.
 - 1. Adhesive shall have a VOC content of not more than 70 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.3 MIRROR HARDWARE

- A. Aluminum Extrusions: One of the following:
 - 1. Top and Bottom Aluminum J-Channels: Aluminum extrusions with a return deep enough to produce a glazing channel to accommodate mirrors of thickness indicated and in lengths required to cover bottom and top edges of each mirror in a single piece.
 - a. Bottom Trim: J-channels formed with front leg and back leg not less than 3/8 and 7/8 inch in height, respectively, and a thickness of not less than 0.05 inch.
 - b. Top Trim: J-channels formed with front leg and back leg not less than 5/8 and 1 inch in height, respectively, and a thickness of not less than 0.062 inch.
 - c. Finish: Clear bright anodized.
 - 2. Top Channel/Cleat and Bottom Aluminum J-Channels: Aluminum extrusions with a return deep enough to produce a glazing channel to accommodate mirrors of thickness indicated and in lengths required to cover bottom and top edges of each mirror in a single piece.
 - a. Bottom Trim: J-channels formed with front leg and back leg not less than 5/16 and 3/4 inch in height, respectively.
 - b. Top Trim: Formed with front leg with a height of 5/16 inch and back leg designed to fit into the pocket created by wall-mounted aluminum cleat.
 - c. Finish: Clear bright anodized.
- B. Fasteners: Fabricated of same basic metal and alloy as fastened metal and matching it in finished color and texture where fasteners are exposed.
- C. Anchors and Inserts: Provide devices as required for mirror hardware installation. Provide toothed or lead-shield expansion-bolt devices for drilled-in-place anchors.

2.4 FABRICATION

- A. Mirror Sizes: To suit Project conditions, cut mirrors to final sizes and shapes.
- B. Mirror Edge Treatment: Flat polished.
 - 1. Seal edges of mirrors with edge sealer after edge treatment to prevent chemical or atmospheric penetration of glass coating.
 - 2. Require mirror manufacturer to perform edge treatment and sealing in factory immediately after cutting to final sizes.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, over which mirrors are to be mounted, with Installer present, for compliance with installation tolerances, substrate preparation, and other conditions affecting performance of the Work.
- B. Verify compatibility with and suitability of substrates, including compatibility of mirror mastic with existing finishes or primers.
- C. Proceed with installation only after unsatisfactory conditions have been corrected and surfaces are dry.

3.2 PREPARATION

- A. Comply with mastic manufacturer's written installation instructions for preparation of substrates, including coating substrates with mastic manufacturer's special bond coating where applicable.

3.3 INSTALLATION

- A. General: Install mirrors to comply with mirror manufacturer's written instructions and with referenced GANA publications. Mount mirrors accurately in place in a manner that avoids distorting reflected images.
- B. Provide a minimum air space of 1/8 inch between back of mirrors and mounting surface for air circulation between back of mirrors and face of mounting surface.
- C. Wall-Mounted Mirrors: Install mirrors with mastic and mirror hardware. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrors.
 - 1. Top and Bottom Aluminum J-Channels: Provide setting blocks 1/8 inch thick by 4 inches long at quarter points. To prevent trapping water, provide, between setting blocks, two slotted weeps not less than 1/4 inch wide by 3/8 inch long at bottom channel.
 - 2. Top Channel/Cleat and Bottom Aluminum J-Channels: Fasten J-channel directly to wall and attach top trim to continuous cleat fastened directly to wall.
 - 3. Install mastic as follows:
 - a. Apply barrier coat to mirror backing where approved in writing by manufacturers of mirrors and backing material.
 - b. Apply mastic to comply with mastic manufacturer's written instructions for coverage and to allow air circulation between back of mirrors and face of mounting surface.
 - c. After mastic is applied, align mirrors and press into place while maintaining a minimum air space of 1/8 inch between back of mirrors and mounting surface.

3.4 CLEANING AND PROTECTION

- A. Protect mirrors from breakage and contaminating substances resulting from construction operations.
- B. Do not permit edges of mirrors to be exposed to standing water.
- C. Maintain environmental conditions that will prevent mirrors from being exposed to moisture from condensation or other sources for continuous periods of time.
- D. Wash exposed surface of mirrors not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash mirrors as recommended in writing by mirror manufacturer.

END OF SECTION 088300

SECTION 090169 - WOOD FLOOR RESTORATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes, but is not limited to:
 - 1. Addressing squeaky existing wood flooring via selected finish nailing.
 - 2. Refinishing existing wood flooring.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. For field-applied finishes for wood flooring, printed statement of VOC content.

1.4 QUALITY ASSURANCE

- A. Mockup: Before refinishing, install mockup of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Approved mockup may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 PROJECT CONDITIONS

- A. Environmental Conditions: Maintain an ambient temperature between 55 and 80 deg F and consistent relative humidity in spaces to receive field finishing.
- B. After refinishing, maintain relative humidity and ambient temperature planned for building occupants.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. FloorScore Compliance: Refinished wood floors shall comply with requirements of FloorScore Standard.
- B. Low-Emitting Materials: Wood finish system shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.2 WOOD FLOORING

- A. Wood Flooring Repairs: Use salvaged existing flooring for patches and repairs to the greatest extent possible.
 - 1. Provide clear maple flooring, as similar as possible to the original flooring, 2-1/4" wide by 3/4 inch thick, tongue-and-groove in random lengths.
- B. Fasteners:

1. Ring-shank flooring nails must be long enough to securely attach the flooring to substrate.
2. Where possible, nails shall be hidden from view.
3. When nails cannot be hidden, countersink nails and fill holes with manufacturer's recommended filler.
4. Nails must not split the flooring.

2.3 FIELD-FINISHING

- A. Urethane Finish System: Complete solvent-based, oil-modified system of compatible components that is recommended by finish manufacturer for application indicated.
 1. VOC Content: When calculated according to 40 CFR 59, Subpart D (EPA Method 24), as follows:
 - a. Finish Coats and Sealers: Not more than 350 g/L.
 - b. Stains: Not more than 250 g/L.
 2. Finish system materials shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
 3. Stain: Penetrating and nonfading type. Provide color as selected by Architect from manufacturer's full range of available colors to match existing.
 4. Floor Sealer: Pliable, penetrating type.
 5. Finish Coats: Formulated for multicoat application on wood flooring.
- B. Wood Filler: Compatible with finish system components and recommended by filler and finish manufacturers for use indicated. If required to match approved Samples, provide pigmented filler.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. All floor repairs must be performed and complete prior to the refinishing of the existing maple flooring.

3.2 FIELD FINISHING

- A. Sweep floors clean.
- B. Machine-sand flooring to remove existing offsets, ridges, cups, and sanding-machine marks that would be noticeable after finishing.
 1. Sand with No. 40 or 36 grit sandpaper if boards are uneven heights. First pass shall be on a diagonal angle to the direction of the floor.
 2. Verify that floor is sanded smooth and level before sanding with medium grit (50 or 60 grit) sandpaper. This cut and all subsequent cuts shall be sanded in the direction of the grain of the floor.
 3. Sand edges with No. 60 or 80 grit spinner paper.
 4. Sand entire floor with No. 80 or 100 grit sandpaper.
 5. Disk sand entire floor with No. 100 disk paper.
 6. Scrape and hand-sand corners and other areas not reached by machine.
 7. Clean floor to remove all dust and debris prior to sealing wood. Floor shall be smooth and free of shiners.
- C. Fill open-grained hardwood.
- D. Fill and repair wood flooring seams and defects.

- E. Apply floor-finish materials in number of coats recommended by finish manufacturer for application indicated, but not less than one (1) coat of floor sealer and three (3) finish coats.
 - 1. Apply stains to achieve an even color distribution matching approved Samples.
- F. Do not cover wood flooring after finishing until finish reaches full cure, and not before seven days after applying last finish coat.

3.3 PROTECTION

- A. Protect refinished wood flooring during remainder of construction period with covering of heavy kraft paper or other suitable material. Do not use plastic sheet or film that might cause condensation.
 - 1. Do not move heavy and sharp objects directly over kraft-paper-covered wood flooring. Protect flooring with plywood or hardboard panels to prevent damage from storing or moving objects over flooring.

END OF SECTION 090169

SECTION 092119 - GYPSUM BOARD SHAFT WALL ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes: Gypsum board shaft wall assemblies.
- B. Related Requirements include, but are not limited to:
 - 1. Division 09 Section "Non-Structural Metal Framing."
 - 2. Division 09 Section "Gypsum Board."
- C. For the purposes of this project, the terms "gypsum board," "gypsum wallboard," and "drywall" may be used interchangeably in the Contract Documents.
- D. For the purposes of this project, the terms "metal," "steel," and "lightgage metal" may be used interchangeably when referring to non-structural metal framing in the Contract Documents.

1.3 ACTION SUBMITTALS

- A. Product Data: For each component of gypsum board shaft wall assembly.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.5 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or with gypsum board manufacturer's written recommendations, whichever are more stringent.
- B. Do not install interior products until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, moisture damaged, or mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

2.2 GYPSUM BOARD SHAFT WALL ASSEMBLIES

- A. Fire-Resistance Rating: As indicated.
- B. Studs: Manufacturer's standard profile for repetitive members, corner and end members, and fire-resistance-rated assembly indicated.
 - 1. Depth: As indicated.
 - 2. Minimum Base-Metal Thickness: 0.033 inch.
- C. Runner Tracks: Manufacturer's standard J-profile track with manufacturer's standard long-leg length, but at least 2 inches long and matching studs in depth.
 - 1. Minimum Base-Metal Thickness: Matching steel studs.
- D. Firestop Tracks: Provide firestop track at head of shaft wall on each floor level.
- E. Room-Side Finish: Gypsum board.
- F. Shaft-Side Finish: Gypsum shaftliner board, Type X.
- G. Insulation: Sound attenuation blankets.

2.3 PANEL PRODUCTS

- A. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.
- B. Gypsum Shaftliner Board, Type X: ASTM C 1396/C 1396M; manufacturer's proprietary fire-resistive liner panels with paper faces.
 - 1. Thickness: 1 inch.
 - 2. Long Edges: Double bevel.
- C. Gypsum Board: As specified in Division 09 Section "Gypsum Board."
- D. Gypsum Base for Gypsum Veneer Plaster: As specified in Division 09 Section "Gypsum Veneer Plastering."

2.4 NON-LOAD-BEARING STEEL FRAMING

- A. Steel Framing Members: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
 - 1. Protective Coating: ASTM A 653/A 653M, G60, hot-dip galvanized unless otherwise indicated.
- B. Firestop Tracks: Top runner specifically manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

2.5 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with manufacturer's written recommendations.
- B. Trim Accessories: Cornerbead, edge trim, and control joints of material and shapes as specified in Division 09 Section "Gypsum Board" that comply with gypsum board shaft wall assembly manufacturer's written recommendations for application indicated.
- C. Steel Drill Screws: ASTM C 1002 unless otherwise indicated.

- D. Track Fasteners: Power-driven fasteners of size and material required to withstand loading conditions imposed on shaft wall assemblies without exceeding allowable design stress of track, fasteners, or structural substrates in which anchors are embedded.
 - 1. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to five (5) times design load, as determined by testing according to ASTM E 488 conducted by a qualified testing agency.
 - 2. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to ten (10) times design load, as determined by testing according to ASTM E 1190 conducted by a qualified testing agency.
- E. Sound Attenuation Blankets: As specified in Division 09 Section "Gypsum Board."
- F. Acoustical Sealant: As specified in Division 09 Section "Gypsum Board."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates to which gypsum board shaft wall assemblies attach or abut, with Installer present, including hollow-metal frames, cast-in anchors, and structural framing. Examine for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install gypsum board shaft wall assemblies to comply with requirements of fire-resistance-rated assemblies indicated, manufacturer's written installation instructions, and ASTM C 754 other than stud-spacing requirements.
- B. Install supplementary framing in gypsum board shaft wall assemblies around openings and as required for blocking, bracing, and support of gravity and pullout loads of fixtures, equipment, services, heavy trim, furnishings, wall-mounted door stops, and similar items that cannot be supported directly by shaft wall assembly framing.
- C. Penetrations: At penetrations in shaft wall, maintain fire-resistance rating of shaft wall assembly by installing supplementary steel framing around perimeter of penetration and fire protection behind boxes containing wiring devices and similar items.
- D. Isolate perimeter of gypsum panels from building structure to prevent cracking of panels, while maintaining continuity of fire-rated construction.
- E. Firestop Tracks: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
- F. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.3 PROTECTION

- A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- B. Remove and replace panels that are wet, moisture damaged, or mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092119

SECTION 092216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes, but is not limited to:
 - 1. Non-load-bearing steel framing systems for interior gypsum board assemblies.
 - 2. Non-load-bearing steel framing systems for exterior walls (at curtain walls at building addition).
 - 3. Suspension systems for interior gypsum ceilings, soffits, and grid systems.
- B. Related Requirements include, but are not limited to:
 - 1. Division 09 Section "Gypsum Board Shaft Wall Assemblies."
 - 2. Division 09 Section "Gypsum Board."
- C. For the purposes of this project, the terms "metal", "steel", and "light gage metal" may be used interchangeably when referring to non-structural metal framing in the Contract Documents.
- D. For the purposes of this project, gage designations are considered equivalent to the following base metal thicknesses for metal framing:
 - 1. 16 gage: .068-inch thick.
 - 2. 18 gage: .052 inch thick.
 - 3. 20 gage: .040 inch thick.
 - 4. 22 gage: .033 inch thick.
 - 5. 24 gage: .027 inch thick.
 - 6. 28 gage: .018 inch thick.
- E. For the purposes of this project, gage designations are considered equivalent to the following diameters for wire:
 - 1. 8 gage: 0.16 inch diameter.
 - 2. 16 gage: .062 inch diameter.
 - 3. 18 gage: .048 inch diameter.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 119 by an independent testing agency.

2.2 FRAMING SYSTEMS

- A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
 2. Protective Coating: ASTM A 653/A 653M, G60, hot-dip galvanized unless otherwise indicated.
- B. Studs and Runners: ASTM C 645. Use either steel studs and runners or dimpled steel studs and runners.
1. Steel Studs and Runners:
 - a. Minimum Base-Metal Thickness: 24 gage.
 - b. Depth: As indicated on Drawings.
 2. Dimpled Steel Studs and Runners:
 - a. Minimum Base-Metal Thickness: 24 gage.
 - b. Depth: As indicated on Drawings.
- C. Slip-Type Head Joints: Where indicated, provide one of the following:
1. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch- deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.
 2. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch- deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
 3. Deflection Track: Steel sheet top runner specifically manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
- D. Firestop Tracks: Top runner specifically manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
- E. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
1. Minimum Base-Metal Thickness: 22 gage.
- F. Cold-Rolled Channel Bridging: Steel, 18 gage minimum base-metal thickness, with minimum 1/2-inch- wide flanges.
1. Depth: 1-1/2 inches unless otherwise indicated.
 2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 16 gage, galvanized steel.
- G. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
1. Minimum Base-Metal Thickness: 28 gage.
 2. Depth: 7/8 inch, unless otherwise indicated.
- H. Resilient Furring Channels: 1/2-inch- deep, steel sheet members designed to reduce sound transmission.
1. Configuration: Asymmetrical.
- I. Cold-Rolled Furring Channels: 18 gage uncoated-steel thickness, with minimum 1/2-inch- wide flanges.
1. Depth: 3/4 inch, unless otherwise indicated.
 2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum 22 gage uncoated-steel thickness.
 3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 16 gage wire, or double strand of 18 gage wire.

- J. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum 28 gage uncoated-metal thickness, and depth required to fit insulation thickness indicated.

2.3 SUSPENSION SYSTEMS

- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 16 gage wire, or double strand of 18 gage wire.
- B. Hanger Attachments to Concrete:
 - 1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to five (5) times that imposed by construction as determined by testing according to ASTM E 488 by an independent testing agency. Provide one of the following types:
 - a. Cast-in-place anchor, designed for attachment to concrete forms.
 - b. Postinstalled, chemical anchor.
 - c. Postinstalled, expansion anchor.
 - 2. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to ten (10) times that imposed by construction as determined by testing according to ASTM E 1190 by an independent testing agency.
- C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 8 gage.
- D. Flat Hangers: Steel sheet, 1 by 3/16 inch by length indicated.
- E. Carrying Channels: Cold-rolled, commercial-steel sheet, 18 gage, minimum 1/2-inch- wide flanges.
 - 1. Depth: 1-1/2 inches, unless otherwise indicated.
- F. Furring Channels (Furring Members):
 - 1. Cold-Rolled Channels: 18 gage, with minimum 1/2-inch- wide flanges, 3/4 inch deep.
 - 2. Steel Studs and Runners: ASTM C 645.
 - a. Minimum Base-Metal Thickness: 28 gage.
 - b. Depth: As indicated on Drawings.
 - 3. Dimpled Steel Studs and Runners: ASTM C 645.
 - a. Minimum Base-Metal Thickness: 28 gage.
 - b. Depth: As indicated on Drawings.
 - 4. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.
 - a. Minimum Base-Metal Thickness: 22 gage.
 - 5. Resilient Furring Channels: 1/2-inch- deep members designed to reduce sound transmission.
 - a. Configuration: Asymmetrical.
- G. Grid Suspension System for Gypsum Board Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock. Provide one of the following:
 - 1. Armstrong World Industries, Inc.; Drywall Grid Systems.
 - 2. Chicago Metallic Corporation; Drywall Grid System.
 - 3. USG Corporation; Drywall Suspension System.

2.4 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
 1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

3.3 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754.
 1. Gypsum Plaster Assemblies: Also comply with requirements in ASTM C 841 that apply to framing installation.
 2. Portland Cement Plaster Assemblies: Also comply with requirements in ASTM C 1063 that apply to framing installation.
 3. Gypsum Veneer Plaster Assemblies: Also comply with requirements in ASTM C 844 that apply to framing installation.
 4. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
- B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- C. Install bracing at terminations in assemblies.
- D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
 1. Single-Layer Application: 16 inches o.c. unless otherwise indicated.
 2. Multilayer Application: 16 inches o.c. unless otherwise indicated.
 3. Tile Backing Panels: 16 inches o.c. unless otherwise indicated.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Install studs so flanges within framing system point in same direction.

- D. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
 - a. Install two (2) studs at each jamb unless otherwise indicated.
 - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
 - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
 3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
 4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
 - a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
- E. Direct Furring: Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
- F. Z-Furring Members:
1. Erect insulation, specified in Division 07 Section "Thermal Insulation," vertically and hold in place with Z-furring members spaced 24 inches o.c.
 2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
 3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.
- G. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.5 INSTALLING SUSPENSION SYSTEMS

- A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
1. Hangers: 48 inches o.c.
 2. Carrying Channels (Main Runners): 48 inches o.c.
 3. Furring Channels (Furring Members): 16 inches o.c.
- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. Suspend hangers from building structure as follows:
1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.

- a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
 3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 5. Do not attach hangers to steel roof deck.
 6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
 7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
 8. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
- E. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
- F. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 092216

SECTION 092400 - PORTLAND CEMENT PLASTER

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes interior portland cement plasterwork for patches and repairs to existing plaster surfaces damaged by demolition or new construction where the surface coating is relatively thick plaster over masonry.
- B. Related Sections include, but are not limited to:
 - 1. Division 04 Section "Unit Masonry"
 - 2. Division 09 Section "Gypsum Veneer Plastering" for interior gypsum-based veneer plaster applied on gypsum base.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Verification: For each type of finish coat indicated; 12 by 12 inches, and prepared on rigid backing.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.

1.5 PROJECT CONDITIONS

- A. Comply with ASTM C 926 requirements.
- B. Environmental Conditions:
 - 1. Apply and cure plaster to prevent plaster drying out during curing period. Use procedures required by climatic conditions, including moist curing, providing coverings, and providing barriers to deflect sunlight and wind.
 - 2. Apply plaster when ambient temperature is greater than 40 deg F.
 - 3. Protect plaster coats from freezing for not less than 48 hours after set of plaster coat has occurred.
- C. Factory-Prepared Finishes: Comply with manufacturer's written recommendations for environmental conditions for applying finishes.

PART 2 - PRODUCTS

2.1 ACCESSORIES

- A. General: Comply with ASTM C 1063 and coordinate depth of trim and accessories with thicknesses and number of plaster coats required.
- B. Metal Accessories:

1. Cornerbeads: Fabricated from zinc or zinc-coated (galvanized) steel. Provide small nose cornerbead with expanded flanges; use unless otherwise indicated.
2. Casing Beads: Fabricated from zinc or zinc-coated (galvanized) steel; square-edged style; with expanded flanges.
3. Control Joints: Fabricated from zinc or zinc-coated (galvanized) steel; one-piece-type, folded pair of unperforated screeds in M-shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.

2.2 MISCELLANEOUS MATERIALS

- A. Water for Mixing: Potable and free of substances capable of affecting plaster set or of damaging plaster, lath, or accessories.
- B. Fiber for Base Coat: Alkaline-resistant glass or polypropylene fibers, 1/2 inch long, free of contaminants, manufactured for use in portland cement plaster.
- C. Bonding Compound: ASTM C 932.

2.3 PLASTER MATERIALS

- A. Portland Cement: ASTM C 150, Type I.
- B. Masonry Cement: ASTM C 91, Type N.
- C. Colorants for Job-Mixed Finish Coats: Colorfast mineral pigments that produce finish plaster color to match existing.
- D. Lime: ASTM C 206, Type S; or ASTM C 207, Type S.
- E. Sand Aggregate: ASTM C 897.
- F. Perlite Aggregate: ASTM C 35.
- G. Ready-Mixed Finish-Coat Plaster: Mill-mixed portland cement, aggregates, coloring agents, and proprietary ingredients.
- H. Acrylic-Based Finish Coatings: Factory-mixed acrylic-emulsion coating systems, formulated with colorfast mineral pigments and fine aggregates; for use over portland cement plaster base coats. Include manufacturer's recommended primers and sealing topcoats for acrylic-based finishes.

2.4 PLASTER MIXES

- A. General: Comply with ASTM C 926 for applications indicated.
 1. Fiber Content: Add fiber to base-coat mixes after ingredients have mixed at least two minutes. Comply with fiber manufacturer's written instructions for fiber quantities in mixes, but do not exceed 1 lb of fiber/cu. yd. of cementitious materials.
- B. Base-Coat Mixes: Single base coats for two-coat plasterwork as follows:
 1. Portland Cement Mix: For cementitious material, mix 1 part portland cement and 0 to 1-1/2 parts lime. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
 2. Portland and Masonry Cement Mix: For cementitious material, mix 1 part portland cement and 1 part masonry cement. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
 3. Plastic Cement Mix: Use 1 part plastic cement and 2-1/2 to 4 parts aggregate.

- C. Job-Mixed Finish-Coat Mixes:
 - 1. Portland Cement Mix: For cementitious materials, mix 1 part portland cement and 3/4 to 1-1/2 parts lime. Use 1-1/2 to 3 parts aggregate per part of cementitious material.
 - 2. Masonry Cement Mix: 1 part masonry cement and 1-1/2 to 3 parts aggregate.
 - 3. Portland and Masonry Cement Mix: For cementitious materials, mix 1 part portland cement and 1 part masonry cement. Use 1-1/2 to 3 parts aggregate per part of cementitious material.
 - 4. Plastic Cement Mix: 1 part plastic cement and 1-1/2 to 3 parts aggregate.
- D. Factory-Prepared Finish-Coat Mixes: For ready-mixed finish-coat plasters or acrylic-based finish coatings, comply with manufacturer's written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Protect adjacent work from soiling, spattering, moisture deterioration, and other harmful effects caused by plastering.
- B. Prepare solid substrates for plaster that are smooth or that do not have the suction capability required to bond with plaster according to ASTM C 926.

3.3 INSTALLING ACCESSORIES

- A. Install according to ASTM C 1063 and at locations indicated on Drawings.
- B. Reinforcement for External Corners: Install cornerbead at exterior locations.
- C. Control Joints: Install control joints at locations indicated on Drawings.

3.4 PLASTER APPLICATION

- A. General: Comply with ASTM C 926.
 - 1. Do not deviate more than plus or minus 1/4 inch in 10 feet from a true plane in finished plaster surfaces, as measured by a 10-foot straightedge placed on surface.
 - 2. Finish plaster flush with metal frames and other built-in metal items or accessories that act as a plaster ground unless otherwise indicated. Where casing bead does not terminate plaster at metal frame, cut base coat free from metal frame before plaster sets and groove finish coat at junctures with metal.
 - 3. Provide plaster surfaces that are ready to receive field-applied finishes indicated.
- B. Bonding Compound: Apply on unit masonry plaster bases.
- C. Walls; Base-Coat Mix: Scratch coat for two-coat plasterwork, 3/8 inch thick on concrete masonry.
 - 1. Portland cement mixes.
 - 2. Masonry cement mixes.

3. Portland and masonry cement mixes.
4. Plastic cement mixes.
5. Portland and plastic cement mixes.

D. Plaster Finish Coats: Apply to provide textured finish to match existing.

E. Acrylic-Based Finish Coatings: Apply coating system, including primers, finish coats, and sealing topcoats, according to manufacturer's written instructions.

3.5 PLASTER REPAIRS

A. Repair or replace work to eliminate cracks, dents, blisters, buckles, crazing and check cracking, dry outs, efflorescence, sweat outs, and similar defects and where bond to substrate has failed.

3.6 PROTECTION

A. Remove temporary protection and enclosure of other work. Promptly remove plaster from door frames, windows, and other surfaces not indicated to be plastered. Repair floors, walls, and other surfaces stained, marred, or otherwise damaged during plastering.

END OF SECTION 092400

SECTION 092510 – SEAMLESS SOUND ABSORPTIVE ACOUSTICAL FINISH SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Description: Seamless Sound Absorptive Acoustical Finish System is used to reduce reverberation time making voice, music and other sound much more intelligible. Its design is based on a fine porous surface that appears to be solid, applied onto a mineral wool panel. High frequency sound energy passes through the pores, into the mineral wool, and is converted into heat energy. Low frequency sound energy vibrates the porous surface diaphragmatically, and is converted into heat energy.
- B. Components: The Seamless Sound Absorption System shall consist of pre-coated mineral wool supporting panels that are adhered to a stable substrate. The seams between panels shall be filled. A base coat and a finish coat are applied onto the supporting panels on site, per manufacturer's specifications. The top coat shall be troweled smooth to give the appearance of a smooth conventional plaster.
- C. Work in this Section includes all labor, materials, equipment and services necessary to complete the seamless sound absorptive system as shown on the drawings, finish schedules, and / or defined and specified herein.

1.3 QUALITY ASSURANCE

- A. Certified Installers: Installer shall be certified by the manufacturer to install the Seamless Acoustical Finish System and have at least 3 years experience installing the product, employing supervisors and mechanics certified and approved by the manufacturer.
- B. New Installers: Shall comply with all requirements of the manufacturer's Certified Training Program, including, but not limited to, the purchase of approved installation hand tools and equipment as well as contracting the services of at least one of the manufacturer's full time on-site Certified Technicians throughout the duration of the installation to ensure quality and compliance with all of the manufacturer's details and other installation requirements.

1.4 ACTION SUBMITTALS

- A. Shop Drawings and Product Data:
 - 1. Base Drawings, Approved Detail Drawings and Product Literature.
 - 2. Show dimensioned ceiling plans with control joint locations, mounting details, transition details to adjacent work, design, weight, thickness, color and other data necessary to install the work and coordinate work with other affected trades.
- B. Samples: Provide two 8-1/2" x 11" samples of the Seamless Acoustical Finish System in color as specified herein.
- C. Job Site Mock-Up: Install a 4' x 4' mock-up of the sound absorptive finish system replicating relative details and conditions. Obtain mock-up acceptance before any additional applications. Accomplish work to equal, or exceed standard established by accepted job site mock-up.

1.5 INFORMATIONAL SUBMITTALS

- A. Acoustical Performance Data: Certified Acoustical Performance Sound Absorption Test Report data, conducted by a recognized, independent, testing agency, demonstrating compliance with the following minimum requirements. Sound absorption reports shall not be more than 3 years old. Noise Reduction Coefficient (NRC) shall be 0.85 per ASTM C 423-07. Specific performance shall be as follows:

Frequency, Hz	Absorption Coefficient
100	0.23
200	0.40
400	0.94
800	0.97
1,000	0.90
1,250	0.91
1,600	0.87
2,000	0.87
2,500	0.79
4,000	0.76
5,000	0.74

- B. Fire Test Data: Certified Reports on Surface Burning Characteristics Determined by ASTM E 84, conducted by a recognized, independent, testing agency, demonstrating compliance with the following minimum requirements:
- Class A Flame Spread Classification
 - Flame Spread: 0–25
 - Smoke Development: 0–450
- C. Light Reflectance Coefficient Test Data: Certified Reports on Light Reflectance Coefficient Performance Determined by ASTM E 1477-98, conducted by a recognized, independent, testing agency demonstrating compliance with the following minimum requirements:
- Light Reflectance Value: 91 minimum

1.6 REFERENCES

- A. ASTM Publications:
- ASTM C 423-07: Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
 - ASTM E 795-05: Standard Practices for Mounting Test Specimens during Sound Absorption Tests.
 - ASTM E 84: Standard Test Method for Surface Burning Characteristics and Building Materials. Class A Fire Rating.
 - ASTM C842, Specification and Standards for Application of Interior Gypsum Plaster.
 - ASTM E 1477-98 Standard Test Method for Luminous Reflectance Factor of Acoustical Materials by Use of Integrating Sphere Reflectometer.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Allow materials to become acclimated to Project conditions before installation.
- B. Ship and deliver in protective packaging to prevent freight damage.
- C. Store materials in accordance with manufacturer's recommendations in a fully enclosed space where materials will be protected against damage from moisture, direct sunlight, surface contamination and other causes. All wet work must be completed in area of storage.

- D. Protect base coat and top coat from freezing. Product that has frozen cannot be used and is not warranted.

1.8 PROJECT CONDITIONS

- A. Environmental Requirements: Comply with requirements of referenced plaster application standards and recommendations of product manufacturer for environmental conditions before, during and after installation.
- B. Cold Weather Requirements: When ambient outdoor temperatures are below 40 deg F, maintain a continuous uniform indoor temperature of at least 50 deg F for at least 3 days before beginning the material application, during its application and until material is dry, but for at least 7 days after application is complete. Distribute heat evenly; prevent concentrated or uneven heat from contacting the materials.
- C. Ventilation: Ventilate building spaces as required to remove excess moisture to promote drying of the applied materials.
- D. Protect contiguous work from soiling, splattering, moisture deterioration and other harmful effects that may be caused by the application of the materials.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Basis of Design: Installation shall be based upon the BASWaphon Sound Absorptive Acoustical Finish System's performance; specifications, information and details as supplied by BASWA Acoustic North America, LLC.
 - 1. Address: 3900 Ben Hur Ave., Suite 10, Willoughby, Ohio 44094
 - 2. Phone: 440.951.6022.
 - 3. Website: www.baswaphon.com
- B. Other products and installers must meet the exact design and performance criteria described herein. Requests for substitutions will be considered in accordance with Division 01 Section "Product Requirements".

2.2 MATERIALS

- A. The seamless sound absorption system shall consist of manufacturer's standard pre-coated mineral wool supporting panels, panel adhesive, fill, base coat and finish coat.
 - 1. Total System Thickness: Approximately 1-9/16".
- B. Trim Pieces: All corner beads, reveals, terminations, control joints or other trim pieces shall be white vinyl in profiles approved by finish system manufacturer.
 - 1. Manufacturer: Trim-Tex or Vinyl Corp.
 - 2. Trims shall be installed with spray adhesive equal to Trim-Tex 847.
- C. The base and top coats shall be provided in the manufacturer's standard "natural white" color and texture to simulate plaster.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine areas where, and conditions under which, seamless sound absorptive finish system is to be installed. Correct any conditions detrimental to the proper and timely completion of the work. Do not proceed until unsatisfactory conditions have been corrected in order to permit the proper installation of the work.
- B. Verify that all mechanical and electrical services within the area of application have been roughed in at the appropriate depth relative to the thickness of the system; tested and approved, prior to commencement of application. Review approved details provided by the manufacturer for verification.

3.2 ACCEPTABLE SUBSTRATE

- A. General: Seamless sound absorptive finish system must be installed over a "sealed air tight" substrate. All penetrations shall be "closed off" to prevent air from passing through the finish system, thereafter through the substrate and then into the plenum above, or vice versa.
 - 1. Seal all HVAC, electrical, fire sprinkler and other penetrations of the substrate with traditional drywall tape or a self-adhesive fire tape to prevent air movement between the plenum and finished space or vice versa.
 - 2. Adhesive Strength required for bonding to the substrate surface for the application of the finish system is a minimum of 17 N/psf.
 - 3. All substrates for the application shall not vary from level, or a by more than 1/4 inch in 12 feet.
- B. Existing substrates with previously painted drywall or plaster shall be primed per manufacturer's specifications.
 - 1. Product: Sherwin Williams Preprite Bonding Primer.

3.3 INSTALLATION

- A. General Requirements:
 - 1. Hand Tools: Application of mineral wool panels, fill, base, and top coats must be facilitated by using the proper stainless steel flat or notched hand trowels supplied by the manufacturer. The proper notched gauging trowels and smoothing trowels shall be used at each step noted below in order to control material thickness.
 - a. Pump Option: Base and top coats may be applied onto the stable substrate using traditional hawk and trowel methods; however, use of the system manufacturer's "BASWAjet" pump, which is specifically designed for the specified finish system, dramatically increases production and greatly reduces product waste.
 - 2. Lighting: Inherent in all hand troweled product applications, minor acceptable trowel marks in the finished surface may occur and become exposed or "exaggerated" under critical lighting. Ensure that the lighting used during the entire installation process replicates the actual finished lighting. All windows and other openings which naturally light the area of the installation shall be uncovered during the entire installation in order to represent finished conditions.
 - 3. Drying Times: Drying times when installing the panel adhesive, fill, base and top coats are typically overnight, however, drying times may be longer due to unusual on-site conditions. Prior to proceeding with any additional work, ensure panel adhesive, fill, base or top coat is completely and thoroughly dry.
 - 4. Finished Coat Installation: Application of the top coat shall be facilitated in one operation at each area of installation; "cold joints" in the top coat are not acceptable.

5. Staging: Generally, the seamless sound absorptive finish system is installed using full “dance floor scaffolding” on ceiling applications in order to achieve an acceptable finish without “cold joints”. Rolling tower scaffolds that can be moved across an installation area may also be acceptable.
 6. Access Doors: Access Doors used in the seamless sound absorptive finish system shall be “trimless” and have a 1-inch recessed door.
 - a. Product: Access Door model number 5020, sized as required, manufactured by Acudor Products, Inc.
 - b. Install per detail approved by finish system manufacturer.
 7. Light fixtures, ornamentation, speakers, cover plates or any other items cannot be attached directly to the seamless sound absorptive finish system. Ensure items are secured to proper blocking or other attachment system independent of the finish system per details approved by the manufacturer.
- B. Installation Procedures: Install acoustical finish system materials in accordance with manufacturer’s installation instructions and details. Installation shall start only after all other work in the area of the installation has been completed.
1. Pre-Coated Mineral Wool Panels: Apply a 2 mm thick layer of adhesive to the mineral wool back face of the 36 mm thick pre-coated panel. Press the panel firmly onto, and fully adhere to, the stable substrate. Ensure that panels are set as level and as smooth to each other as practicable. Stagger joints between panels.
 2. Trim: Install white vinyl trim pieces with approved adhesives.
 3. Fill: Fill seams between pre-coated panels and cover all white vinyl trim. Sand fill smooth when completely dry.
 4. Base Coat (Natural White): Prior to applying the layer of base coat, ensure product is thoroughly mixed and several pails are continuously batched together in order to provide even consistent coloring. Apply a 2.0 to 3.0 mm thick layer and trowel smooth. Sand smooth when completely dry.
 5. Top (Natural White): Prior to applying the layer of top coat, ensure product is thoroughly mixed and several pails are continuously batched together in order to provide even consistent coloring. Apply a 0.5 to 1.0 mm thick layer of top coat and trowel smooth to a quality level consistent with accepted samples or mock-up. Note that this system is a hand troweled finished product. Inherent in all hand troweled product applications, minor acceptable trowel marks and other imperfections in the finished surface may occur which are only visible at certain times of day or under certain critical lighting conditions. The finish should be critically viewed only under end-use lighting conditions.

3.4 PROTECTION

- A. Protect installed seamless sound absorptive acoustical finish system from damage until date of Substantial Completion.

END OF SECTION 092510

SECTION 092613 - GYPSUM VENEER PLASTER

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes interior gypsum veneer plaster for patches and repairs to existing plaster surfaces damaged by demolition or new construction where the surface coating is relatively thin.
- B. Related Requirements include, but are not limited to:
 - 1. Division 09 Section "Portland Cement Plastering" for thick plaster repairs.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages, containers, and bundles bearing brand name and identification of manufacturer or supplier.
- B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.
- C. Stack panels flat on leveled supports off floor or slab to prevent sagging.

1.5 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 843 requirements or gypsum veneer plaster manufacturer's written recommendations, whichever are more stringent.
- B. Room Temperatures: Maintain not less than 55 deg F or more than 80 deg F for seven days before application of gypsum base and gypsum veneer plaster, continuously during application, and after application until veneer plaster is dry.
- C. Avoid conditions that result in gypsum veneer plaster drying too rapidly.
 - 1. Distribute heat evenly; prevent concentrated or uneven heat on veneer plaster.
 - 2. Maintain relative humidity levels, for prevailing ambient temperature, that produce normal drying conditions.
 - 3. Ventilate building spaces in a manner that prevents drafts of air from contacting surfaces during veneer plaster application until it is dry.
- D. Do not install panels that are wet, moisture damaged, or mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain gypsum veneer plaster products, including gypsum base for veneer plaster, joint reinforcing tape, and embedding material, from single manufacturer.

2.2 GYPSUM VENEER PLASTER

- A. Materials: Provide one of the following:
 1. One-Component Gypsum Veneer Plaster: ASTM C 587, ready-mixed, smooth, finish-coat veneer plaster formulated for application directly over substrate without use of separate base-coat material.
 2. Two-Component Gypsum Veneer Plaster: ASTM C 587, with separate formulations; one for base-coat application and one for finish-coat application over substrates.

2.3 PANEL PRODUCTS

- A. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.
- B. Materials: Provide one of the following, type and thickness as best suited to repair or patch application encountered:
 1. Gypsum Base for Veneer Plaster: ASTM C 1396/C 1396M.
 2. Glass-Mat Interior Gypsum Board: ASTM C 1658/C 1658M. With moisture- and mold-resistant core; glass-mat facing on both sides of panel.
 3. Cementitious Backer Units: ANSI A118.9 and ASTM C 1288 and approved by backer unit manufacturer for use as veneer plaster substrate.
 - a. Thickness: 1/2 inch.
 - b. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
- C. Backing Panels for Multilayer Applications: ASTM C 1396/C 1396M gypsum base or gypsum board, as recommended by gypsum veneer plaster manufacturer, for application method and thicknesses indicated.
 1. Core: Matching face layer unless otherwise indicated.
 2. Thickness: Matching face layer unless otherwise indicated.

2.4 TRIM ACCESSORIES

- A. Standard Trim: ASTM C 1047, provided or approved by manufacturer for use in gypsum veneer plaster applications indicated.
 1. Material: Provide one of the following:
 - a. Galvanized-steel sheet.
 - b. Aluminum-coated steel sheet
 - c. Rolled zinc.
 - d. Paper-faced galvanized-steel sheet.
 2. Shapes:
 - a. Cornerbead.
 - b. Bullnose bead.
 - c. LC-Bead: J-shaped; exposed long flange receives veneer plaster.
 - d. L-Bead: L-shaped; exposed long flange receives veneer plaster.
 - e. Curved-Edge Cornerbead: With notched or flexible flanges.
 - f. Control joints.

2.5 JOINT REINFORCING MATERIALS

- A. General: Comply with joint strength requirements in ASTM C 587 and with gypsum veneer plaster manufacturer's written recommendations for each application indicated.
- B. Joint Tape:
 - 1. Gypsum Base for Veneer Plaster: Paper or open-mesh glass fiber as recommended by gypsum veneer plaster manufacturer for applications indicated.
 - 2. Cementitious Backer Units: As recommended by cementitious backer unit manufacturer.
- C. Embedding Material for Joint Tape:
 - 1. Gypsum Base for Veneer Plaster: As recommended by gypsum veneer plaster manufacturer for use with joint-tape material and gypsum veneer plaster applications indicated.
 - 2. Cementitious Backer Units: As recommended by cementitious backer unit manufacturer for applications indicated.

2.6 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced product standards and manufacturer's written recommendations.
- B. Bonding Agent: ASTM C 631, polyvinyl acetate.
- C. Laminating Adhesive: Adhesive or joint compound recommended by manufacturer for directly adhering gypsum-base, face-layer panels to backing-layer panels in multilayer construction.
- D. Steel Drill Screws: ASTM C 1002 unless otherwise indicated.
 - 1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
- E. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- F. Patching Mortar: Dry-pack patching mortar, consisting of 1 part Portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, or mold damaged.
- C. Masonry Substrates: Verify that mortar joints are struck flush.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Monolithic Concrete Substrates: Prepare according to gypsum veneer plaster manufacturer's written recommendations and as follows:

1. Clean surfaces to remove dust, loose particles, grease, oil, incompatible curing compounds, form-release agents, and other foreign matter and deposits that could impair bond with gypsum veneer plaster.
 2. Remove ridges and protrusions greater than 1/8 inch and fill depressions greater than 1/4 inch with patching mortar. Allow to set and dry.
 3. Apply bonding agent on dry and cured concrete substrates.
- B. Masonry Substrates: Prepare according to gypsum veneer plaster manufacturer's written recommendations and as follows:
1. Clean surfaces to remove dirt, grease, oil, and other foreign matter and deposits that could impair bond with gypsum veneer plaster.
 2. Apply bonding agent on dry masonry substrates.

3.3 INSTALLING PANELS, GENERAL

- A. Gypsum Base for Veneer Plaster: Apply according to ASTM C 844 unless manufacturer's written recommendations are more stringent.
1. Do not allow gypsum base to degrade from exposure to sunlight, as evidenced by fading of paper facing.
 2. Erection Tolerance: No more than 1/16-inch offsets between planes of gypsum base panels, and 1/8 inch in 8 feet noncumulative, for level, plumb, warp, and bow.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not locate joints, other than control joints, at corners of framed openings.
- E. Attach panels to steel studs so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- F. Attach panels to framing provided at openings and cutouts.
- G. Form control joints with space between edges of adjoining panels.
- H. Cover both sides of partition framing with panels in concealed spaces, including above ceilings, except in internally braced chases.
1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
 2. Fit panels around ducts, pipes, and conduits.
- I. Fastener Spacing: Comply with ASTM C 844, manufacturer's written recommendations, and fire-resistance-rating requirements.
1. Space screws a maximum of 12 inches o.c. along framing members for wall or ceiling application.
 2. Space fasteners in cementitious backer units a maximum of 8 inches o.c. along framing members for wall applications and 6 inches o.c. along framing members for ceiling applications.

3.4 INSTALLING PANELS

- A. Single-Layer Application:
 - 1. On ceilings, apply gypsum base panels before wall panels, to the greatest extent possible and at right angles to framing unless otherwise indicated.
 - 2. On walls, apply gypsum base panels to framing and minimize end joints. Stagger abutting end joints not less than one framing member in alternate courses of panels.
 - 3. On Z-furring, apply gypsum base panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
- B. Multilayer Application on Ceilings: Apply backing panels for ceilings before applying backing panels for partitions; apply gypsum-base face layers in same sequence. Apply backing panels at right angles to framing members and offset gypsum-base, face-layer joints a minimum of 16 inches from parallel backing panel joints unless otherwise required by fire-resistance-rated assembly.
- C. Multilayer Application on Partitions: Apply backing panels indicated and gypsum-base face layers vertically (parallel to framing) with joints of backing panels located over stud or furring members and gypsum-base, face-layer joints offset at least one stud or furring member from backing-panel joints unless otherwise required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
 - 1. Z-Furring: Apply backing panels vertically (parallel to framing) and gypsum-base face layer either vertically or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of backing panels over furring members.
- D. Fasteners: Drive fasteners flush with gypsum base surface. Do not overdrive fasteners or cause surface depressions.
- E. Single-Layer Fastening Methods: Apply gypsum base panels to supports with steel drill screws.
- F. Multilayer Fastening Methods: Fasten backing panels and gypsum-base face layers separately to supports with screws with screws; fasten gypsum-base face layers with adhesive and supplementary fasteners.
- G. Curved Partitions: Comply with gypsum base manufacturer's written installation recommendations.
- H. Cementitious Backer Units: Install according to ANSI A108.11.
 - 1. Where cementitious backer units abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.5 INSTALLING TRIM ACCESSORIES

- A. General: Install trim with back flanges intended for fasteners, and attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Trim: Install in the following locations:
 - 1. Cornerbead: Use at outside corners unless otherwise indicated.
 - 2. Bullnose Bead: Use at repairs to outside corners where existing corner has bullnose edge.
 - 3. LC-Bead: Use at exposed panel edges.
 - 4. L-Bead: Use where LC bead is not feasible.
 - 5. Curved-Edge Cornerbead: Use at curved openings.

3.6 GYPSUM VENEER PLASTERING

- A. Bonding Agent: Apply bonding agent on dry monolithic concrete, masonry, or cementitious backer units according to gypsum veneer plaster manufacturer's written recommendations.
- B. Gypsum Veneer Plaster Mixing: Mechanically mix gypsum veneer plaster materials to comply with ASTM C 843 and with gypsum veneer plaster manufacturer's written recommendations.
- C. Gypsum Veneer Plaster Application: Comply with ASTM C 843 and with veneer plaster manufacturer's written recommendations.
 - 1. One-Component Gypsum Veneer Plaster: Trowel apply base coat over substrate to uniform thickness. Fill all voids and imperfections. Immediately double back with same mixer batch of plaster to a uniform total thickness of 1/16 to 3/32 inch.
 - 2. Two-Component Gypsum Veneer Plaster:
 - a. Base Coat: Hand trowel or machine apply base coat over substrate to a uniform thickness of 1/16 to 3/32 inch . Fill all voids and imperfections.
 - b. Finish Coat: Trowel apply finish-coat plaster over base-coat plaster to a uniform thickness of 1/16 to 3/32 inch .
 - 3. Where gypsum veneer plaster abuts only metal door frames, windows, and other units, groove finish coat to eliminate spalling.
 - 4. Do not apply veneer plaster to gypsum base if paper facing has degraded from exposure to sunlight. Before applying veneer plaster, use remedial methods to restore bonding capability to degraded paper facing according to manufacturer's written recommendations and as approved by Architect.
- D. Gypsum Veneer Plaster Finish: Smooth-troweled finish unless otherwise required to match existing adjacent plaster to remain.

3.7 PROTECTION

- A. Protect installed gypsum veneer plaster from damage from weather, condensation, construction, and other causes during remainder of the construction period.
- B. Remove and replace gypsum veneer plaster and gypsum base panels that are wet, moisture damaged, or mold damaged.
 - 1. Indications that gypsum base panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
 - 2. Indications that gypsum base panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092613

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes, but is not limited to:
 - 1. Interior gypsum board.
 - 2. Tile backing panels.
 - 3. Texture finish.
 - 4. Reveal trim moldings.
- B. Related Requirements include, but are not limited to:
 - 1. Division 06 Section "Sheathing" for gypsum sheathing for exterior walls.
 - 2. Division 09 Section "Non-Structural Metal Framing" for non-structural framing and suspension systems that support gypsum board panels.
 - 3. Division 09 Section "Gypsum Board Shaft Wall Assemblies" for metal shaft-wall framing, gypsum shaft liners, and other components of shaft-wall assemblies.
 - 4. Division 09 Section "Gypsum Veneer Plastering" for gypsum base for veneer plaster and for other components of gypsum-veneer-plaster finishes.
 - 5. Division 09 Section "Tile" for cementitious backer units installed as substrates for ceramic tile.
- C. For the purposes of this project, the terms "gypsum board", "gypsum wallboard", and "drywall" may be used interchangeably in the Contract Documents.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Product Data for Adhesives Used to Laminate Gypsum Board Panels to Substrates: Documentation including printed statement of VOC content.
 - 2. Laboratory Test Reports for Adhesives Used to Laminate Gypsum Board Panels to Substrates: Documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

1.4 QUALITY ASSURANCE

- A. Mockup: Before beginning gypsum board installation, install texture finish mockup of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Install mockup for each texture finish indicated.
 - 2. Apply final painting on exposed surface for review of mockup.
 - 3. Simulate finished lighting conditions for review of mockup.
 - 4. Subject to compliance with requirements, approved mockup may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. Low Emitting Materials: For ceiling and wall assemblies, provide materials and construction identical to those tested in assembly and complying with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.2 GYPSUM BOARD, GENERAL

- A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

- A. Gypsum Wallboard: ASTM C 1396/C 1396M.
 - 1. Thickness: 5/8 inch.
 - 2. Long Edges: Tapered.
- B. Gypsum Board, Type X: ASTM C 1396/C 1396M.
 - 1. Thickness: 5/8 inch, unless otherwise indicated.
 - 2. Long Edges: Tapered.
- C. Flexible Gypsum Board: ASTM C 1396/C 1396M. Manufactured to bend to fit radii and to be more flexible than standard regular-type gypsum board of same thickness.
 - 1. Thickness: 1/4 inch, unless otherwise indicated.
 - 2. Long Edges: Tapered.
- D. Gypsum Ceiling Board: ASTM C 1396/C 1396M.

1. Thickness: 5/8 inch.
2. Long Edges: Tapered.

2.4 TILE BACKING PANELS

- A. Tile Backing Panels: Provide either cementitious backer units specified in Division 09 Section "Tiling" or one of the following:
1. Glass-Mat, Water-Resistant Backing Board: ASTM C 1178/C 1178M, with manufacturer's standard edges. Provide one of the following:
 - a. CertainTeed Corp.; GlasRoc Tile Backer.
 - b. Georgia-Pacific Gypsum LLC; DensShield Tile Backer.
 2. Cementitious Backer Units: ANSI A118.9 and ASTM C 1288 or 1325, mold resistant, with manufacturer's standard edges. Provide one of the following:
 - a. CertainTeed Corp.; FiberCement BackerBoard.
 - b. Custom Building Products; Wonderboard.
 - c. James Hardie Building Products, Inc.; Hardiebacker or Hardiebacker 500.
 - d. National Gypsum Company, Permapase Cement Board.
 - e. USG Corporation; DUROCK Cement Board.

2.5 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.
1. Material: Provide one of the following:
 - a. Galvanized or aluminum-coated steel sheet.
 - b. Rolled zinc
 - c. Paper-faced galvanized steel sheet.
 2. Shapes:
 - a. Cornerbead.
 - b. Bullnose bead.
 - c. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - d. L-Bead: L-shaped; exposed long flange receives joint compound.
 - e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
 - f. Expansion (control) joint.
 - g. Curved-Edge Cornerbead: With notched or flexible flanges.
- B. Drywall Reveal Trim: Extruded aluminum reveal moldings of profiles indicated.
1. Material: Extruded alloy 6063 T5.
 2. Finish: Chemical conversion coating.
 3. Manufacturer: Fry Reglet Corporation
 - a. Address: 625 South Palm Avenue, Alhambra CA 91803
 - b. Phone: (800) 237-9773
 - c. Fax: (800) 200-4397
 - d. Web site: www.fryreglet.com
 4. Drywall/Acoustical Reveal Molding: Provides a reveal separating two dissimilar materials, a support for acoustical material and a taping flange for finishing drywall.
 - a. Reveal Width: As indicated.
 - b. Basis of Design Product: Fry Reglet DRMAD-50-75.
 5. "W" Reveal Molding: Provides a reveal at the intersection of drywall ceiling and vertical surface.
 - a. Reveal Width: As indicated.
 - b. Basis of Design Product: Fry Reglet DRWT-75-75.

2.6 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.

- B. Joint Tape:
 1. Interior Gypsum Board: Paper.
 2. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
 3. Tile Backing Panels: As recommended by panel manufacturer.

- C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
 1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound or drying-type, all-purpose compound.
 - a. Use only setting-type compound for installing paper-faced metal trim accessories.
 3. Fill Coat: For second coat, use setting-type, sandable topping compound or drying-type, all-purpose compound.
 4. Finish Coat: For third coat, use setting-type, sandable topping compound or drying-type, all-purpose compound.

- D. Joint Compound for Tile Backing Panels:
 1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.
 2. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.7 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
 1. Laminating adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 2. Laminating adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

- C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
 1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

- D. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
 1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

- E. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

- F. Thermal Insulation: As specified in Division 07 Section "Thermal Insulation."

2.8 TEXTURE FINISH

- A. Primer: As recommended by texture finish manufacturer.

- B. Non-Aggregated Texture Wall Finish: Product specifically formulated for use in creating a wide range of wall and ceiling surfaces, suitable for spraying.
 - 1. Basis of Design: ProForm® Perfect Spray EM.
 - 2. Texture: Spatter Knock-Down.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
 - 2. Fit gypsum panels around ducts, pipes, and conduits.
 - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber,

including floor joists and headers. Float gypsum panels over these members or provide control joints to counteract wood shrinkage.

- J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 APPLYING INTERIOR GYPSUM BOARD

A. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
 - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
 - b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

B. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying face layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
3. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
4. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

- C. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.

D. Curved Surfaces:

1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch- long straight sections at ends of curves and tangent to them.
2. For double-layer construction, fasten base layer to studs with screws 16 inches o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches o.c.

3.4 APPLYING TILE BACKING PANELS

- A. Glass-Mat, Water-Resistant Backing Panels: Comply with manufacturer's written installation instructions. Install with 1/4-inch gap where panels abut other construction or penetrations.

- B. Cementitious Backer Units: ANSI A108.11.
- C. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.5 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.
- C. Interior Trim: Install in the following locations:
 - 1. Cornerbead: Use at outside corners unless otherwise indicated.
 - 2. LC-Bead: Use at exposed panel edges.
 - 3. L-Bead: Use at exposed panel edges where use of LC-bead is impractical.
 - 4. U-Bead: Use at concealed panel edges only.
 - 5. Curved-Edge Cornerbead: Use at curved openings.
- D. Reveal Trim: Install in accordance with manufacturer's installation instructions and as follows:
 - 1. Fasten metal trim shapes to framing system with mechanical anchors spaced at 8" on center.
 - 2. Finish joints and attachment flanges as specified for gypsum board.
 - 3. Joint and fastener treatment shall be indistinguishable in finished work.

3.6 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
 - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 - 2. Level 2: Panels that are substrate for tile.
 - 3. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
 - a. Primer and its application to surfaces are specified in Division 09 Section "Interior Painting."
- E. Glass-Mat Faced Panels: Finish according to manufacturer's written instructions.
- F. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.7 APPLYING TEXTURE FINISH

- A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finish. Apply primer to surfaces that are clean, dry, and smooth.

- B. Texture Finish Application: Mix and apply finish using powered spray equipment, to produce a uniform texture matching approved mockup and free of starved spots or other evidence of thin application or of application patterns.
- C. Prevent texture finish from coming into contact with surfaces not indicated to receive texture finish by covering them with masking agents, polyethylene film, or other means. If, despite these precautions, texture finish contacts these surfaces, immediately remove droppings and overspray to prevent damage according to texture-finish manufacturer's written recommendations.
- D. After finish texture has reached initial set but prior to hardening, create final "knock-down" appearance by running a straight metal blade over it to knock down raised pumps to flat.

3.8 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

SECTION 093000 - TILE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes, but is not limited to, the following interior applications:
 - 1. Ceramic tile.
 - 2. Stone thresholds.
 - 3. Crack isolation membrane.
- B. Related Sections include, but are not limited to:
 - 1. Division 07 Section "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
 - 2. Division 09 Section "Gypsum Board" for tile backer units.

1.3 DEFINITIONS

- A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.
- B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in "American National Standard Specifications for Installation of Ceramic Tile."
- C. Module Size: Actual tile size plus joint width indicated.
- D. Face Size: Actual tile size, excluding spacer lugs.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Initial Selection: For each type of tile and grout indicated. Include Samples of accessories involving color selection.
- C. Samples for Verification:
 - 1. Full-size units of each type and composition of tile and for each color and finish required.
 - 2. Stone thresholds in 6-inch lengths.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.
- C. Product Certificates: For each type of product, signed by product manufacturer.

1.6 MATERIALS MAINTENANCE SUBMITTALS

- A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Tile and Trim Units: Furnish quantity of full-size units equal to three percent (3%) of amount installed for each type, composition, color, pattern, and size indicated.
 - 2. Grout: Furnish quantity of grout equal to three percent (3%) of amount installed for each type, composition, and color indicated.

1.7 QUALITY ASSURANCE

- A. Source Limitations for Tile: Obtain tile of each type from one source or producer.
 - 1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.
- B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from one manufacturer and each aggregate from one source or producer.
- C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer for each product:
 - 1. Stone thresholds.
 - 2. Crack isolation membrane.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.
- D. Store liquid materials in unopened containers and protected from freezing.
- E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.9 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
 - 1. Provide tile complying with Standard grade requirements unless otherwise indicated.

- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCA installation methods specified in tile installation schedules, and other requirements specified.
- C. FloorScore Compliance: Tile for floors shall comply with requirements of FloorScore Standard.
- D. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.
- E. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.

2.2 TILE PRODUCTS

- A. Ceramic Mosaic Floor Tile:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the project include, but are not limited to:
 - a. American Olean – Unglazed Ceramic Mosaics
 - b. Crossville – Color Blox Mosaics
 - c. Daltile – Mosaic ColorBody™ Porcelain, Keystones
 - 2. Composition: Porcelain.
 - 3. Module Size: 3 x 3 inches.
 - 4. Thickness: 1/4 inch.
 - 5. Face: Pattern of design indicated, with cushion edges.
 - 6. Grout Color: As selected by Architect from manufacturer's full range of available colors.
- B. Glazed Wall Base:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the project include, but are not limited to:
 - a. Crossville
 - b. Daltile
 - c. Trinity
 - 2. Face Size: 3 by 6 inches, coved.
 - 3. Thickness: 1/4 inch.
 - 4. Face: Plain with square or cushion edges.
 - 5. Grout Color: As selected by Architect from manufacturer's full range of available colors.
- C. Glazed Wall Tile:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the project include, but are not limited to:
 - a. Crossville
 - b. Daltile
 - c. Trinity
 - 2. Module Size: 3 by 6 inches.
 - 3. Thickness: 5/16 inch.
 - 4. Face: Plain with modified square edges or cushion edges.
 - 5. Grout Color: As selected by Architect from manufacturer's full range of available colors.
 - 6. Mounting: Factory, back mounted.
 - 7. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:
 - a. External Corners for Thin-Set Mortar Installations: Surface bullnose, same size as adjoining flat tile.
 - b. Internal Corners: Field-buttet square corners.

2.3 THRESHOLDS

- A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.
 - 1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch or less above adjacent floor surface.
- B. Marble Thresholds: ASTM C 503, with a minimum abrasion resistance of 10 per ASTM C 1353 or ASTM C 241 and with honed finish.
 - 1. Description: Uniform, fine- to medium-grained white stone with gray veining.

2.4 TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A118.9 or ASTM C 1325, in maximum lengths available to minimize end-to-end butt joints.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. C-Cure; C-Cure Board 990.
 - b. Custom Building Products; Wonderboard.
 - c. FinPan, Inc.; Util-A-Crete Concrete Backer Board.
 - d. USG Corporation; DUROCK Cement Board.
 - 2. Thickness: As indicated.
- B. Fiber-Cement Underlayment: ASTM C 1288, in maximum lengths available to minimize end-to-end butt joints.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed Corp.; FiberCement Underlayment or BackerBoard.
 - b. James Hardie; Hardiebacker or Hardiebacker 500.
 - 2. Thickness: As indicated.

2.5 CRACK ISOLATION MEMBRANE

- A. General: Manufacturer's standard product, selected from the following, that complies with ANSI A118.12 for high performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
- B. Chlorinated Polyethylene Sheet: Nonplasticized, chlorinated polyethylene faced on both sides with nonwoven polyester fabric; 0.030-inch nominal thickness.
 - 1. Product: Noble Company (The); Nobleseal CIS.
- C. PVC Sheet: Two layers of PVC sheet heat-fused together and to facings of nonwoven polyester; 0.040-inch nominal thickness.
 - 1. Product: Compotite Corporation; Composeal Gold.
- D. Polyethylene Sheet: Polyethylene faced on both sides with fleece webbing; 0.008-inch nominal thickness.
 - 1. Product: Schluter Systems L.P.; KERDI.
- E. Corrugated Polyethylene: Corrugated polyethylene with dovetail-shaped corrugations and with anchoring webbing on the underside; 3/16-inch nominal thickness.
 - 1. Product: Schluter Systems L.P.; DITRA.
- F. Fabric-Reinforced, Modified-Bituminous Sheet: Self-adhering, modified-bituminous sheet with fabric reinforcement facing; 0.040-inch nominal thickness.
 - 1. Products: One of the following:

- a. MAPEI Corporation; Mapelastic SM.
- b. National Applied Construction Products, Inc.; Strataflex.

2.6 SETTING MATERIALS

- A. Portland Cement Mortar (Thickset) Installation Materials: ANSI A108.02.
 - 1. Cleavage Membrane: Asphalt felt, ASTM D 226, Type I (No. 15); or polyethylene sheeting, ASTM D 4397, 4.0 mils thick.
 - 2. Reinforcing Wire Fabric: Galvanized, welded wire fabric, 2 by 2 inches by 0.062-inch diameter; comply with ASTM A 185 and ASTM A 82 except for minimum wire size.
 - 3. Latex Additive: Manufacturer's standard acrylic resin or styrene-butadiene-rubber water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement and aggregate mortar bed.
- B. Dry-Set Portland Cement Mortar (Thin Set): ANSI A118.1.
 - 1. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.1.
- C. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4.
 - 1. Prepackaged Dry-Mortar Mix: Provide one of the following:
 - a. Mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
 - b. Mix combined with acrylic resin or styrene-butadiene-rubber liquid-latex additive at Project site.
 - 2. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.
- D. Medium-Bed, Latex-Portland Cement Mortar: Comply with requirements in ANSI A118.4. Provide product that is approved by manufacturer for application thickness of 5/8 inch.
 - 1. Prepackaged Dry-Mortar Mix: Provide one of the following:
 - a. Mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
 - b. Mix combined with acrylic resin or styrene-butadiene-rubber liquid-latex additive at Project site.

2.7 GROUT MATERIALS

- A. Sand-Portland Cement Grout: ANSI A108.10, composed of white or gray cement and white or colored aggregate as required to produce color indicated.
- B. Standard Cement Grout: ANSI A118.6.
- C. Polymer-Modified Tile Grout: ANSI A118.7. Provide one of the following:
 - 1. Ethylene vinyl acetate or acrylic additive, in dry, redispersible form, prepackaged with other dry ingredients.
 - 2. Acrylic resin or styrene-butadiene rubber in liquid-latex form for addition to prepackaged dry-grout mix.
- D. Grout for PregROUTed Tile Sheets: Same product used in factory to pregROUT tile sheets.

2.8 MISCELLANEOUS MATERIALS

- A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
- B. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.
- C. Grout Sealer: Manufacturer's standard product for sealing grout joints and that does not change color or appearance of grout.

2.9 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
- B. Add materials, water, and additives in accurate proportions.
- C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
 - 1. Verify that substrates for setting tile are firm, dry, clean, and free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
 - 2. Verify that concrete substrates for tile floors installed with bonded mortar bed or thin-set mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
 - a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
 - b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
 - 3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
 - 4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thin-set mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
- B. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from

other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

- C. Field-Applied Temporary Protective Coating: If needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.3 TILE INSTALLATION

- A. Comply with TCA's "Handbook for Ceramic Tile Installation" for TCA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
 - 1. For tile floors composed of rib-backed tiles, follow procedures in the ANSI A108 Series of tile installation standards for providing 95 percent mortar coverage.
- B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.
- E. Jointing Pattern: Lay floor tile in grid pattern unless otherwise indicated. Lay base and wall tile in running bond pattern. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
 - 1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
 - 2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
 - 3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.
- F. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
 - 1. Ceramic Mosaic Tile: 1/16 inch.
 - 2. Glazed Wall Tile: 1/16 inch.
- G. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
 - 1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
 - 2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."
- H. Stone Thresholds: Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated.
 - 1. At locations where mortar bed (thickset) would otherwise be exposed above adjacent floor finishes, set thresholds in latex-portland cement mortar (thin set).

2. Do not extend crack isolation membrane under thresholds set in dry-set portland cement or latex-portland cement mortar. Fill joints between such thresholds and adjoining tile set on crack isolation membrane with elastomeric sealant.
- I. Grout Sealer: Apply grout sealer to cementitious grout joints in tile floors according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.4 TILE BACKING PANEL INSTALLATION

- A. Install cementitious backer units or fiber-cement underlayment and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated. Use latex-portland cement mortar for bonding material unless otherwise directed in manufacturer's written instructions.

3.5 CRACK ISOLATION MEMBRANE INSTALLATION

- A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness and bonded securely to substrate.
- B. Do not install tile or setting materials over crack isolation membrane until membrane has cured.

3.6 CLEANING AND PROTECTING

- A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
 1. Remove latex-portland cement grout residue from tile as soon as possible.
 2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
 3. Remove temporary protective coating by method recommended by coating manufacturer and that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent drain clogging.
- B. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
- C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- D. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.7 INTERIOR TILE INSTALLATION SCHEDULE

- A. Interior Floor Installations, Concrete Subfloor:
 1. Tile Installation F113: Thin-set mortar; TCA F113.
 - a. Tile Type: Ceramic Floor Tile.
 - b. Thin-Set Mortar: Dry-set, latex, or medium-bed, latex- portland cement mortar.
 2. Tile Installation F125A: Thin-set mortar on crack isolation membrane; TCA F125A.
 - a. Tile Type: Ceramic Floor Tile.

- b. Thin-Set Mortar: Latex, medium-bed, or latex- portland cement mortar.
- B. Interior Floor Installations, Wood Subfloor:
 - 1. Tile Installation F144: Thin-set mortar on cementitious backer units or fiber cement underlayment; TCA F144.
 - a. Tile Type: Ceramic Floor Tile.
 - b. Thin-Set Mortar: Dry-set, Latex- or Medium-bed, latex-Portland cement mortar.
- C. Interior Wall Installations, Masonry or Concrete:
 - 1. Tile Installation W202: Thin-set mortar; TCA W202.
 - a. Tile Type: Ceramic Wall Tile.
 - b. Thin-Set Mortar: Dry-set, latex, or medium-bed, latex- portland cement mortar.
 - 2. Tile Installation W211: Cement mortar bed (thickset) bonded to substrate; TCA W211.
 - a. Tile Type: Ceramic wall tile repairs or patches to existing tile walls with thickset mortar.
 - b. Bond Coat Mortar for Wet-Set Method: Dry-set, latex, or portland cement mortar.
 - c. Thin-Set Mortar for Cured-Bed Method: Dry-set, latex, or portland cement mortar.
- D. Interior Wall Installations, Metal Studs or Furring:
 - 1. Tile Installation W244: Thin-set mortar on cementitious backer units or fiber cement underlayment; TCA W244.
 - a. Tile Type: Ceramic Wall Tile.
 - b. Thin-Set Mortar: Dry-set, latex, or Portland cement mortar.
- E. Shower Wall Installations, Metal Studs or Furring:
 - 1. Tile Installation B411: Cement mortar bed (thickset); TCA B411 and ANSI A108.1A.
 - a. Tile Type: Glazed Wall Tile.
 - b. Bond Coat Mortar for Wet-Set Method: Dry-set or Latex-Portland cement mortar.
 - 2. Tile Installation B412: Thin-set mortar on cementitious backer units or fiber cement underlayment; TCA B412.
 - a. Tile Type: Glazed Wall Tile.
 - b. Thin-Set Mortar: Dry-set or Latex-Portland cement mortar.
- F. Shower Wall Installations, Masonry:
 - 1. Tile Installation B414: Cement mortar bed (thickset); TCA B414.
 - a. Tile Type: Glazed Wall Tile.
 - b. Bond Coat Mortar for Wet-Set Method: Dry-set or Latex-Portland cement mortar.
 - c. Thin-Set Mortar for Cured-Bed Method: Dry-set or Latex-Portland cement mortar.

END OF SECTION 093000

SECTION 095113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes, but is not limited to:
 - 1. Acoustical panels and suspension systems for ceilings.
 - 2. Perimeter trim
- B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified, minimum 6 inches square in size.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For finishes to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Acoustical Ceiling Panels: Full-size panels equal to two percent (2%) percent of quantity installed.
 - 2. Suspension-System Components: Quantity of each exposed component equal to two percent (2%) percent of quantity installed.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to NVLAP for testing indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels, suspension-system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.
- C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
 - 1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: Comply with ASTM E 1264 for Class A materials.
 - 2. Smoke-Developed Index: 50 or less.
- B. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 ACOUSTICAL PANELS, GENERAL

- A. Source Limitations:
 - 1. Acoustical Ceiling Panel: Obtain each type from single source from single manufacturer.
 - 2. Suspension System: Obtain each type from single source from single manufacturer.
- B. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances unless otherwise indicated.
 - 1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface according to ASTM E 795.
- C. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.
- D. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

2.3 ACOUSTICAL PANELS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Armstrong World Industries, Inc.
 - 2. CertainTeed Corp.
 - 3. Chicago Metallic Corporation.
 - 4. Hunter Douglas Architectural Products
 - 5. USG Interiors, Inc.; Subsidiary of USG Corporation.

- B. ACP-1:
1. Basis of Design Product: Armstrong "Ultima" Item #1912.
 2. Classification: Provide panels complying with ASTM E 1264 for type, form, and pattern as follows:
 - a. Type and Form: Type IV, mineral base with membrane-faced overlay; Form 2, water felted.
 - b. Pattern: E (lightly textured).
 3. Color: White
 4. LR: Not less than 0.90.
 5. NRC: Not less than 0.70.
 6. CAC: Not less than 35.
 7. Edge/Joint Detail: Reveal sized to fit flange of 9/16" exposed suspension-system members.
 8. Thickness: 3/4 inch.
 9. Modular Size: 24 by 24 inches.
- C. ACP-2:
1. Basis of Design Product: Armstrong "Fine Fissured" Item #1732.
 2. Classification: Provide panels complying with ASTM E 1264 for type, form, and pattern as follows:
 - a. Type and Form: Type III, mineral base with painted finish, Form 2, water felted.
 - b. Pattern: CD (perforated, small holes and lightly textured).
 3. Color: White.
 4. LR: Not less than 0.85.
 5. NRC: Not less than .055.
 6. CAC: Not less than 35.
 7. Edge/Joint Detail: Reveal sized to fit flange of 15/16" exposed suspension-system members.
 8. Thickness: 5/8 inch.
 9. Modular Size: 24 by 24 inches.
- D. ACP-3:
1. Basis of Design Product: USG Sheetrock™ Lay-in Ceiling Panel "ClimaPlus™ " Item #3260.
 2. Classification: Provide panels complying with ASTM E 1264 for type, form, and pattern as follows:
 - a. Type and Form: Type XX, other types; described as high-density, ceramic- and mineral-base panels with scrubbable finish, resistant to heat, moisture, and corrosive fumes.
 - b. Pattern: G (smooth).
 3. Color: White.
 4. LR: Not less than 0.75.
 5. CAC: Not less than 35.
 6. Edge/Joint Detail: Square.
 7. Thickness: 1/2 inch.
 8. Modular Size: 24 by 24 inches.
 9. Substrate: Gypsum panel.
 10. Vinyl Face: Washable and scrubbable finish, impact and scratch resistant.
 11. Panels shall meet USDA/FSIS requirements for food processing areas.
- E. ACP-4:
1. Basis of Design Product: Sonora® Acoustical Ceiling Tiles as manufactured by Acoustics First.
 2. Description: Panels comprising 6-7 pcf non-combustible and dimensionally stable glass fiber core with fabric facing specifically designed for use in lay-in ceiling systems.
 3. Nominal Panel Dimensions:

- a. Thickness: 2 inches.
- b. Modular Size: 24 x 24 inches
- 4. Edge/Joint Detail: Square cut.
- 5. Fabric Facing: Guilford of Maine FR701 2100 Series.
- 6. Colors: Multiple colors as selected by Architect from manufacturer's full range of available colors.

2.4 METAL SUSPENSION SYSTEMS, GENERAL

- A. Metal Suspension-System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635/C 635M.
- B. Attachment Devices: Size for five (5) times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
 - 1. Anchors in Concrete: Anchors of one of the types and materials indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five (5) times that imposed by ceiling construction, as determined by testing according to ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.
 - a. Type: Cast-in-place, postinstalled expansion, or postinstalled bonded anchors.
 - b. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition.
 - c. Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Group 1 Alloy 304 or 316 for bolts; Alloy 304 or 316 for anchor.
 - d. Corrosion Protection: Components fabricated from nickel-copper-alloy rods complying with ASTM B 164 for UNS No. N04400 alloy.
 - 2. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to ten (10) times that imposed by ceiling construction, as determined by testing according to ASTM E 1190, conducted by a qualified testing and inspecting agency.
- C. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
 - 1. Material: One of the following:
 - a. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
 - b. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304, nonmagnetic.
 - c. Nickel-Copper-Alloy Wire: ASTM B 164, nickel-copper-alloy UNS No. N04400.
 - 2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.135-inch- diameter wire.
- D. Hanger Rods or Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.
- E. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed with 0.04-inch- thick, galvanized-steel sheet complying with ASTM A 653/A 653M, G90 coating designation; with bolted connections and 5/16-inch- diameter bolts.

2.5 METAL SUSPENSION SYSTEM

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Armstrong World Industries, Inc.
 - 2. CertainTeed Corp.

3. Chicago Metallic Corporation.
 4. USG Interiors, Inc.; Subsidiary of USG Corporation.
- B. Narrow-Face, Capped, Double-Web, Steel Suspension System for ACP-1: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 coating designation; with prefinished 9/16-inch- wide metal caps on flanges.
1. Structural Classification: Intermediate-duty system.
 2. End Condition of Cross Runners: Override (stepped) or butt-edge type.
 3. Face Design: Flanges formed with an integral center reveal.
 4. Cap Material: Steel cold-rolled sheet.
 5. Cap Finish: Painted white.
- C. Wide-Face, Capped, Double-Web, Steel Suspension System for ACP-2 and ACP-4: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 coating designation; with prefinished 15/16-inch- wide metal caps on flanges.
1. Structural Classification: Intermediate-duty system.
 2. End Condition of Cross Runners: Override (stepped) or butt-edge type.
 3. Face Design: Flat, flush.
 4. Cap Material: Steel cold-rolled sheet.
 5. Cap Finish: Painted white.
- D. Wide-Face, Capped, Double-Web, Steel Suspension System for ACP-3: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 coating designation; with prefinished, 15/16-inch- wide metal caps on flanges.
1. Structural Classification: Intermediate-duty system.
 2. Face Design: Flat, flush.
 3. Cap Material: Aluminum.
 4. Cap Finish: Painted white.

2.6 METAL EDGE MOLDINGS AND TRIM

- A. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.
1. Provide manufacturer's standard edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners unless otherwise indicated.
 2. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
 3. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
- B. Edge Trim System for Suspended Ceiling System:
1. Material: Commercial quality cold-rolled 24 gauge steel, factory-finished in baked enamel white finish to match ceiling grid.
 2. Metal Pans: Face width as indicated, 9/16-inch horizontal legs with hems formed for attachment to mounting clips. Edges formed to snap onto attachments clips and provide positive mechanical lock with no visible fasteners.
 3. Splice Plates: Steel in finish to match trim pans; formed to snap into and provide positive lock between abutting pan ends with no visible fasteners.

4. Attachment Clips: Hot dipped galvanized steel formed to snap into pans and provide positive mechanical lock with no visible fasteners while providing a variable angle, screw-fastened connection to suspension members that intersect the trim.
5. Pre-Fabricated 90-Degree Corner Trim Pieces: To match metal pans.
6. Basis of Design Product: "Compasso" Standard suspension trim as manufactured by USG Interiors, Inc., Chicago IL.

2.7 ACOUSTICAL SEALANT

- A. Acoustical Sealant: Manufacturer's standard sealant complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
 1. Exposed and Concealed Joints: Nonsag, paintable, nonstaining latex sealant.
 2. Concealed Joints: Nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
- B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

- A. General: Install acoustical panel ceilings to comply with ASTM C 636/C 636M and seismic design requirements indicated, according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
 1. Fire-Rated Assembly: Install fire-rated ceiling systems according to tested fire-rated design.
- B. Suspend ceiling hangers from building's structural members and as follows:
 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 2. Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.

4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three (3) tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
 6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
 7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
 8. Do not attach hangers to steel deck tabs.
 9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 10. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
 11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
- C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four (4) tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.
- D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
 2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet . Miter corners accurately and connect securely.
 3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- F. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
1. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
 2. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
 3. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
 4. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

3.4 CLEANING AND PROTECTION

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and

touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

- B. Protect installed acoustical panel ceilings until completion of project.

END OF SECTION 095113

SECTION 096430 - WOOD STAGE FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes, but is not limited to, field-finished wood stage flooring.
- B. Related Sections include, but are not limited to:
 - 1. Division 06 Section "Rough Carpentry" for sleepers and underlayment.
 - 2. Division 06 Section "Finish Carpentry" for finish wood trim.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. For wood flooring installation adhesives, printed statement of VOC content.
 - 2. For field-applied finishes for wood flooring, printed statement of VOC content.
- B. Samples for Verification: For each type of wood flooring and accessory, approximately 12 inches long and of same thickness and material indicated for the Work and showing the full range of normal grain variations expected.

1.4 MATERIALS MAINTENANCE SUBMITTALS

- A. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Wood Flooring: Equal to three percent (3%) of amount installed for each type of wood flooring indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver wood flooring materials in unopened cartons or bundles.
- B. Protect wood flooring from exposure to moisture. Do not deliver wood flooring until after concrete, masonry, plaster, ceramic tile, and similar wet work is complete and dry.
- C. Store wood flooring materials in a dry, warm, ventilated, weathertight location.

1.6 PROJECT CONDITIONS

- A. Conditioning period begins not less than seven days before wood flooring installation, is continuous through installation, and continues not less than seven days after wood flooring installation.
 - 1. Environmental Conditioning: Maintain an ambient temperature between 65 and 75 deg F and relative humidity per museum standards in spaces to receive wood flooring during the conditioning period.
 - 2. Wood Flooring Conditioning: Move wood flooring into spaces where it will be installed, no later than the beginning of the conditioning period.

- a. Do not install flooring until it adjusts to relative humidity of, and is at same temperature as, space where it is to be installed.
 - b. Open sealed packages to allow wood flooring to acclimatize immediately on moving flooring into spaces in which it will be installed.
- B. After conditioning period, maintain relative humidity and ambient temperature planned for building occupants.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. FloorScore Compliance: Wood floors shall comply with requirements of FloorScore Standard.
- B. Low-Emitting Materials: Wood flooring systems shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.2 FIELD-FINISHED WOOD FLOORING

- A. Solid-Wood Flooring: Kiln dried to six to nine percent (6% to 9%) maximum moisture content, tongue and groove and end matched, and with backs channeled.
 - 1. Species and Grade: Southern Yellow Pine.
 - 2. Cut: Vertical grain (No flat sawn or mixed grain to be used).
 - 3. Thickness: 3/4 inch.
 - 4. Face Width: 2-1/4 inches minimum, 3-1/2 inches maximum.
 - 5. Lengths: Random-length strips.
- B. Urethane Finish System: Complete solvent-based, oil-modified system of compatible components that is recommended by finish manufacturer for application indicated.
 - 1. VOC Content: When calculated according to 40 CFR 59, Subpart D (EPA Method 24), as follows:
 - a. Finish Coats and Sealers: Not more than 350 g/L.
 - b. Stains: Not more than 250 g/L.
 - 2. Finish system materials shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
 - 3. Stain: Penetrating and nonfading type. Provide color as selected by Architect from manufacturer's full range of available colors; dark or black color is anticipated.
 - 4. Floor Sealer: Pliable, penetrating type.
 - 5. Finish Coats: Formulated for multicoat application on wood flooring.
- C. Wood Filler: Compatible with finish system components and recommended by filler and finish manufacturers for use indicated. If required to match approved Samples, provide pigmented filler.

2.3 ACCESSORY MATERIALS

- A. Plywood Underlayment: As specified in Division 06 Section "Rough Carpentry."
 - 1. CDX Plywood, APA-rated exterior grade Fir on SYP.
 - 2. Tongue-and-groove edges.
- B. Vapor Retarder: ASTM D 4397, polyethylene sheet not less than 8.0 mils thick.

- C. Asphalt-Saturated Felt: ASTM D 4869, Type II.
- D. Wood Flooring Adhesive: Mastic recommended by flooring and adhesive manufacturers for application indicated.
 - 1. Adhesive shall have a VOC content on not more than 100 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- E. Fasteners: As recommended by manufacturer, but not less than that recommended in NWFA's "Installation Guidelines: Wood Flooring."
 - 1. Subflooring Fastener: One-inch coated staples or equivalent.
 - 2. Flooring Fasteners: Two-inch barbed floor cleats or staples.
- F. Thresholds and Saddles: To match wood flooring. Tapered on each side.
- G. Reducer Strips: To match wood flooring. 2 inches wide, tapered, and in thickness required to match height of flooring.
- H. Cork Expansion Strip: Composition cork strip.
- I. Resilient Pads: With air voids for resiliency and installed at spacing indicated.
 - 1. Type: Molded rubber isolation pads.
 - 2. Nominal Size: 2 inch x 2 inch x 3/8 inch.
 - 3. Product: Mason "Mini Super W" pads.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas and conditions, with Installer present, for compliance with requirements for maximum moisture content, installation tolerances, and other conditions affecting performance of wood flooring.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove coatings, including curing compounds, and other substances on substrates that are incompatible with installation adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
- B. Broom or vacuum clean substrates to be covered immediately before product installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

- A. Comply with flooring manufacturer's written installation instructions, but not less than applicable recommendations in NWFA's "Installation Guidelines: Wood Flooring."
- B. Wood Subfloor and Underlayment: Install according to requirements in Division 06 Section "Rough Carpentry."

- C. Install resilient pads under subflooring with adhesive.
- D. Provide expansion space at walls and other obstructions and terminations of flooring of not less than 3/4 inch.
- E. Vapor Retarder: Comply with NOFMA's "Installing Hardwood Flooring" for vapor retarder installation and the following:
 - 1. Wood Flooring Nailed to Wood Subfloor: Install flooring over a layer of asphalt-saturated felt.
- F. Solid-Wood Flooring: Blind nail or staple flooring to substrate.

3.4 FIELD FINISHING

- A. Machine-sand flooring to remove offsets, ridges, cups, and sanding-machine marks that would be noticeable after finishing. Vacuum and tack with a clean cloth immediately before applying finish.
 - 1. Comply with applicable recommendations in NWFAs "Installation Guidelines: Wood Flooring."
- B. Fill and repair wood flooring seams and defects.
- C. Apply floor-finish materials in number of coats recommended by finish manufacturer for application indicated, but not less than one (1) coat of floor sealer and three (3) finish coats.
 - 1. Apply stains to achieve an even color distribution matching approved Samples.
- D. Cover wood flooring before finishing.
- E. Do not cover wood flooring after finishing until finish reaches full cure, and not before seven days after applying last finish coat.

3.5 PROTECTION

- A. Protect installed wood flooring during remainder of construction period with covering of heavy kraft paper or other suitable material. Do not use plastic sheet or film that might cause condensation.
 - 1. Do not move heavy and sharp objects directly over kraft-paper-covered wood flooring. Protect flooring with plywood or hardboard panels to prevent damage from storing or moving objects over flooring.

END OF SECTION 096430

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes, but is not limited to:
 - 1. Resilient base.
 - 2. Resilient molding accessories.
- B. Related Sections include, but are not limited to:
 - 1. Division 09 Section "Resilient Tile Flooring."

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Product Data for Adhesives: Documentation including printed statement of VOC content.
 - 2. Laboratory Test Reports for Adhesives: Documentation indicating that products comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. Samples: For each exposed product and for each color and texture specified, not less than 12 inches long.
- C. Product Schedule: For resilient base and accessory products.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.6 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following time periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.

- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. FloorScore Compliance: Resilient base shall comply with requirements of FloorScore certification.

2.2 VINYL BASE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Armstrong World Industries, Inc.
 - 2. Burke Mercer Flooring Products, Division of Burke Industries Inc.
 - 3. Flexco.
 - 4. Johnsonite; A Tarkett Company.
 - 5. Roppe Corporation, USA.
 - 6. VPI, LLC, Floor Products Division.
- B. Product Standard: ASTM F 1861, Type TV (vinyl, thermoplastic).
 - 1. Group: I (solid, homogeneous).
 - 2. Style and Location: Style B, Cove. Provide in areas with resilient flooring or other hard surface finish material.
- C. Minimum Thickness: 0.125 inch.
- D. Height: 4 inches.
- E. Lengths: Coils in manufacturer's standard length.
- F. Outside Corners: Preformed.
- G. Inside Corners: Job Formed or Preformed.
- H. Colors: As selected by Architect from manufacturer's full range of available solid colors.

2.3 CONTOURED RUBBER BASE

- A. Basis of Design Product: Johnsonite Millwork® Reveal® MW-XX-F6.
 - 1. Profile: 45-degree angled top and continuous 7/32" horizontal reveal.
- B. Product Standard: ASTM F 1861, Type TP
 - 1. Group: 1
 - 2. Style: A, Straight.
- C. Minimum Thickness: 0.25 inch.
- D. Height: 6 inches.
- E. Length: 8 feet.

- F. Inside and Outside Corners: Job Formed (mitered).
- G. Color: As selected by Architect from manufacturer's full range of available solid colors.

2.4 RESILIENT MOLDING ACCESSORIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Armstrong World Industries, Inc.
 - 2. Burke Mercer Flooring Products, Division of Burke Industries Inc.
 - 3. Flexco.
 - 4. Johnsonite; A Tarkett Company.
 - 5. Musson Rubber Company.
 - 6. Roppe Corporation, USA.
 - 7. VP1, LLC, Floor Products Division.
- B. Description: Vinyl or rubber accessories for the following applications:
 - 1. Reducer strip for resilient flooring
 - 2. Transition strips.
- C. Profile and Dimensions: As selected by Architect from manufacturer's full range of available profiles.
- D. Colors and Patterns: As selected by Architect from manufacturer's full range of available colors.

2.5 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, Portland cement based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.
 - 1. Adhesives shall comply with the following limit for VOC content: 60 g/L or less.
 - 2. Adhesives shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- C. Do not install resilient products until they are the same temperature as the space where they are to be installed.
 - 1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.
- D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- G. Preformed Corners: Install preformed corners before installing straight pieces.
- H. Job-Formed Inside Corners (Vinyl Base): Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length. Cope corners to minimize open joints.

3.4 RESILIENT ACCESSORY INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient accessories.
- B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.
- B. Perform the following operations immediately after completing resilient-product installation:
 - 1. Remove adhesive and other blemishes from exposed surfaces.
 - 2. Sweep and vacuum horizontal surfaces thoroughly.
 - 3. Damp-mop horizontal surfaces to remove marks and soil.

- C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 096513

SECTION 096519 - RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes, but is not limited to:
 - 1. Rubber floor tile.
 - 2. Rubber stair treads.
 - 3. Vinyl composition floor tile.
- B. Related Sections includes, but are not limited to:
 - 1. Division 09 Section "Resilient Base and Accessories."

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Product Data for Adhesives: Documentation including printed statement of VOC content.
 - 2. Laboratory Test Reports for Adhesives: Documentation indicating that products comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. Samples for Initial Selection: For each type of floor tile indicated.
- C. Samples for Verification: Full-size units of each color and pattern of floor tile required.
- D. Product Schedule: For floor tile. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Floor Tile: Furnish one box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store floor tiles on flat surfaces.

1.9 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive floor tile during the following time periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Close spaces to traffic during floor tile installation.
- D. Close spaces to traffic for 48 hours after floor tile installation.
- E. Install floor tile after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For resilient tile flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
 - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.
- B. FloorScore Compliance: Resilient tile flooring shall comply with requirements of FloorScore certification.
- C. Low-Emitting Materials: Flooring system shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.2 RAISED PROFILE RUBBER FLOOR TILE AND STAIR TREADS (RT-1)

- A. Manufacturer: Subject to compliance with requirements, provide products by one of the following:
 - 1. Burke Mercer Flooring Products, Division of Burke Industries Inc.
 - 2. Flexco.
 - 3. Johnsonite; A Tarkett Company.
 - 4. Mannington Mills, Inc.
 - 5. Mondo Rubber International, Inc.
 - 6. Nora Rubber Flooring, Freudenberg Building Systems, Inc.

- 7. Roppe Corporation, USA.
 - B. Basis of Design Products:
 - 1. Rubber Floor Tile: Roppe Rubber Tile, Raised Design, Profile 992.
 - 2. Rubber Stair Treads: Roppe Raised Design Treads, Profile 92.
 - C. Tile Standard: ASTM F 1344, Class I-A, homogeneous rubber tile, solid color.
 - D. Hardness: Manufacturer's standard hardness, measured using Shore, Type A durometer per ASTM D 2240.
 - E. Wearing Surface: Molded pattern.
 - 1. Molded-Pattern Figure: Raised discs.
 - F. Thickness: 0.125 inch.
 - G. Size: 24 by 24 inches.
 - H. Colors and Patterns: As selected by Architect from full range of industry colors.
- 2.3 RECYCLED RUBBER FLOORING (RT-2)
- A. Basis of Design: ECOsurfaces Commercial Flooring as manufactured by ECORE International.
 - B. Composition: Rubber floor tile shall be manufactured from recycled rubber and colored EPDM flecks.
 - C. Wearing Surface: Smooth.
 - D. Thickness: 1/4 inch.
 - E. Size: 24 inches x 24 inches.
 - F. Coating: Factory-applied, water-based polymeric maintenance coating ("ECOguard").
 - G. Color and Patterns: Multiple colors as selected by Architect from full range of manufacturer's available colors and patterns.
- 2.4 VINYL COMPOSITION FLOOR TILE
- A. Manufacturer: Subject to compliance with requirements, provide products by one of the following:
 - 1. Armstrong World Industries, Inc.
 - 2. Congoleum Corporation.
 - 3. Mannington Mills, Inc.
 - B. Basis of Design Product: Armstrong Imperial Texture Standard Excelon.
 - C. Tile Standard: ASTM F 1066, Class 2, through-pattern tile.
 - D. Wearing Surface: Smooth.
 - E. Thickness: 0.125 inch.
 - F. Size: 12 by 12 inches.

- G. Colors and Patterns: Multiple colors as selected by Architect from full range of industry colors.

2.5 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, Portland cement based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.
 - 1. Adhesives shall comply with the following limits for VOC content:
 - a. Vinyl Composition Tile Adhesives: 50 g/L or less.
 - b. Rubber Floor Adhesives: 60 g/L or less.
 - 2. Adhesives shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates: Prepare according to ASTM F 710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
 - 3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
 - 4. Moisture Testing: Proceed with installation only after substrates pass testing according to floor tile manufacturer's written recommendations, but not less stringent than the following:
 - a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
 - b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

- D. Do not install floor tiles until they are the same temperature as the space where they are to be installed.
 - 1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.
- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.3 FLOOR TILE INSTALLATION

- A. Comply with manufacturer's written instructions for installing floor tile.
- B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
 - 1. Lay tiles square with room axis.
- C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
- D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.
- G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.
- H. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.
- B. Perform the following operations immediately after completing floor tile installation:
 - 1. Remove adhesive and other blemishes from exposed surfaces.
 - 2. Sweep and vacuum surfaces thoroughly.
 - 3. Damp-mop surfaces to remove marks and soil.
- C. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Cover floor tile until Substantial Completion.

END OF SECTION 096519

SECTION 096723 - RESINOUS FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes, but is not limited to:
 - 1. Solid color polyurethane mortar resinous flooring for commercial kitchen environment.
 - 2. Multi-color polyurethane mortar resinous flooring for public corridors.
- B. Related Sections include, but are not limited to:
 - 1. Division 03 Section "Cast-in-Place Concrete for new concrete floor slab construction.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Product Data for Adhesives: Documentation including printed statement of VOC content.
 - 2. Product Data for Resinous Flooring Components: Documentation including printed statement of VOC content.
 - 3. Laboratory Test Reports for Flooring System: Documentation indicating that products comply with California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. Samples for Initial Selection: Manufacturer's color charts showing colors and glosses available for flooring and game-line and marker paints.
- C. Samples for Verification: For each color, gloss, and texture of flooring required, 12 inches square, applied to a rigid backing.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For fluid-applied athletic flooring to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An Installer (Applicator) who is approved, trained, or certified by flooring manufacturer.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Comply with flooring manufacturer's written instructions for substrate temperature, ambient temperature, humidity, ventilation, and other conditions affecting flooring application.

1. Do not apply flooring until spaces are enclosed and weatherproof; wet work in spaces is complete and dry; and overhead work, including installing mechanical systems and lighting is complete.
2. Maintain temperatures during installation within range recommended in writing by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive flooring 48 hours before installation, during installation, and 48 hours after installation unless longer period is recommended in writing by manufacturer.
3. After installation period, maintain temperatures within range recommended in writing by manufacturer, but not less than 55 deg F or more than 95 deg F.
4. Close spaces to traffic during flooring installation.

1.8 COORDINATION

- A. Coordinate layout and installation of kitchen flooring with floor inserts for floor drain, grease interceptor, and similar items.

PART 2 - PRODUCTS

2.1 SOLID COLOR RESINOUS FLOORING (RF-1)

- A. Basis of Design Product: Stonhard "StonClad® UT".
- B. Description: Dense, liquid-rich, self-priming, textured, four-component, notch travel applied, polyurethane mortar system consisting of a urethane-urea binder, pigments, and graded quartz aggregates.
 1. Nominal Thickness: 1/4-inch
- C. Physical Characteristics:
 1. Compressive Strength: 7,700 psi after 7 days per ASTM C-579
 2. Tensile Strength: 1,000 psi per ASTM C-307.
 3. Flexural Strength: 2,400 psi per ASTM C-580.
 4. Flexural Modulus of Elasticity: 2.6×10^6 psi per ASTM C-580.
 5. Hardness: 80 to 84 Shore D per ASTM D-2240.
 6. Impact Resistance: >160 in-lbs per ASTM D-2794.
 7. Abrasion Resistance: 0.05 gm per ASTM D-4060, CS-17.
 8. Coefficient of Friction: >1 (dry) per ASTM F-1679.
 9. Slip Resistance Index: >1 (wet) per ASTM F-1679, F-2508.
 10. Flammability: Class I, per ASTM E-648.
 11. Water Absorption: < 1% per ASTM C-413.
- D. Performance:
 1. Low-Emitting Materials: Products shall comply with the following limits for VOC content when calculated according to ASTM D-2369, Method E:
 - a. Mortar: VOC content of not more than 5 g/L.
 - b. Sealer: VOC content of not more than 200 g/L.
 2. Low-Emitting Materials: Flooring system shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- E. Materials: Manufacturer's standard system components.
 1. Mortar: Mix of isocyanurate, polyol, and aggregate.
 2. Pigment: Powdered pigment.
 3. Broadcast Aggregate: Colored quartz.
 4. Sealer: Mix of isocyanurate and polyol.

- F. Finishes:
 1. Color: Single Color as selected by Architect from manufacturer's full range of available colors.
 2. Surface Texture: Manufacturer's standard medium texture.

2.2 MULTI-COLOR RESINOUS FLOORING (RF-2)

- A. Basis of Design Product: Stonhard "StonTec® TRF".
- B. Description: Nominal 3/16-inch thick durable floor system with a decorative, stain-resistant surface consisting of a troweled base and color flake broadcast layer.
- C. Physical Characteristics.
 1. Compressive Strength: 5,000 psi after 7 days per ASTM C-579
 2. Tensile Strength: 1,000 psi per ASTM D-638.
 3. Flexural Strength: 2,000 psi per ASTM C-580.
 4. Flexural Modulus of Elasticity: 1.1×10^6 psi per ASTM D-790.
 5. Hardness: 80 Shore D per ASTM D-2240.
 6. Impact Resistance: >160 in-lbs per ASTM D-4226.
 7. Abrasion Resistance: < 0.03 gm maximum per ASTM D-4060, CS-17.
 8. Coefficient of Friction: 0.79 (dry) per ASTM F-1679.
 9. Slip Resistance Index: 0.65 (wet) per ASTM F-1679, F-2508.
 10. Flammability: Class I, per ASTM E-648.
- D. Performance:
 1. Low-Emitting Materials: Products shall comply with the following limits for VOC content when calculated according to ASTM D-2369 Method E:
 - a. Urethane Mortar: VOC content of not more than 5 g/L.
 - b. Undercoat: VOC content of not more than 30 g/L.
 - c. Sealer: VOC content of not more than 100 g/L.
 2. Low-Emitting Materials: Flooring system shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- E. Materials: Manufacturer's standard system components:
 1. Urethane Mortar: Four-component, troweled high solids urethane mortar system applied at 1/8-inch thickness.
 2. Undercoat: Two-component, high solids epoxy colored bonding coat that accepts flakes.
 3. Flakes: Brightly colored flakes.
 4. Sealer: Two-component, UV-resistant, aliphatic polyaspartic urethane sealer.
- F. Color and Texture: As selected by Architect from manufacturer's full range of available colors and textures.

2.3 ACCESSORIES

- A. Trowelable Leveling and Patching Compound: Latex-modified, hydraulic-cement-based formulation approved by flooring manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Concrete Substrates: Prepare substrates according to manufacturer's written instructions to ensure adhesion of flooring.
 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners. Remove contaminants using mechanical means.
 2. Alkalinity Testing: Perform pH testing according to ASTM F 710. Proceed with installation only if pH readings are not less than 7.0 and not greater than 8.5.
 3. Moisture Testing:
 - a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
 - 1) Perform tests so that each test area does not exceed 200 sq. ft., and perform not less than two (2) tests in each installation area and with test areas evenly spaced in installation areas.
 - b. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
- B. Remove substrate coatings and other substances that are incompatible with flooring and that contain soap, wax, oil, or silicone, using mechanical methods recommended in writing by manufacturer. Do not use solvents.
- C. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.
- D. Treat nonmoving substrate cracks and control joints to prevent cracks from telegraphing (reflecting) through flooring according to manufacturer's written instructions.
- E. Protect substrate voids and joints to prevent flooring resins from flowing into or leaking through them.
- F. Move flooring and installation materials into spaces where they will be installed at least 48 hours in advance of installation unless manufacturer recommends a longer period in writing.
 1. Do not install flooring until it is same temperature as space where it is to be installed.
- G. Sweep and vacuum clean substrates to be covered by flooring immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust.
- H. Proceed with installation only after unsatisfactory conditions have been corrected.
- I. Protect walls, floor openings, athletic equipment inserts, electrical openings, door frames, and other obstructions during installation. Cover floor and wall areas at mixing stations.

3.3 FLOORING INSTALLATION, GENERAL

- A. General: Mix and apply flooring components according to manufacturer's written instructions.
 1. At substrate expansion, isolation, and other moving joints, install continuous joint of same width through flooring.
- B. Apply primer over prepared substrate at manufacturer's recommended spreading rate.

- C. Apply body coat(s) and topcoat to produce a uniform, level surface and finish.

3.4 PROTECTION

- A. Close spaces to traffic for 96 hours after flooring installation unless manufacturer recommends longer period in writing.
- B. Protect flooring from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.
 - 1. Do not move heavy and sharp objects directly over flooring. Protect flooring with plywood or hardboard panels to prevent damage from storing or moving objects over flooring.

END OF SECTION 096723

SECTION 097700 – FIBERGLASS REINFORCED PLASTIC PANELING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes, but is not limited to, interior Fiberglass reinforced plastic (FRP) paneling for wall surfaces, including trim accessories.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product, include the following
 1. Preparation instructions and recommendations.
 2. Storage and handling requirements and recommendations.
 3. Installation methods.
- B. Samples: For plastic paneling and trim accessories, in manufacturer's standard sizes.

1.4 INFORMATION SUBMITTAL

- A. Manufacturer's Material Safety Data Sheets (MSDS): For adhesives and sealants, prior to their delivery to site.

1.5 QUALITY ASSURANCE

- A. Testing Agency: FM Approvals.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install plastic paneling until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.7 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For installed products including maintenance methods and precautions against cleaning materials and methods detrimental to finishes and performance.
- B. Warranty: Warranty documents required in this section.
- C. Extra Materials: Deliver to Owner extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels. Comply with Division 01 Section "Project Closeout".
 1. Quantity: Furnish quantity of units equal to five percent (5%) of amount installed.
 2. Delivery, Storage and Protection: Comply with Owner's requirements for delivery, storage and protection of extra materials.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace FRP panels that fail within specified warranty period.
 - 1. Failures shall include, but not be limited to, substantial defects in material and workmanship, rotting, rusting, corrosion, development of structural surface cracks, or requiring painting or refinishing.
 - 2. Warranty Period: Ten years from date of Substantial Completion.
- B. Special Warranty: Installer's standard form in which installer agrees to repair or replace FRP panels that fail due to poor workmanship or faulty installation within the specified warranty period.
 - 1. Warranty Period: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain plastic paneling and trim accessories from single manufacturer.

2.2 PLASTIC SHEET PANELING

- A. Glass-Fiber-Reinforced Plastic Paneling: Gelcoat-finished, glass-fiber-reinforced plastic panels complying with ASTM D 5319. Panels shall be USDA accepted for incidental food contact.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Composites, Inc.
 - b. Glasteel.
 - c. Marlite.
 - d. Parkland Plastics, Inc.
 - 2. Surface-Burning Characteristics: As follows when tested by a qualified testing agency according to ASTM E 84. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 450 or less.
 - 3. Nominal Thickness: Not less than 0.09 inch.
 - 4. Surface Finish: Molded pebble texture.
 - 5. Color: As selected by Architect from manufacturer's full range of available colors.
 - 6. Wall Panel Size: 4 feet wide by height required to cover entire wall surface without horizontal joints or seams,
 - 7. Tolerance:
 - a. Length and Width: +/- 1/8 inch maximum.
 - b. Square: not to exceed 1/8 inch for 8-foot panels or 5/32 inch for 10-foot panels.
- B. Properties:
 - 1. Flexural Strength: 1.0×10^4 psi per ASTM D 790.
 - 2. Flexural Modulus: 3.1×10^5 psi per ASTM D 790.
 - 3. Tensile Strength: 7.0×10^3 psi per ASTM D 638
 - 4. Tensile Modulus: 1.6×10^5 psi per ASTM D 638
 - 5. Water Absorption: 0.72% per ASTM D 570.
 - 6. Barcol Hardness (scratch resistance) of .55 as per ASTM D 2583.
 - 7. Izod Impact Strength of 72 ft. lbs./in. ASTM D 256.

2.3 ACCESSORIES

- A. Trim Accessories: Manufacturer's standard one-piece vinyl extrusions designed to retain and cover edges of panels. Provide division bars, inside corners, outside corners, and caps as needed to conceal edges.
 - 1. Color: Match panels.
- B. Exposed Fasteners: Nylon drive rivets recommended by panel manufacturer.
- C. Adhesive: As recommended by plastic paneling manufacturer.
- D. Sealant: One of the following, as recommended by plastic paneling manufacturer:
 - 1. Mildew-resistant, single-component, neutral-curing silicone.
 - 2. Mildew-resistant, single-component, acid-curing silicone.
 - 3. Latex sealant complying with requirements in Division 07 Section "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrate by sanding high spots and filling low spots as needed to provide flat, even surface for panel installation.
- B. Clean substrates of substances that could impair adhesive bond, including oil, grease, dirt, and dust.
- C. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.
- D. Lay out paneling before installing. Locate panel joints so that trimmed panels at corners are not less than 12 inches wide.
 - 1. Mark plumb lines on substrate at panel joint locations for accurate installation.
 - 2. Locate trim accessories and panel joints to allow clearance at panel edges according to manufacturer's written instructions.

3.3 INSTALLATION

- A. Install plastic paneling to board substrate, above base, according to manufacturer's written instructions. Apply panels vertically oriented with seams plumb. Install panels with manufacturer's recommended gap for panel field and corner joints.
- B. Install panels in a full spread of adhesive.
- C. Install panels with fasteners. Layout fastener locations and mark on face of panels so that fasteners are accurately aligned.
 - 1. Drill oversized fastener holes in panels and center fasteners in holes.
 - 2. Apply sealant to fastener holes before installing fasteners.

3. Drive fasteners for snug fit. Do not over-tighten.

D. Install trim accessories with adhesive. Do not fasten through panels.

E. Fill grooves in trim accessories with sealant before installing panels, and bed inside corner trim in a bead of sealant.

F. Maintain uniform space between panels and wall fixtures. Fill space with sealant.

G. Maintain uniform space between adjacent panels and between panels and floors, ceilings, and fixtures. Fill space with sealant.

3.4 CLEANING AND PROTECTION

A. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains. Do not use abrasive cleaners.

B. Protect installed product and finish surfaces from damage during construction.

END OF SECTION 097700

SECTION 098413 - ACOUSTICAL WALL PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes shop-fabricated, acoustical wall panels for the following applications:
 1. Continuous narrow bands of wall panels in Classroom and Conference Room spaces (between picture molding and the ceiling).
 2. Individual large format wall panels on the back wall of the Auditorium.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of facing, panel edge, core material, and mounting indicated.
 1. Product Data for Installation Adhesives: Documentation including printed statement of VOC content.
 2. Laboratory Test Reports for Installation Adhesives and Wall Panels: Documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. Shop Drawings: For acoustical wall panels. Include mounting devices and details at panel head, base, joints, and corners. Indicate panel edge and core materials.
 1. Include elevations showing panel sizes.
 2. Indicate required field measurements.
- C. Samples for Verification: For the following products, prepared on Samples of size indicated below:
 1. Panel Finish: Maximum 6" x 6".
 2. Panel Edge: 6-inch- long Sample(s) showing each edge profile, corner, and finish.
 3. Core Material: 6-inch- square Sample at corner.
 4. Mounting Devices: Full-size Samples.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of acoustical wall panel, from manufacturer.
- B. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For acoustical wall panels to include in maintenance manuals. Include manufacturers' written cleaning and stain-removal recommendations.

1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain acoustical wall panels from single source from single manufacturer.

- B. Fire-Test-Response Characteristics: Provide acoustical wall panels meeting the following as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - 1. Surface-Burning Characteristics: As determined by testing per ASTM E 84.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 450 or less.
 - 2. Fire Growth Contribution: Meeting acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 265 or NFPA 286.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Comply with wall panel manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.
- B. Deliver materials and panels in unopened bundles and store in a temperature-controlled dry place with adequate air circulation.
- C. Only handle panels wearing clean, lightweight, white gloves during installation.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install acoustical wall panels until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work at and above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Lighting: Do not install acoustical wall panels until a lighting level of not less than 50 fc is provided on surfaces to receive wall panels.
- C. Air-Quality Limitations: Protect wall panels from exposure to airborne odors such as tobacco smoke, and install panels under conditions free from odor contamination of ambient air.
- D. Field Measurements: Verify locations of acoustical wall panels and actual dimensions of openings, penetrations, and adjoining construction by field measurements prior to fabrication. Include field measurements in shop drawings

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of acoustical wall panels that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Finish sagging, distorting, or releasing from panel edge.
 - b. Warping of core.
 - 2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 ACOUSTICAL WALL PANELS

- A. Basis-of-Design Product: Acoustical Panel AP with Claro ® finish as manufactured by Decoustics Limited; a CertainTeed Ceilings company.
- B. General Requirements for Acoustical Wall Panels: Panels shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for

the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

- C. Acoustical Wall Panel: Manufacturer's standard panel construction consisting of finish coating applied to front face and edges.
 - 1. Mounting: Back mounted with manufacturer's standard metal clips or bar hangers, secured to substrate.
 - 2. Core: Manufacturer's standard medium density glass-fiber board.
 - 3. Finish: Coated finish specifically formulated to provide acoustical transparency and exhibit a flat painted gypsum board/plaster appearance.
 - 4. Edge Construction: Manufacturer's standard extruded-aluminum frame.
 - 5. Edge Profile: Square.
 - 6. Corner Detail in Elevation: Square.
 - 7. Nominal Core Thickness: 1 inch.
 - 8. Panel Width: As indicated on Drawings.
 - 9. Panel Heights:
 - a. For Continuous Boards in Classrooms: Nominal 12 inches high.
 - b. For Auditorium Rear Wall Panels: Nominal 88 inches high.

2.2 MATERIALS

- A. Glass-Fiber Board Core Material: ASTM C 612; Type standard with manufacturer; nominal density of 6 to 7 lb/cu. ft. , unfaced, and dimensionally stable, molded rigid board.
 - 1. Maximum Flame-Spread Index: 25.
 - 2. Maximum Smoke-Developed Index: 50.
- B. Mounting Devices: Concealed on back of panel, recommended by manufacturer to support weight of panel, and as follows:
 - 1. Adhesives: As recommended by fabric-wrapped, wall panel manufacturer and as follows:
 - a. VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - b. Comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
 - 2. Metal Clips or Bar Hangers: Manufacturer's standard two-part metal "Z" clips, with one part of each clip mechanically attached to back of panel and the other part to substrate, designed to permit unit removal.

2.3 FABRICATION

- A. General: Use manufacturer's standard construction except as otherwise indicated; with finish coating applied to face and edges of dimensionally stable core; and with rigid edges to reinforce panel perimeter against warpage and damage.
- B. Glass-Fiber Board Core: Chemically harden core edges and areas of core where mounting devices are attached.
- C. Noise Reduction Coefficient (NRC) Rating: Fabricate panels to achieve NRC of 0.85.
- D. Finish Coating: Factory apply finish coating covering visible surfaces of panel free from puckers, ripples, wrinkles, sags, blisters, seams, adhesive, or other visible distortions or foreign matter.
- E. Dimensional Tolerances of Finished Panels: Plus or minus 1/16 inch for the following:
 - 1. Thickness.

2. Edge straightness.
3. Overall length and width.
4. Squareness from corner to corner.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fabricated panels, substrates, areas, and conditions, for compliance with requirements, installation tolerances, and other conditions affecting performance of acoustical wall panels.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install acoustical wall panels in locations indicated with vertical surfaces and edges plumb, top edges level and in alignment with other panels, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.
- B. Comply with wall panel manufacturer's written instructions for installation of panels using type of mounting devices indicated. Mount panels securely to supporting substrate.

3.3 INSTALLATION TOLERANCES

- A. Variation from Plumb and Level: Plus or minus 1/16 inch.
- B. Variation of Panel Joints from Hairline: Not more than 1/16 inch wide.

3.4 CLEANING

- A. Clean panels on completion of installation to remove dust and other foreign materials according to manufacturer's written instructions.
- B. Protect installed wall panels from damage until Substantial Completion.

END OF SECTION 098413

SECTION 099113 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes surface preparation and the application of paint systems on the following new and previously coated existing exterior substrates:
 - 1. Concrete.
 - 2. Steel.
 - 3. Galvanized metal.
 - 4. Wood.
 - 5. Plastic trim fabrications.
- B. Related Requirements include, but are not limited to:
 - 1. Division 05 Sections "Structural Steel Framing" and "Metal Fabrications" for shop priming of metal substrates with primers specified in this Section.
 - 2. Division 09 Section "Interior Painting" for surface preparation and the application of paint systems on interior substrates.
 - 3. Division 09 Section "Elastomeric Coatings" for elastomeric coatings applied to exterior masonry substrates.

1.3 DEFINITIONS

- A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- D. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- E. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- F. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
- B. Samples for Verification: For each type of paint system and each color and gloss of topcoat.
 - 1. Submit Samples on rigid backing, 8 inches square.
 - 2. Step coats on Samples to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.

- C. Product List: For each product indicated, include the following:
 - 1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
 - 2. Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
 - 3. VOC content.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Paint: Five percent (5%), but not less than 1 gal. of each material and color applied.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Benjamin Moore & Co.
 - 2. Duron, Inc.
 - 3. ICI Paints.
 - 4. M.A.B. Paints.
 - 5. PPG Architectural Finishes, Inc.
 - 6. Pratt & Lambert.
 - 7. Sherwin-Williams Company (The).

2.2 PAINT, GENERAL

- A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."
- B. Material Compatibility:
 - 1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- C. VOC Content: Provide materials that comply with VOC limits of authorities having jurisdiction.

- D. Colors: As selected by Architect from manufacturer's full range of available colors.
 - 1. Up to ten percent (10%) of surface area may be painted with deep tones.

2.3 PRIMERS/SEALERS

- A. Primers
 - 1. Primer, Bonding, Water Based: MPI #17.
 - 2. Primer, Bonding, Solvent Based: MPI #69.
 - 3. Wood-Knot Sealer: Sealer recommended in writing by topcoat manufacturer for exterior use in paint system indicated.
- B. Metal Primers
 - 1. Primer, Alkyd, Anti-Corrosive for Metal: MPI #79.
 - 2. Primer, Alkyd, Quick Dry, for Metal: MPI #76.
 - 3. Primer, Galvanized: As recommended in writing by topcoat manufacturer.

2.4 WOOD PRIMERS

- A. Wood Primers:
 - 1. Primer, Alkyd for Exterior Wood: MPI #5.
 - 2. Primer, Oil for Exterior Wood: MPI #7.

2.5 WATER-BASED PAINTS

- A. Latex Paints
 - 1. Latex, Exterior Low Sheen (Gloss Level 3-4): MPI #15.

2.6 SOLVENT-BASED PAINTS

- A. Alkyd Paints
 - 1. Alkyd, Exterior, Semi-Gloss (Gloss Level 5): MPI #94.
 - 2. Alkyd, Quick Dry, Semi-Gloss (Gloss Level 5): MPI #81.

2.7 TEXTURED AND HIGH-BUILD COATINGS

- A. Textured Coating
 - 1. Primer for Textured Coating, Latex, Flat: As recommended in writing by topcoat manufacturer.
 - 2. Intermediate Coat for Textured Coating, Latex, Flat: As recommended in writing by topcoat manufacturer.
 - 3. Textured Coating, Latex, Flat: MPI #42.

2.8 SOURCE QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
 - 1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
 - 2. Testing agency will perform tests for compliance with product requirements.
 - 3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from

previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Concrete: 12 percent.
 - 2. Wood: 15 percent.
- C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- D. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.
- F. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer but not less than SSPC-SP 3, "Power Tool Cleaning."
- G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

- H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- I. Wood Substrates:
 - 1. Scrape and clean knots. Before applying primer, apply coat of knot sealer recommended in writing by topcoat manufacturer for exterior use in paint system indicated.
 - 2. Sand surfaces that will be exposed to view, and dust off.
 - 3. Prime edges, ends, faces, undersides, and backsides of wood.
 - 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.
- J. Plastic Trim Fabrication Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Manual."
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
 - 3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
 - 4. Paint entire exposed surface of window frames and sashes.
 - 5. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 6. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work: Paint the following work where exposed to view:
 - 1. Equipment, including panelboards and switch gear.
 - 2. Uninsulated metal piping.
 - 3. Uninsulated plastic piping.
 - 4. Pipe hangers and supports.
 - 5. Metal conduit.
 - 6. Plastic conduit.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
 - 1. Contractor shall touch up and restore painted surfaces damaged by testing.

2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 EXTERIOR PAINTING SCHEDULE

- A. Concrete Substrates, Nontraffic Surfaces: One of the following:
 1. Latex Aggregate/Latex System:
 - a. Prime Coat: Textured coating, latex, flat, MPI #42.
 - b. Intermediate Coat: Latex, exterior, matching topcoat.
 - c. Topcoat: Latex, exterior, low sheen (Gloss Level 3-4), MPI #15.
 2. Latex Aggregate System:
 - a. Prime Coat: As recommended in writing by topcoat manufacturer.
 - b. Intermediate Coat: As recommended in writing by topcoat manufacturer.
 - c. Topcoat: Textured coating, latex, flat, MPI #42.
- B. Steel Substrates: One of the following:
 1. Alkyd System:
 - a. Prime Coat: Primer, alkyd, anticorrosive for metal, MPI #79 or Shop primer specified in Section where substrate is specified.
 - b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
 - c. Topcoat: Alkyd, exterior, semi-gloss (Gloss Level 5), MPI #94.
 2. Quick-Drying Enamel System:
 - a. Prime Coat: Primer, alkyd, quick dry, for metal, MPI #76.
 - b. Intermediate Coat: Alkyd, quick dry, matching topcoat.
 - c. Topcoat: Alkyd, quick dry, semi-gloss (Gloss Level 5), MPI #81.
- C. Galvanized-Metal Substrates:
 1. Alkyd System:
 - a. Prime Coat: Primer, galvanized metal, as recommended in writing by topcoat manufacturer for exterior use on galvanized-metal substrates with topcoat indicated.
 - b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
 - c. Topcoat: Alkyd, exterior, semi-gloss (Gloss Level 5), MPI #94.
- D. Wood Substrates: Including wood trim, doors, and windows.
 1. Alkyd System:
 - a. Prime Coat: Primer, alkyd for exterior wood, MPI #5, and oil for exterior wood, MPI #7.

- b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
- c. Topcoat: Alkyd, exterior, semi-gloss (Gloss Level 5), MPI #94.

E. Plastic Trim Fabrication Substrates:

- 1. Alkyd System:
 - a. Prime Coat: Primer, bonding, water based, MPI #17, or solvent based, MPI #69.
 - b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
 - c. Topcoat: Alkyd, exterior, semi-gloss (Gloss Level 5), MPI #94.

END OF SECTION 099113

SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes, but is not limited to, surface preparation and the application of paint systems on the following new and previously coated existing interior substrates:
 - 1. Concrete.
 - 2. Concrete masonry units (CMU).
 - 3. Steel.
 - 4. Cast iron.
 - 5. Galvanized metal.
 - 6. Aluminum (not anodized or otherwise coated).
 - 7. Wood.
 - 8. Gypsum board.
 - 9. Plaster.
 - 10. Cotton or canvas insulation covering.
 - 11. ASJ insulation covering.
- B. Related Requirements include, but are not limited to:
 - 1. Division 05 Section "Structural Steel Framing" for shop priming of metal substrates with primers specified in this Section.
 - 2. Division 09 Section "Exterior Painting" for surface preparation and the application of paint systems on exterior substrates.

1.3 DEFINITIONS

- A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- D. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- E. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- F. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- G. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
 - 1. Provide documentation that paints and coatings meet the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. Product List: For each product indicated, include the following:
 - 1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
 - 2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.
 - 3. VOC content.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Paint: Five percent (5%), but not less than 1 gal. of each material and color applied.

1.6 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft.
 - b. Other Items: Architect will designate items or areas required.
 - 2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.8 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Benjamin Moore & Co.
 2. Duron, Inc.
 3. ICI Paints.
 4. M.A.B. Paints.
 5. PPG Architectural Finishes, Inc.
 6. Pratt & Lambert.
 7. Sherwin-Williams Company (The).

2.2 PAINT, GENERAL

- A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."
- B. Material Compatibility:
1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- C. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction and, for interior paints and coatings applied at Project Site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to CFR 59, Subpart D (EPA Method 24):
- | | |
|---|----------|
| 1. Flat Paints and Coatings: | 50 g/L. |
| 2. Nonflat Paints and Coatings: | 150 g/L. |
| 3. Dry-Fog Coatings: | 400 g/L. |
| 4. Primers, Sealers, and Undercoaters: | 200 g/L. |
| 5. Anticorrosive and Antirust Paints Applied to Ferrous Metals: | 250 g/L. |
| 6. Zinc-Rich Industrial Maintenance Primers: | 340 g/L. |
| 7. Pretreatment Wash Primers: | 420 g/L. |
- D. Low-Emitting Materials: Interior paints and coatings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- E. Colors: As selected by Architect from manufacturer's full range of available colors.
1. Up to fifteen percent (15%) of surface area may be painted with deep tones.

2.3 BLOCK FILLERS

- A. Block Filler, Latex, Interior/Exterior: MPI #4.

2.4 PRIMERS/SEALERS

- A. Primer Sealer, Interior, Institutional Low Odor VOC: MPI #149.
- B. Primer, Latex, for Interior Wood: MPI #39.
- C. Primer, Bonding, Water Based: MPI #17.
- D. Primer, Bonding, Solvent Based: MPI #69.
- E. Wood-Knot Sealer: Sealer recommended in writing by topcoat manufacturer for use in paint systems indicated.

2.5 METAL PRIMERS

- A. Primer, Alkyd, Anti-Corrosive, for Metal: MPI #79.
- B. Primer, Alkyd, Quick Dry, for Metal: MPI #76.
- C. Primer, Galvanized, Water Based: MPI #134.
- D. Primer, Quick Dry, for Aluminum: MPI #95.

2.6 WATER-BASED PAINTS

- A. Latex, Interior, Institutional Low Odor/VOC, Flat (Gloss Level 1): MPI #143.
- B. Latex, Interior, Institutional Low Odor/VOC, Semi-Gloss (Gloss Level 5): MPI #147.

2.7 SOURCE QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
 - 1. Owner may engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
 - 2. Testing agency will perform tests for compliance with product requirements.
 - 3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Concrete: 12 percent.
 - 2. Masonry (Clay and CMU): 12 percent.
 - 3. Wood: 15 percent.
 - 4. Gypsum Board: 12 percent.
 - 5. Plaster: 12 percent.
- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- D. Plaster Substrates: Verify that plaster is fully cured.
- E. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- F. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceed that permitted in manufacturer's written instructions.
- F. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer.
- G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- I. Aluminum Substrates: Remove loose surface oxidation.

- J. Wood Substrates:
 - 1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
 - 2. Sand surfaces that will be exposed to view, and dust off.
 - 3. Prime edges, ends, faces, undersides, and backsides of wood.
 - 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.
- K. Cotton or Canvas Insulation Covering Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 - 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
 - 1. Paint the following work where exposed in equipment rooms:
 - a. Equipment, including panelboards.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Tanks that do not have factory-applied final finishes.
 - h. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - 2. Paint the following work where exposed in occupied spaces:
 - a. Equipment, including panelboards.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.

- g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - h. Other items as directed by Architect.
3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
- 1. Contractor shall touch up and restore painted surfaces damaged by testing.
 - 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

- A. Concrete Substrates, Nontraffic Surfaces: Latex System:
 - 1. Primer sealer, latex, interior low VOC, MPI #149.
 - 2. Latex, interior, matching topcoat.
 - 3. Topcoat: Latex, interior low VOC, semi-gloss, (Gloss Level 5), MPI #147.
- B. CMU Substrates: Latex System:
 - 1. Block Filler: Block filler, latex, interior/exterior, MPI #4.
 - 2. Intermediate Coat: Latex, interior, matching topcoat.
 - 3. Topcoat: Latex, interior low VOC, semi-gloss, (Gloss Level 5), MPI #147.
- C. Steel Substrates: Latex over Alkyd Primer System:
 - 1. Primer: Provide one of the following:
 - a. Primer, alkyd, anti-corrosive, for metal, MPI #79.
 - b. Primer, alkyd, quick dry, for metal, MPI #76.
 - c. Shop primer specified in Division 05 Section "Structural Steel Framing" where substrate is specified.
 - 2. Intermediate Coat: Latex, interior, matching topcoat.
 - 3. Topcoat: Latex, interior low VOC, semi-gloss, (Gloss Level 5), MPI #147.
- D. Galvanized-Metal Substrates: Latex over Waterborne Primer System:
 - 1. Prime Coat: Primer, galvanized, water based, MPI #134.
 - 2. Intermediate Coat: Latex, interior, matching topcoat.

3. Topcoat: Latex, interior low VOC, semi-gloss, (Gloss Level 5), MPI #147.
- E. Aluminum (Not Anodized or Otherwise Coated) Substrates: Latex System:
1. Prime Coat: Primer, quick dry, for aluminum, MPI #95.
 2. Intermediate Coat: Latex, interior, matching topcoat.
 3. Topcoat: Latex, interior low VOC, semi-gloss, (Gloss Level 5), MPI #147.
- F. Wood Substrates: Latex System:
1. Prime Coat: Primer, latex, for interior wood, MPI #39.
 2. Intermediate Coat: Latex, interior, matching topcoat.
 3. Topcoat: Latex, interior low VOC, semi-gloss, (Gloss Level 5), MPI #147.
- G. Fiberglass and Plastic Substrates: Latex System:
1. Prime Coat: Provide one of the following:
 - a. Primer, bonding, water based, MPI #17.
 - b. Primer, bonding, solvent based, MPI #69.
 2. Intermediate Coat: Latex, interior, matching topcoat.
 3. Topcoat: Latex, interior low VOC, semi-gloss, (Gloss Level 5), MPI #147.
- H. Gypsum Board and Plaster Substrates: Latex System:
1. Primer sealer, latex, interior low VOC, MPI #149.
 2. Latex, interior, matching topcoat.
 3. Intermediate Coat: Latex, interior, matching topcoat.
 4. Topcoat (for ceiling surfaces): Latex, interior low VOC, flat, (Gloss Level 1), MPI #143.
 5. Topcoat (for wall surfaces): Latex, interior low VOC, semi-gloss, (Gloss Level 5), MPI #147
- I. Cotton or Canvas and ASJ Insulation-Covering Substrates: Including pipe and duct coverings. Latex System:
1. Prime Coat: Primer sealer, latex, interior low VOC, MPI #149.
 2. Intermediate Coat: Latex, interior, matching topcoat.
 3. Topcoat: Latex, interior low VOC, semi-gloss, (Gloss Level 5), MPI #147.

END OF SECTION 099123

SECTION 099653 - ELASTOMERIC COATINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes surface preparation and application of elastomeric coatings to the following exterior substrates:
 1. Concrete unit masonry.
 2. Clay masonry.
 3. Existing painted clay masonry.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Initial Selection: For each type of elastomeric coating indicated.
- C. Product List: For each product indicated, including the following:
 1. Cross-reference to coating system and locations of application areas. Use same designations indicated on Drawings and in schedules.
 2. Manufacturer's recommended spreading rate for each separate coat, including primers and block fillers for each type of substrate as applicable.
 3. Printout of current "MPI Approved Products List" for each product category specified in Part 2 that specifies coatings approved by MPI, with the proposed product highlighted.

1.4 MATERIALS MAINTENANCE SUBMITTALS

- A. Furnish extra materials that are from same production run (batch mix) as materials applied and that are packaged for storage in unopened, factory-sealed containers and identified with labels describing contents.
 1. Quantity: Furnish an additional five percent (5%) but not less than 1 gal. of each material, color, and texture applied.

1.5 QUALITY ASSURANCE

- A. MPI Standards: Comply with MPI standards indicated and provide elastomeric coatings listed in the "MPI Approved Products List."
 1. Preparation and Workmanship: Comply with requirements in the "MPI Architectural Painting Specification Manual" for products and coating systems indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
 1. Maintain containers in clean condition, free of foreign materials and residue.
 2. Remove rags and waste from storage areas daily.

1.7 PROJECT CONDITIONS

- A. Apply coatings only when temperature of surfaces to be coated and ambient air temperatures are between 50 and 90 deg F unless otherwise permitted by manufacturer's written instructions.
- B. Do not apply coatings in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
- C. Allow wet surfaces to dry thoroughly and attain temperature and conditions specified before starting or continuing coating operation.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace elastomeric coatings that fail within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Water penetration through the coating.
 - b. Deterioration of coating beyond normal weathering.
 - 2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Material Compatibility:
 - 1. Provide elastomeric finish coatings and crack fillers, primers, and block fillers as applicable for use within elastomeric finish coatings that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each material or coat, provide products and spreading rates recommended in writing by elastomeric coating manufacturer for use on substrate indicated.

2.2 ELASTOMERIC FINISH COATINGS

- A. At the Contractor's option, provide either non-flat or flat waterborne, pigmented elastomeric coating.
- B. Exterior Non-Flat Waterborne, Pigmented Elastomeric Coating: MPI #38.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. BASF Building Systems; Thoro Thorolastic.
 - b. Benjamin Moore & Co.; Moorlastic.
 - c. Envirocoat Technologies Inc.; Envirocoat, Ceramic Insulcoat - Wall or Liquid Ceramic Exterior Wall Coat.
 - d. Euclid Tamms; Tamms Tammolastic.
 - e. Flex Bon Paints; Ext. 100% Acrylic Elastomeric Waterproof.
 - f. Frazee Paint & Wallcovering; EMC Elasto-Wall, Smooth Elastomeric Finish.
 - g. Kryton Canada Corporation; Kryton Wall Gard.
 - h. L & L Coatings Corporation; 300?Mastic (Brush, Roller, and Airless Spray Grade).
 - i. Modco Technology Ltd.; General Paint, Elastocoat.
 - j. Parker Paint Mfg. Co. Inc., a subsidiary of PPI; Ext. Acrylic Elastomeric.
 - 2. Surface Profile: Smooth or Fine texture.
 - 3. VOC Content: 100 g/L or less.
- C. Exterior Flat Waterborne, Pigmented Elastomeric Coating: MPI #113.
 - 1. Products: Subject to compliance with requirements, provide one of the following:

- a. BASF Building Systems; Sonneborn Colorflex.
 - b. Cloverdale Paint; Towerthon Elastomeric Coating or Towerthon Plus Elastomeric Coating.
 - c. Columbia Paint & Coatings; Hi Performance Flex Pro Elastomeric Coating or Elastech 100% Acry. Elastomeric Coating.
 - d. Coronado Paint Company; Elast-O-Meric Acrylic Membrane - 20 mil.
 - e. Diamond Vogel Paints; Permaflex Elastomeric Latex Coating.
 - f. Fox Industries, Inc.; FX-501 Elastomeric Coating.
 - g. ICI Paints; Decra-Flex Elastomeric Coating.
 - h. Kelly-Moore Paints; Kel-Seal Terpolymer 100% Acrylic Elastomeric.
 - i. Kwal Paint; Kwal Accu-Pro Elasto Wall.
 - j. L & L Coatings Corporation; 300 Mastic (Brush, Roller, and Airless Spray Grade).
 - k. M.A.B. Paints; Acra-Lastic Series or Motite Elastomeric Coating.
 - l. Miller Paint Co.; Milastic Elastomeric Coating.
 - m. Mills Paint; Weather Flex Elastomeric Coating.
 - n. Modco Technology Ltd.; Elastocoat Acrylic Elastomeric Paint.
 - o. Neogard, a division of Jones-Blair Company; Neoflex.
 - p. Pacific Polymers International, Inc.; Elasto-Tex Wallcoating or Elasto-Tex Wallcoating H.S..
 - q. Parker Paint Mfg. Co. Inc., a subsidiary of PPI; EMC Elastomeric Coating.
 - r. PPG Industries; Pitt-Flex Elastomeric Coating.
 - s. Pratt & Lambert; Pro-Hide Gold Ext. Elastomeric Coating.
 - t. Rodda Paint Co.; Super Roflex Acrylic Elastomeric Coating.
 - u. Sherwin-Williams Company (The); Sherlastic Elastomeric Coating.
 - v. Spectra-Tone Paint Corporation; Elasto-Coat High Build Waterproofing Coating.
 - w. Sto Corp.; Stolastic.
 - x. Teifs; Professional Coatings, TeifsLastic.
 - y. Tnemec Company, Inc.; Enviro-Crete Series.
 - z. Vista Paint; Solutex.
- 2. Surface Profile: Smooth or Fine texture.
 - 3. VOC Content: 100 g/L or less.

2.3 OTHER MATERIALS

- A. Crack Fillers: Elastomeric coating manufacturer's recommended, factory-formulated crack fillers or sealants, including crack filler primers, compatible with substrate and other materials indicated; VOC content complying with limits of authorities having jurisdiction.
- B. Primer: Elastomeric coating manufacturer's recommended, factory-formulated, alkali-resistant primer compatible with substrate and other materials indicated.
- C. Concrete Unit Masonry Block Filler: Elastomeric coating manufacturer's recommended, factory-formulated, high-performance latex block filler compatible with substrate and other materials indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with manufacturer's requirements for maximum moisture content, alkalinity, and other conditions affecting performance of work.
- B. Begin coating only when moisture content of substrate is 12 percent or less when measured with an electronic moisture meter.

- C. Begin coating no sooner than 28 days after substrate is constructed and is visually dry on both sides.
- D. Verify that substrate is within the range of alkalinity recommended by manufacturer.
- E. Verify suitability of substrates including surface conditions and compatibility with existing finishes and primers.
- F. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in the "MPI Architectural Painting Specification Manual" applicable to substrates and coating systems indicated.
- B. Remove hardware and hardware accessories, plates, machined surfaces, light fixtures, and similar items already installed that are not to be coated. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and coating.
 - 1. After completing coating operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of coatings, including dirt, oil, grease, and incompatible paints and encapsulants. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
 - 1. Remove incompatible primers and reprime substrate with compatible primers as required to produce coating systems indicated.
 - 2. Perform cleaning and coating application so dust and other contaminants from cleaning process will not fall on wet, newly coated surfaces.
- D. Crack Repair: Fill cracks according to manufacturer's written instructions before coating surfaces.

3.3 APPLICATION

- A. Apply elastomeric coatings according to manufacturer's written instructions.
 - 1. Use equipment and techniques best suited for substrate and type of material being applied.
 - 2. Coat surfaces behind movable items the same as similar exposed surfaces.
 - 3. Apply each coat separately according to manufacturer's written instructions.
- B. Primers: Apply at a rate to ensure complete coverage.
- C. Block Fillers: Apply at a rate to ensure complete coverage with pores filled.
- D. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats similar to color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- E. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform finish, color, and appearance.

- F. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- G. Apply coatings to prepared surfaces as soon as practicable after preparation and before subsequent surface soiling or deterioration.
- H. Spray Application: Use spray equipment for application only when permitted by authorities having jurisdiction. Wherever spray application is used, do not double back with spray equipment to build up film thickness of two coats in one pass.

3.4 FIELD QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following testing procedures:
 - 1. Owner may engage the services of a qualified testing agency to sample materials being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
 - 2. Testing agency will perform tests for compliance of materials with product requirements.
 - 3. Owner may direct Contractor to stop coating application if test results show materials being used do not comply with requirements. Remove noncomplying materials from Project site, pay for testing, and recoat surfaces that were coated with rejected materials. Remove rejected materials from previously coated surfaces if, on recoating with complying materials, the two coatings are incompatible.
- B. Field Testing and Inspection: Owner reserves the right to engage the services of a qualified testing agency to verify installed thickness of elastomeric coatings.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from coating application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities, touch up and restore damaged or defaced coated surfaces.

3.6 COATING SCHEDULE

- A. Concrete Unit Masonry Substrates:
 - 1. Primer: Concrete unit masonry primer if required by manufacturer.
 - 2. Block Filler: Concrete unit masonry block filler if required by manufacturer.
 - 3. Elastomeric Finish Coat(s): Minimum two coats with a total dry film thickness of 16 to 18 mils.
 - 4. Finish-Coat Color: As selected by Architect from manufacturer's full range of available colors.
- B. Clay Masonry Substrates:
 - 1. Primer: Clay masonry primer if required by manufacturer.

2. Elastomeric Finish Coat(s): Minimum two coats with a total dry film thickness of 16 to 18 mils.
 3. Finish-Coat Color: As selected by Architect from manufacturer's full range of available colors.
- C. Existing Painted Clay Masonry Substrates:
1. Primer: Clay masonry primer if required by manufacturer.
 2. Elastomeric Finish Coat(s): Minimum one coat with a total dry film thickness of 7 to 10 mils.
 3. Finish-Coat Color: As selected by Architect from manufacturer's full range of available colors.

END OF SECTION 099653

SECTION 101200 – DISPLAY CASES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes recessed display cases.
- B. Referenced Standards:
 - 1. ASTM E84.
 - 2. ASTM B221.

1.3 SUBMITTALS

- A. Shop Drawings: Provide shop drawings for each type of recessed display or trophy case required.
- B. Product Data: Provide technical data for materials specified. Include Material Safety Data Sheets, when applicable.
- C. Manufacturer's Instructions: Provide manufacturer's installation instructions.

1.4 OPERATION AND MAINTENANCE

- A. Include data on regular cleaning, stain removal, and precautions.

1.5 REGULATORY REQUIREMENTS

- A. Conform to applicable code for flame/smoke rating in tackboards in accordance with ASTM E84.

1.6 QUALITY ASSURANCE

- A. Manufacturer shall be a firm engaged in the manufacture of display cases in the United States.
- B. Manufacturer shall have a minimum of 5 years experience in the manufacture of display cases.

1.7 FIELD CONDITIONS

- A. Field measure prior to preparation of shop drawings and fabrication to ensure proper fit.

1.8 WARRANTY

- A. Submit a standard warranty, stating that when installed in accordance with manufacturer's instructions and recommendations, recessed display cases are guaranteed for one year against defects in materials and workmanship. Guarantee shall not cover normal wear and tear, improper handling, any misuse, or any defects caused by vandalism or subsequent abuse. Guarantee shall cover replacement of defective material but shall not include cost of removal or reinstallation.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Recessed Display Case Basis of Design: 370 Series as manufactured by Claridge Products and Equipment, Inc., Harrison, Arkansas.
 - 1. Phone: 870-743-2200
 - 2. Toll Free: 800-434-4610
 - 3. Fax: 870-743-1908
 - 4. Website: www.claridgeproducts.com
- B. Requests for substitutions will be considered in accordance with provisions of Division 01 Section "Product Requirements".

2.2 MATERIALS

- A. Recessed Display Case Fronts
 - 1. Tackable Back Panel: Cork.
 - 2. Housing: 3" extruded aluminum angle perimeter trim.
 - 3. Inside depth: 12" nominal
- B. Glass Doors: 3/16" tempered hinged glass doors equipped with piano hinge and flat key tumbler locks.
- C. Glass Shelves: Three (3) adjustable glass shelves furnished with brackets and shelf standards.
- D. Metal Trim and Accessories: Provide aluminum extrusions by display case manufacturer. Trim shall be heavy gauge extruded aluminum and shall meet or exceed ASTM B221 alloy standards. Finish to be etched and shop primed for field painting.
- E. Integral Fluorescent Lights: 120 V, sized to match case width.

2.3 FABRICATION

- A. Shop assembly: Provide factory assembled cases to requirements indicated on shop drawings.
- B. Units shall be of dimensions shown in details and in accordance with manufacturer's shop drawings, as approved by Architect.

PART 3 - EXECUTION

3.1 PROJECT CONDITIONS

- A. Verify before installation that interior moisture and temperature approximate normal occupied conditions.
- B. Verify that wall surfaces are prepared and ready to receive cases.

3.2 INSTALLATION

- A. Deliver cases knocked-down to be reassembled on job.
- B. Follow manufacturer's instructions for storage and handling of units before installation.
- C. Install level and plumb, in accordance with manufacturer's recommendations.

3.3 ADJUST AND CLEAN

- A. Verify that all accessories are installed as required for each unit.
- B. At completion of work, clean glass surfaces, back panels and trim, in accordance with manufacturer's recommendations, leaving all materials ready for use

END OF SECTION 101200

SECTION 102113 - TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes, but is not limited to, solid-polymer toilet compartments configured as toilet enclosures and urinal screens.
- B. Related Sections include, but are not limited to:
 - 1. Division 06 Section "Rough Carpentry" for blocking.
 - 2. Division 10 Section "Toilet and Bath Accessories" for toilet tissue dispensers, grab bars, and similar accessories.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 - 1. Laboratory Test Reports for Adhesives: Documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. Shop Drawings: For toilet compartments. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Show locations of cutouts for compartment-mounted toilet accessories.
 - 2. Show locations of reinforcements for compartment-mounted grab bars.
 - 3. Show locations of centerlines of toilet fixtures.
- C. Samples for Initial Selection: For each type of unit indicated. Include Samples of hardware and accessories involving material and color selection.
- D. Samples for Verification: For the following products, in manufacturer's standard sizes unless otherwise indicated:
 - 1. Each type of material, color, and finish required for units, prepared on 6-inch- square Samples of same thickness and material indicated for Work.
 - 2. Each type of hardware and accessory.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of toilet compartment, from manufacturer.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For toilet compartments to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Comply with requirements in GSA's CID-A-A-60003, "Partitions, Toilets, Complete."

- B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84, or another standard acceptable to authorities having jurisdiction, by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: 25 or less.
 - 2. Smoke-Developed Index: 450 or less.
- C. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities" and ICC/ANSI A117.1 for toilet compartments designated as accessible.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum Castings: ASTM B 26/B 26M.
- B. Aluminum Extrusions: ASTM B 221.
- C. Steel Sheet: Commercial steel sheet for exposed applications; mill phosphatized and selected for smoothness.
 - 1. Electrolytically Zinc Coated: ASTM A 879/A 879M, 01Z.
 - 2. Hot-Dip Galvanized: ASTM A 653/A 653M, either hot-dip galvanized or galvanized.
- D. Stainless-Steel Sheet: ASTM A 666, Type 304, stretcher-leveled standard of flatness.
- E. Stainless-Steel Castings: ASTM A 743/A 743M.
- F. Zamac: ASTM B 86, commercial zinc-alloy die castings.
- G. Adhesives: Manufacturer's standard product that complies with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.2 SOLID-POLYMER UNITS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Accurate Partitions Corporation - cited as design standard.
 - 2. Global Steel Products Corp.
 - 3. Scranton Products (Santana-Comtec "Hiney Hiders").
- B. Toilet-Enclosure Style: Overhead braced.
- C. Urinal-Screen Style: Wall hung.
- D. Door, Panel, Screen, and Pilaster Construction: Solid, high-density polyethylene (HDPE) or polypropylene (PP) panel material, not less than 1 inch thick, seamless, with eased edges and with homogenous color and pattern throughout thickness of material.

1. Integral Hinges: Configure doors and pilasters to receive integral hinges.
 2. Heat-Sink Strip: Manufacturer's standard continuous, extruded-aluminum or stainless-steel strip fastened to exposed bottom edges of solid-polymer components to prevent burning.
 3. Color and Pattern: One color and pattern in each room as selected by Architect from manufacturer's full range.
 4. Texture: Raised dot pattern equal to Accurate "Tough Texture™ (TT)".
- E. Pilaster Shoes and Sleeves (Caps): Manufacturer's standard design; polymer or stainless steel.
1. Polymer Color and Pattern: Matching pilaster.
- F. Brackets (Fittings): One of the following:
1. Stirrup Type: Ear or U-brackets, chrome-plated zamac, clear-anodized aluminum or stainless steel.
 2. Full-Height (Continuous) Type: Manufacturer's standard design; polymer, extruded aluminum or stainless steel.
 - a. Polymer Color and Pattern: Matching panel.

2.3 ACCESSORIES

- A. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories.
1. Material: Chrome-plated zamac, clear-anodized aluminum or stainless steel.
 2. Hinges: Manufacturer's standard. One of the following:
 - a. Paired, self-closing type that can be adjusted to hold doors open at any angle up to 90 degrees
 - b. Continuous, cam type that swings to a closed or partially open position
 - c. Continuous, spring-loaded type
 - d. Integral hinge for solid-polymer doors.
 3. Latch and Keeper: Manufacturer's standard recessed latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible.
 4. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent in-swinging door from hitting compartment-mounted accessories.
 5. Door Bumper: Manufacturer's standard rubber-tipped bumper at out-swinging doors.
 6. Door Pull: Manufacturer's standard unit at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible.
- B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.
- C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel or chrome-plated steel or brass, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized steel, or other rust-resistant, protective-coated steel.

2.4 FABRICATION

- A. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.

- B. Door Size and Swings: Unless otherwise indicated, provide 24-inch- wide, in-swinging doors for standard toilet compartments and 36-inch- wide, out-swinging doors with a minimum 32-inch-wide, clear opening for compartments designated as accessible.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
 - 1. Maximum Clearances:
 - a. Pilasters and Panels: 1/2 inch.
 - b. Panels and Walls: 1 inch.
 - 2. Stirrup Brackets: Secure panels to walls and to pilasters with no fewer than three brackets attached at midpoint and near top and bottom of panel.
 - a. Locate wall brackets so holes for wall anchors occur in masonry or tile joints.
 - b. Align brackets at pilasters with brackets at walls.
- B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels, and adjust so tops of doors are parallel with overhead brace when doors are in closed position.
- C. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.

3.2 ADJUSTING

- A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 102113

SECTION 102215 – INTERIOR CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes, but is not limited to:
 - 1. Interior Chain-link fencing used to subdivide storage space.
 - 2. Swing Gates.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for chain-link fences and gates.
 - 1. Fence and gate posts, rails, and fittings.
 - 2. Chain-link fabric, reinforcements, and attachments.
 - 3. Gates and hardware.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work. Show accessories, hardware, gate operation, and operational clearances. Include required field measurements.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of chain-link fence, and gate, from manufacturer.
- B. Product Test Reports: For framing strength according to ASTM F 1043.
- C. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For the following to include in emergency, operation, and maintenance manuals:
 - 1. Gate hardware.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to existing construction. Verify dimensions by field measurements and indicate measurements on shop drawings.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of chain-link fences and gates that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Faulty operation of gate hardware.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CHAIN-LINK FENCE FABRIC

- A. General: Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist. Comply with CLFMI Product Manual and with requirements indicated below:
 - 1. Fabric Height: Nominal 8 feet.
 - 2. Steel Wire Fabric: Wire with a diameter of 0.120 inch minimum.
 - a. Mesh Size: 2-1/8 inches maximum.
 - b. Coated Fabric: One of the following:
 - 1) Aluminum-Coated Fabric: ASTM A 491, Type I, 0.30 oz./sq. ft..
 - 2) Zinc-Coated Fabric: ASTM A 392, Type II, Class 1, 1.2 oz./sq. ft. with zinc coating applied before or after weaving.
 - 3) Zn-5-Al-MM Aluminum-Mischmetal-Coated Fabric: ASTM F 1345, Type III, Class 1, 0.60 oz./sq. ft..
 - c. Coat selvage ends of fabric that is metallic coated before the weaving process with manufacturer's standard clear protective coating.
 - 3. Selvage: Knuckled at both selvages.

2.2 FENCE FRAMING

- A. Posts and Rails: Comply with ASTM F 1043 for framing, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thickness according to ASTM F 1043 or ASTM F 1083 based on the following:
 - 1. Fence Height: 96 inches nominal.
 - 2. Light Industrial Strength: Material Group IC-L, round steel pipe, electric-resistance-welded pipe; Group II-L, roll-formed steel C-section shapes; Group III-L, hot-rolled H-beam shapes; or Group IV, Alternative Design.
 - a. Line Post: 1.9 inches in diameter or 2.25 by 1.7 inches minimum.
 - b. End, Corner and Pull Post: 2.375 inches 2.25 by 1.7 inches minimum.
 - 3. Horizontal Framework Members: Intermediate, top, and bottom rails complying with ASTM F 1043.
 - a. Top Rail: 1.66 inches in diameter or 1.25 by 1.63 inches minimum.
 - 4. Brace Rails: Comply with ASTM F 1043.
 - 5. Metallic Coating for Steel Framing:
 - a. Type A, consisting of not less than minimum 2.0-oz./sq. ft. average zinc coating per ASTM A 123/A 123M or 4.0-oz./sq. ft. zinc coating per ASTM A 653/A 653M.
 - b. Type B, zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. of zinc after welding, a chromate conversion coating, and a clear, verifiable polymer film.
 - c. External, Type B, zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. of zinc after welding, a chromate conversion coating, and a clear, verifiable polymer film. Internal, Type D, consisting of 81 percent, not less than 0.3-mil- thick, zinc-pigmented coating.

- d. Type C, Zn-5-Al-MM alloy, consisting of not less than 1.8-oz./sq. ft. coating.

2.3 TENSION WIRE

- A. Metallic-Coated Steel Wire: 0.177-inch- diameter, marcelled tension wire complying with ASTM A 817 and ASTM A 824, with one of the following metallic coatings:
 - 1. Type I, aluminum coated (aluminized).
 - 2. Type II, zinc coated (galvanized) by hot-dip or electrolytic process, with minimum coating weight matching chain-link fabric coating weight.
 - 3. Type III, Zn-5-Al-MM alloy with minimum coating weight matching chain-link fabric coating weight.

2.4 SWING GATES

- A. General: Comply with ASTM F 900 for gate posts and single swing gate types.
 - 1. Gate Leaf Width: 48 inches.
 - 2. Gate Fabric Height: More than 72 inches.
- B. Pipe and Tubing:
 - 1. Zinc-Coated Steel: Comply with ASTM F 1043 and ASTM F 1083; protective coating and finish to match fence framing.
 - 2. Gate Posts: Round tubular steel or rectangular tubular steel.
 - 3. Gate Frames and Bracing: Round tubular steel or rectangular tubular steel.
- C. Frame Corner Construction: Welded or assembled with corner fittings.
- D. Hardware:
 - 1. Hinges: 180-degree outward swing.
 - 2. Latches permitting operation from both sides of gate with provision for padlocking accessible from both sides of gate.
 - 3. Padlock and Chain: Owner-furnished.

2.5 FITTINGS

- A. General: Comply with ASTM F 626.
- B. Post Caps: Provide for each post.
 - 1. Provide line post caps with loop to receive tension wire or top rail.
- C. Rail and Brace Ends: For each gate, corner, pull, and end post.
- D. Rail Fittings: Provide the following:
 - 1. Top Rail Sleeves: Pressed-steel or round-steel tubing not less than 6 inches long.
 - 2. Rail Clamps: Line and corner boulevard clamps for connecting intermediate and bottom rails in the fence line-to-line posts.
- E. Tension and Brace Bands: Pressed steel.
- F. Tension Bars: Steel, length not less than 2 inches shorter than full height of chain-link fabric. Provide one bar for each gate and end post, and two for each corner and pull post, unless fabric is integrally woven into post.
- G. Tie Wires, Clips, and Fasteners: According to ASTM F 626.

1. Standard Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames. Provide Hot-Dip Galvanized Steel 0.106-inch- diameter wire; galvanized coating thickness matching coating thickness of chain-link fence fabric.

H. Finish: Metallic Coating for Pressed Steel or Cast Iron, not less than 1.2 oz. /sq. ft. zinc.

2.6 GROUT AND ANCHORING CEMENT

- A. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Mark locations of fence lines, gates, and terminal posts.

3.3 INSTALLATION, GENERAL

- A. Install chain-link fencing to comply with ASTM F 567 and more stringent requirements indicated.

3.4 CHAIN-LINK FENCE INSTALLATION

- A. Post Setting: Set posts in existing concrete with mechanical anchors.
 1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
- B. Terminal Posts: Locate terminal end, corner, and gate posts per ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment.
- C. Line Posts: Space line posts uniformly at 96 inches maximum o.c.
- D. Post Bracing and Intermediate Rails: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Diagonally brace terminal posts to adjacent line posts with truss rods and turnbuckles. Install braces at end and gate posts and at both sides of corner and pull posts.
 1. Locate horizontal braces at midheight of fabric 72 inches or higher, on fences with top rail and at two-third fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.
- E. Tension Wire: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch- diameter hog rings of same material and finish as fabric wire, spaced a maximum of 24 inches o.c. Install tension wire in locations indicated before stretching fabric. Provide horizontal tension wire at the following locations:
 1. Extended along top and bottom of fence fabric. Install top tension wire through post cap loops. Install bottom tension wire within 6 inches of bottom of fabric and tie to each post with not less than same diameter and type of wire.

- F. Top Rail: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.
- G. Intermediate and Bottom Rails: Install and secure to posts with fittings.
- H. Chain-Link Fabric: Apply fabric to outside or inside of enclosing framework. Leave 2 inches between finish grade or surface and bottom selvage unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.
- I. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts with tension bands spaced not more than 15 inches o.c.
- J. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric per ASTM F 626. Bend ends of wire to minimize hazard to individuals and clothing.
 - 1. Maximum Spacing: Tie fabric to line posts at 12 inches o.c. and to braces at 24 inches o.c.
- K. Fasteners: Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

3.5 GATE INSTALLATION

- A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.6 ADJUSTING

- A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.
- B. Lubricate hardware and other moving parts.

END OF SECTION 102215

SECTION 102800 - TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes, but is not limited to:
 - 1. Public-use washroom accessories.
 - 2. Public-use shower room accessories.
 - 3. Warm-air dryers.
 - 4. Childcare accessories.
 - 5. Underlavatory guards.
 - 6. Custodial accessories.
- B. Owner-Furnished Material: Waste receptacles.
- C. Related Sections include, but are not limited to:
 - 1. Division 10 Section "Toilet Compartments".

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include the following:
 - 1. Construction details and dimensions.
 - 2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
 - 3. Material and finish descriptions.
 - 4. Features that will be included for Project.
 - 5. Manufacturer's warranty.
- B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
 - 1. Identify locations using room designations indicated.
 - 2. Identify products using designations indicated.

1.4 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Source Limitations: For products listed together in the same Part 2 articles, obtain products from single source from single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.7 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.8 WARRANTY

- A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch minimum nominal thickness unless otherwise indicated.
- B. Brass: ASTM B 19, flat products; ASTM B 16/B 16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings.
- C. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.036-inch minimum nominal thickness.
- D. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 hot-dip zinc coating.
- E. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
- F. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.
- G. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).
- H. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.
- I. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

2.2 PUBLIC-USE WASHROOM ACCESSORIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. A & J Washroom Accessories, Inc.
 - 2. American Specialties, Inc.
 - 3. Bobrick Washroom Equipment, Inc.
 - 4. Bradley Corporation - cited as design standard.
 - 5. Tubular Specialties Manufacturing, Inc.
- B. Toilet Tissue (Double Roll) Dispenser:
 - 1. Basis-of-Design Product: Bradley Model 5263.
 - 2. Description: Double-roll dispenser with shelf.

3. Mounting: Surface mounted.
4. Operation: Noncontrol delivery with theft-resistant spindle.
5. Capacity: Designed for two (2) 6-inch- diameter tissue rolls.
6. Material and Finish: Stainless steel, No. 4 finish (satin), 18 gauge.

C. Soap Dispenser:

1. Basis-of-Design Product: Bradley 6562.
2. Description: Designed for dispensing soap in liquid or lotion form.
3. Mounting: Vertically oriented, surface mounted.
4. Capacity: 40 oz..
5. Materials: Stainless Steel, 20 gauge, satin finish.
6. Lockset: Tumbler type.
7. Refill Indicator: Window type.

D. Grab Bar:

1. Basis-of-Design Product: Bradley 812 series.
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch thick.
 - a. Finish: Smooth, No. 4 finish (satin).
4. Outside Diameter: 1-1/2 inches.
5. Configuration and Length: As indicated on Drawings.

E. Surface-Mounted Sanitary-Napkin Disposal Unit:

1. Basis-of-Design Product: Bradley Model 4722-15.
2. Mounting: Surface mounted.
3. Door or Cover: Self-closing, disposal-opening cover and hinged face panel with tumbler lockset.
4. Receptacle: Removable.
5. Material and Finish: Stainless steel, No. 4 finish (satin).
6. Capacity: 1.5 gal.

F. Partition-Mounted Sanitary-Napkin Disposal Unit:

1. Basis-of-Design Product: Bradley Model 4721-15.
2. Mounting: Partition mounted, dual access.
3. Door or Covers: Self-closing, disposal-opening cover and hinged face panel with tumbler lockset
4. Receptacle: Removable.
5. Minimum Capacity: 1.5 gal.
6. Material and Finish: Stainless steel, No. 4 finish (satin).

G. Mirror Unit:

1. Basis-of-Design Product: Bradley Model 781 series.
2. Frame: Stainless-steel channel.
 - a. Corners: Mitered and mechanically interlocked.
3. Hangers: Produce rigid, tamper- and theft-resistant installation, using one of the methods indicated below.
 - a. One-piece, galvanized-steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.
 - b. Wall bracket of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.
4. Size: As indicated on Drawings.

2.3 PUBLIC-USE SHOWER ROOM ACCESSORIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. A & J Washroom Accessories, Inc.
2. American Specialties, Inc.
3. Bobrick Washroom Equipment, Inc.
4. Bradley Corporation - cited as design standard.
5. Tubular Specialties Manufacturing, Inc.

B. Shower Curtain Rod:

1. Basis-of-Design Product: Bradley Model 9539.
2. Description: 1-1/4-inch OD; fabricated from nominal 0.05-inch- thick stainless steel.
3. Mounting Flanges: Stainless-steel flanges designed for concealed fasteners.
4. Finish: No. 4 (satin).

C. Shower Curtain:

1. Basis-of-Design Product: Bradley Model 9533 with Model 9536 hooks.
2. Size: Minimum 12 inches wider than opening by 72 inches high.
3. Material: Nylon-reinforced vinyl, minimum 10 oz. or 0.008-inch- thick vinyl, with integral antibacterial agent.
4. Color: White.
5. Grommets: Corrosion resistant at minimum 6 inches o.c. through top hem.
6. Shower Curtain Hooks: Chrome-plated or stainless-steel, spring wire curtain hooks with snap fasteners, sized to accommodate specified curtain rod. Provide one hook per curtain grommet.

D. Folding Shower Seat:

1. Basis-of-Design Product: Bradley 9562.
2. Configuration: Rectangular seat.
3. Seat: 1/2-inch thick phenolic or polymeric composite of slat-type or one-piece construction in color as selected by Architect.
4. Mounting Mechanism: Stainless steel, No. 4 finish (satin).
5. Nominal Dimensions: 28-1/2 inches long by 15 inches deep.

E. Soap Dish:

1. Basis-of-Design Product: Bradley Model 9014.
2. Description: Soap dish with drain holes.
3. Mounting: Surface mounted.
4. Material and Finish: Stainless steel, No. 4 finish (satin).

F. Robe Hook:

1. Basis-of-Design Product: Bradley Model 9124.
2. Description: Double-prong unit.
3. Projection: 2-1/4 inch.

G. Towel Bar:

1. Basis-of-Design Product: Bradley Model 907.
2. Description: 3/4-inch- square tube with rectangular end brackets.
3. Mounting: Flanges with concealed fasteners.
4. Length: 18 inches.
5. Material and Finish: Forged or cast brass, nickel-plated with highly polishes chrome finish.

2.4 WARM-AIR DRYERS

A. Warm-Air Dryer:

1. Basis-of-Design Product: World Dryer Airmax™ series, DXM5-973 and DXRM5-Q973.
2. Mounting: Surface mounted where indicated, recessed where indicated.
3. Operation: Touch-button activated with timed power cut-off switch.

- a. Operation Time: 20 seconds.
4. Cover Material and Finish: Stainless steel, brushed finish.
5. Electrical Requirements: 115 V, 20 A, 2300 W at 60 Hz.

2.5 CHILDCARE ACCESSORIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. American Specialties, Inc.
 2. Bradley Corporation – cited as design standard.
 3. Brocar Products, Inc.
 4. Diaper Deck & Company, Inc.
 5. Koala Kare Products; a division of Bobrick Washroom Equipment, Inc.
 6. SSC, Inc.
 7. Tubular Specialties Manufacturing, Inc.
- B. Diaper-Changing Station:
 1. Basis-of-Design Product: Bradley Model 961 series.
 2. Description: Horizontal unit that opens by folding down from stored position and with child-protection strap.
 - a. Engineered to support a minimum of 100-lb static load when opened.
 3. Mounting: Surface mounted, with unit projecting not more than 4 inches from wall when closed.
 4. Operation: By pneumatic shock-absorbing mechanism.
 5. Material and Finish: HDPE in color as selected by Architect from manufacturer's full range of available colors.
 6. Liner Dispenser: Built in.

2.6 UNDERLAVATORY GUARDS

- A. Product: Subject to compliance with requirements, provide one of the following:
 1. Plumberex Specialty Products, Inc.
 2. Truebro by IPS Corporation.
- B. Underlavatory Guard:
 1. Description: Insulating pipe covering for supply and drain piping assemblies that prevent direct contact with and burns from piping; allow service access without removing coverings.
 2. Material and Finish: Antimicrobial, molded plastic, white.

2.7 CUSTODIAL ACCESSORIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. A & J Washroom Accessories, Inc.
 2. American Specialties, Inc.
 3. Bobrick Washroom Equipment, Inc.
 4. Bradley Corporation – cited as design standard.
 5. Tubular Specialties Manufacturing, Inc.
- B. Utility Shelf:
 1. Basis-of-Design Product: Bradley Model 9986.
 2. Description: With exposed edges turned down not less than 1-1/2 inches and supported by two triangular brackets welded to shelf underside.
 3. Size: 48 inches long by 8 inches deep.

4. Hooks: Five, 14 gauge stainless steel.
5. Mop/Broom Holders: Six, spring-loaded, rubber hat, cam type.
6. Material and Finish: Stainless steel, No. 4 finish (satin).
 - a. Shelf: Not less than nominal 0.05-inch- thick stainless steel.
 - b. Rod: Approximately 1/4-inch- diameter stainless steel.

2.8 FABRICATION

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of four (4) keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to ASTM F 446.

3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 102800

SECTION 104413 - FIRE EXTINGUISHERS AND CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes, but is not limited to:
 - 1. Fire-protection cabinets for portable fire extinguishers.
 - 2. Fire extinguishers.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing mounting method and relationships of box and trim to surrounding construction.
- B. Samples: For each type of exposed finish required.
- C. Samples for Initial Selection: For each type of exposed finish required.
- D. Product Schedule: For fire-protection cabinets. Indicate whether recessed, semi-recessed, or surface mounted. Coordinate final fire-protection cabinet schedule with fire-extinguisher schedule to ensure proper fit and function.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

1.5 COORDINATION

- A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
- B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 FIRE-PROTECTION CABINETS

- A. Cabinet Type: Suitable for fire extinguisher.
 - 1. Basis of Design Product: Larsen's Cameo series Model No. C2409.
 - 2. Manufacturer: Subject to compliance with requirements, provide products by one of the following:
 - a. Guardian Fire Equipment, Inc.
 - b. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - c. Larsens Manufacturing Company.
 - d. Nystrom, Inc.
 - e. Potter Roemer LLC.

- B. Cabinet Construction: Nonrated.
- C. Cabinet Material: Cold-rolled steel sheet.
- D. Semi-Recessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
 - 1. Square-Edge Trim: 1-1/4- to 1-1/2-inch backbend depth.
- E. Cabinet Trim Material: Copper-alloy bronze sheet.
- F. Door Material: Copper-alloy bronze sheet.
- G. Door Style: Full acrylic bubble with frame.
- H. Door Glazing: Molded acrylic bubble.
 - 1. Acrylic Bubble Color: Bronze, transparent.
- I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
 - 1. Provide projecting lever handle with self-adjusting roller catch.
 - 2. Provide continuous hinge, of same material and finish as trim.
- J. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
- K. Materials:
 - 1. Cold-Rolled Steel: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
 - a. Finish: Baked enamel or powder coat.
 - b. Color: White.
 - 2. Copper Alloy, Bronze: ASTM B 36/B 36M, alloy as standard with manufacturer.
 - a. Finish: As selected by Architect from full range of manufacturer's available finishes..
 - 3. Transparent Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), Finish 1 (smooth or polished).

2.2 FABRICATION

- A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
 - 1. Weld joints and grind smooth.
 - 2. Provide factory-drilled mounting holes.
 - 3. Prepare doors and frames to receive locks.
 - 4. Install door locks at factory.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.
 - 1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
 - 2. Fabricate door frames of one-piece construction with edges flanged.
 - 3. Miter and weld perimeter door frames.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.3 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish fire-protection cabinets after assembly.
- D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.4 PORTABLE FIRE EXTINGUISHERS

- A. General: Provide fire extinguishers of type, size, and capacity for each cabinet and other locations indicated.
 - 1. Product: A 10-lb. multi-purpose, UL listed, dry chemical fire extinguisher with a minimum rating of 4-A:40-B:C.
- B. Mounting Brackets: Manufacturer's standard steel bracket, designed to secure extinguisher, of sizes required for types and capacities of fire extinguisher indicated, with plated or baked-enamel finish.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls and partitions for suitable framing depth and blocking where semi-recessed cabinets will be installed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare recesses for semi-recessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

- A. General: Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
- B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.
 - 1. Unless otherwise indicated, provide semi-recessed fire-protection cabinets.
 - 2. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.

3.4 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

- C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.
- E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 104413

SECTION 114000 - FOODSERVICE EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes but is not limited to:
 - 1. All Food Service Equipment
 - 2. Electrical Work: Interwiring of food service equipment between components within equipment, such as heating elements, switches, thermostats, motors, etc., complete with junction box as is applicable, ready for final connection. Voltages shall be as indicate on contract drawings. Any differences in electrical characteristics at job site from those shown on contract documents must be submitted to Architect for consideration prior to ordering equipment.
 - 3. Plumbing Work: Furnish all equipment with faucets, sink waste assemblies and trim as specified in this section. Other than sink compartments, extend all indirect waste lines to nearest floor receptor. All such drain lines to be properly sized. Drain shall terminate with proper air gap above flood rim of floor receptor.
 - 4. Mechanical Work: Provide exhaust hoods with connection collars ready for final connection by HVAC section.
- B. Related Sections include, but are not limited to:
 - 1. Division 22 "Plumbing" for rough-in piping for gas and water supply and waste lines, piping for supply and waste lines, grease traps, line strainers, tail pieces, valves, stops, shut-off and miscellaneous fittings required for complete installation, indirect drains for sink lines and final connections.
 - 2. Division 23 "Heating Ventilating and Air-Conditioning" for roof mounted fans and connecting ductwork not shown as part of the kitchen equipment, and small final connections, including approved welded duct connections to hoods.
 - 3. Division 26 "Electrical" for rough-in conduit, wiring, line and disconnect switches, safety cut-offs and fittings, control panels, fuses, boxes and fittings required for complete installation. Final connections, including mounting and wiring of switches furnished as part of the food service equipment (unless otherwise indicated on the drawings)

1.3 SUBMITTALS

- A. Submit illustrative brochures for manufactured or buy-out equipment items, complete with illustrations, specifications, line drawings, rough-in requirements, and list of accessories or other specified additional requirements to Architect as soon as possible after award of contract. Brochures shall be bound and shall include data on all equipment which is to be provided, arranged in numerical sequence which conforms to item numbers of specifications. Omissions of data does not reduce obligation to provide items as specified. After approval, Food Service Equipment Contractor shall furnish to Architect 4 sets of shop drawings and brochures, corrected as required by virtue of review comments, for distribution to various interested trades on project. All costs of reproduction and submission shall be part of contract.

Bound brochure and cut sheet submittals must be copied to Owner for review and comment.

- B. Provide fully dimensioned rough-in plans at 1/4" scale, consisting of a separate drawing for each discipline. Rough-in set shall include all required mechanical, electrical, plumbing, services for equipment and dimensioned rough-in location for same. Rough-in locations shown shall make allowances for required traps, switches, etc., thereby not requiring interpretation or adjustment on the part of other Contractors. Drawings shall indicate dimensions for floor depressions, wall openings, etc., for equipment.
 - 1. Rough-in plans shall include all required services which relate to equipment but which may not directly connect thereto, such as convenience outlets at walls, hose stations, floor drains, etc.
 - 2. Rough-in plans shall also include all required outlet services for equipment which is designated on drawing schedule, even though such equipment may not be included in this contract.
- C. Submit detailed shop drawings of custom fabricated equipment items, drawn at 3/4" and 1-1/2" scale for plans, elevations and sections respectively. Drawings shall show all details of construction, installation, and relation to adjoining and related work where cutting or close fitting is required. Drawings shall show all reinforcements, anchorage, and other work required for complete installation of all fixtures.
- D. Review of shop drawings and brochures will be in general and shall be understood to mean that Architect has no objection to use of materials or processes shown. Review does not relieve Food Service Equipment Contractor from responsibility for errors, omissions, or deviations from contract requirements.

1.4 QUALITY ASSURANCE

- A. All custom fabricated equipment such as food serving units, tables, sink, counter tops, etc., shall be manufactured by a food service equipment fabricator who has the plant, personnel and engineering equipment required. Such manufacturer shall be subject to review of Architect. All work in above category shall be manufactured by one manufacturer and shall be of uniform design and finish.
- B. Manufacturer of this equipment must be able to show that he is now and for the past five years has been engaged in manufacture or distribution of equipment, as required under this contract, as his principle project.
- C. Manufacturer of equipment herein specified shall be a recognized distributor for items of equipment specified herein which are of other manufacture than his own.
- D. All work shall be done in an approved workmanlike manner, to complete satisfaction of the owner.

1.5 COORDINATION

- A. Food Service Equipment Contractor shall visit site to verify all rough-in and sleeve locations prior to installation of finished floors, and shall cooperate with other Contractors involved in proper location of same. Food Service Equipment Contractor shall be responsible for any

required relocations of rough-in due to errors or inaccuracies on those rough-in plans which he prepares.

- B. Do not begin fabrication of custom manufactured equipment until approvals of shop drawings have been received and until field measurements have been taken where such measurements are necessary to assure proper conformance with intent of contract drawings and specifications.
- C. Make field measurements giving due consideration to any architectural, mechanical, or structural discrepancies which may occur during construction of building. No extra compensation will be allowed for any difference between actual measurements secured at job site and dimensions indicated on contract drawings. Any differences which may be found at job site during field measurements shall be submitted to Architect for consideration before proceeding with fabrication of equipment.

1.6 WARRANTY

- A. Special Project Warranty: Provide written warranty from manufacturer, agreeing to replace/repair, within warranty period, products with inadequate and defective materials and workmanship, including leakage, breakage, improper assembly, or failure to perform as required, provided manufacturer's instructions for handling, installing, protecting, and maintaining units have been adhered to during warranty period. This warranty shall be in addition to, and not in limitation of, the rights the Owner may have against the Contractor under the Contract Documents.
- B. Warranty Period: 1 year from date of Substantial Completion, all new equipment furnished. However, manufacturer's warranty shall prevail when the period is longer than one year.
 - 1. 5 year warranty period on refrigeration compressors.

1.7 MANUFACTURER'S DIRECTIONS

- A. Follow manufacturer's directions in all cases where manufacturers of articles used in this contract furnish directions or instructions covering points not shown on drawings or specifications.

1.8 INDUSTRY STANDARDS

- A. Electric operated and/or heated equipment, fabricated or otherwise, shall conform to latest standards of National Electric Manufacturers Associations and of Underwriters Laboratories, Inc., and shall bear the U.L. label.
- B. Cooking and hot food holding equipment shall meet minimum construction standards as noted by NSF #4.
- C. Refrigeration equipment shall meet minimum construction standard as noted by NSF #7.
- D. Items of food service equipment shall bear the N.S.F. seal.
- E. Food service equipment shall be installed in accord with N.S.F. standards.
- F. Work and materials shall be in compliance with requirements of applicable codes, ordinances and regulations, including but not limited to those of Occupational Safety and Health Act (OSHA), National Fire Protection Association, State Fire Marshal, State

Accident Commission, U.S. Public Health Service, State Board of Health, local health codes, etc.

- H. Rulings and interpretations of enforcing agencies shall be considered part of regulations.

PART 2 - PRODUCTS

2.1 MANUFACTURED EQUIPMENT

- A. All similar types of equipment such as all refrigerated and heated cabinets, all ovens, and all mixers shall be by the same manufacturer.
- B. Except as many be specified otherwise under individual item specifications in "Equipment Schedule", all items of standard manufactured equipment shall be complete in accord with manufacturer's standard specification for specific unit or model called for, including finishes, components, attachments, appurtenances, etc.
- C. All items of standard equipment shall be that manufacturer's latest model at time of delivery.

2.2 FABRICATED EQUIPMENT

- A. Stainless steel shall be U.S. standard gauges as called for, 18-8 Type 302 or 304 Type, No. 4 finish.
- B. Galvanized iron shall be Armco or equal. Framework of galvanized iron shall be welded construction, having welds smooth and where galvanizing has been burned off, touched up with high grade aluminum bronze.
- C. Legs and cross rails shall be continuously welded, unless otherwise noted, and ground smooth.
- D. Bottom of legs at floor shall be fitted with sanitary stainless steel bullet type foot, with not less than 1" adjustment.
- E. Legs shall be fastened to equipment as follows:
 - 1. To sinks by means of closed gussets. Gussets shall be stainless steel, reinforced with bushing, having set screws for the scouring legs.
 - 2. To tables and drain boards with closed gussets which shall be welded to stainless steel hat sections or channels, 14 gauge or heavier, exposed hat sections having closed ends. Bracing shall be welded to underside of tops.
- F. Closed gussets shall be a 3" minimum diameter at top, continuously welded to frame members or to sink bottom.
- G. Rolls shall be 1-1/2" diameter, except as detailed contrary, with corners bullnosed, ground and polished.
- H. Seams and joints shall be shop welded. Welds are to be ground smooth and polished to match original finish. Materials 18 gauge or heavier shall be welded.
- I. Metal tops shall be one-piece welded construction, unless specified otherwise, reinforced on underside with stainless steel hat sections or channels welded in place. Cross bracing to be not more than 30" on centers.

- J. Drawers to be 18 gauge stainless steel channel type housing and drawer cradle, both housing and cradle being reinforced and welded at corners, housing being secured to underside of table top and both housing and cradle being sized for and fitted with 18 gauge 20"x20"x5" deep stainless steel drawer insert having coved corners. Drawer insert shall be easily removable from cradle without tools or having to remove entire drawer. Drawers to have stainless steel fronts. Provide with recessed flush type stainless steel pulls.
- K. Support drawer on fabricated 14 gauge stainless steel interlocking channel solid delrin ball bearing wheels. Support slides shall be load rated at 200 lb. per pair.
- L. Fabricate sink compartments with fully coved vertical and horizontal corners. Multiple compartment partition to be double thickness, continuously welded where sheets join at top. Bottoms shall be creased to drain.
- M. Ends of all fixtures, splashbacks, shelves, etc., shall be finished flush to walls or adjoining fixtures.
- N. Dishtables, draitables, splashbacks and turned-up edges shall have radius bends in all horizontal and vertical corners, coved at intersections.
- O. Rounded coved corners or radius bends shall be ½" radius or longer.
- P. Shelves in fixtures with enclosed bases shall be turned up on back and sides and feathered slightly to insure tight fit to enclose panels.
- Q. Metal components, unless specified or noted otherwise, to be the following gauges:
 - 1. Counter and table tops 14 ga. Stainless Steel
 - 2. Wall shelves 16 ga. Stainless Steel
 - 3. Pipe leg undershelves 16 ga. Stainless Steel
 - 4. Drawer fronts 16 ga. Stainless Steel
 - 5. Sinks and Drainboards 14 ga. Stainless Steel
 - 6. Exhaust hoods 18 ga. Stainless Steel
 - 7. Legs 1-5/8" diameter 16 ga. Stainless Steel

2.3 HEATING EQUIPMENT

- A. Wherever electric heating equipment or thermostat control for such equipment is specified, it shall be complete, and of the materials, size and rating specified within equipment item or details. All such equipment shall be designed and installed to be easily cleaned or to be easily removed for cleaning.
- B. Electrical appliances or heating element circuits of 120 volts shall not exceed 1650 watts, unless specifically shown contrary.

2.4 SWITCHES AND CONTROLS

- A. Food Service Equipment Contractor shall supply on each motor driven appliance or electrical heating unit suitable control switch of proper type in accord with Underwriter's Code.
- B. All internal wiring for fabricated equipment items including, all electrical devices, wiring, controls, switches, etc., built into or forming an integral part of these items shall be furnished and installed

by Food Service Equipment Contractor in his factory or building site with all items complete to junction box for final connection to building lines by Electrical Contractor.

2.5 CONNECTION TERMINALS

- A. All equipment shall be complete with connection terminals as standardized by equipment manufacturers, except where specified otherwise.

2.6 LOCKS

- A. Fit all doors for reach-in refrigerated compartments with locking type latches. Provide master keys.

2.7 GAS EQUIPMENT

- A. Equipment to be suitable for use with gas available at site and to be furnished by F.S.E.C. with pressure regulators designed to work with incoming pressure.

2.8 GAS QUICK DISCONNECTS

- A. Where specified, provide gas quick disconnects complete with gas valve, gas connector hose, quick disconnect fitting elbows and restraining cable, all AGA approved. Gas hose shall be flexible, braided or corrugated stainless steel with smooth plastic exterior coating or sleeve of heat shrink tubing.

PART 3 - EXECUTION

3.1 GENERAL

- A. Work under this contract and covered under this section of specifications includes but is not limited to:
 1. Cutting of holes and/or ferrules on equipment for piping, drains, electrical outlets, conduits, etc., as required to coordinate installation of food service equipment with work of other contractors on project.
 2. Field checking of building and rough-in requirements, and submission of brochures and shop drawings, all as required above under "Submittals".
 3. Repair of all damage to premises as result of this installation, and removal of all debris left by those engaged in this installation.
 4. Having all food service equipment fixtures completely cleaned and ready for operation when building is turned over to Owner.

3.2 INSTALLATION PROCEDURE

- A. Food Service Equipment Contractor shall make arrangements for receiving his custom fabricated and "buy out" equipment and shall make delivery into building as requisitioned by his installation superintendent. He shall not consign any of his equipment to Owner or to any other Contractor unless he has written acceptance from them and has made satisfactory arrangements for the payment of all freight and handling charges.
- B. Food Service Equipment Contractor shall deliver all of his custom fabricated and "buy out" equipment temporarily in its final location, permitting trades to make necessary arrangements for connection of service lines. He shall then move equipment sufficiently to permit installation of

service lines, after which he shall realign his equipment level and plumb, making final erection as shown on contract drawings.

- C. This Contractor shall coordinate his work and cooperate with other trades working at site toward the orderly progress of the project.
- D. Architect or Owner's Agent shall have access at all times to plant or shop in which custom fabricated equipment is being manufactured, from time contract is let until equipment is shipped, in order that progress of work can be checked, as well as addressing any technical problem which may arise in coordination of equipment with building. Any approval given at this point of manufacture shall be tentative, subject to final inspection and test after complete installation.
- E. Food Service Equipment Contractor shall assist Architect, Owner, and/or Owner's Agent in making any desired tests during or prior to final inspection of equipment. He shall remove immediately any work or equipment rejected by Architect, Owner, and/or Owner's Agent, replacing same with work conforming with contract requirements, and shall reimburse mechanical and/or other contractors involved for extra work made necessary by such replacement.
- F. This Contractor shall keep premises free from accumulation of his waste material and rubbish, and at completion of his work shall remove his rubbish and implements, leaving areas of his work broom clean.
- G. This Contractor shall provide and maintain coverings or other approved protection for finished surfaces and other parts of his equipment subject to damage during and after erection. After removal of protective coverings, all field joints shall be ground and polished and entire work shall be thoroughly cleaned and polished.

3.3 TRIMMING AND SEALING EQUIPMENT

- A. Seal completely spaces between all units to walls, ceilings, floors and adjoining (not portable) units with enclosed bodies against entrance of food particles or vermin by means of trim strips, welding, soldering, or commercial joint material best suited to of equipment and adjoining surface material.
- B. Close ends of all hollow sections.
- C. Equipment butting against walls, ceilings, floor surfaces and corners to fit tightly against same; backsplash or risers which fit against wall to be neatly scribed and sealed to wall with clear silicone sealant, wiping excess sealant out of joint to fillet radius. Where required to prevent shifting of equipment and breaking wall seal, anchor item to floor or wall.
- D. Treat enclosed spaces (inaccessible after equipment installation) for vermin prevention in accord with industry practice.

3.4 TESTING AND DEMONSTRATION OF EQUIPMENT

- A. After completion of installation, all equipment using water, gas and electricity shall be performance inspected and tested by factory certified service agent, including wet test of hood fire suppression systems, if so required. Food Service Equipment Contractor shall document that these inspections have been performed prior to scheduling demonstrations and owner acceptance of equipment.

- B. Food Service Equipment Contractor shall arrange to have all manufactured, mechanically operated equipment furnished under this contract demonstrated by authorized representatives of equipment manufacturers. These representatives shall instruct Owner's designated personnel in use, care and maintenance of all items of equipment after same are in working order. Demonstration and instruction shall be held on dates designated by Owner.

3.5 EQUIPMENT HANDLING AND STORAGE

- A. Deliver equipment to site, properly crated or protected, and store in safe place, protected from damage until time of installation.

3.6 OPERATING AND MAINTENANCE MANUALS

- A. After completion of installation, Food Service Equipment Contractor shall present to Owner three sets of all operating and maintenance manuals, covering all mechanically operated equipment furnished under this contract, each set being neatly bound in loose leaf binder having durable cover.
- B. Include in each binder a list of names, addresses and telephone numbers of local servicing agencies authorized to make necessary repairs and/or adjustments of equipment furnished under this contract.

PART 4 – EQUIPMENT SCHEDULE

- | | | |
|--------|--|-----------------------|
| ITEM 1 | Ice Machine | N.I.C. |
| | A. Relocate existing ice machine per plan. | |
| ITEM 2 | HVAC Unit | N.I.C. |
| | A. This item to be furnished by others. | |
| ITEM 3 | Shelving, Wire | Quantity as Scheduled |
| | A. Shelving unit, four tier, 14" x 24", green epoxy finish with chromate substrate, NSF. | |
| | B. Uprights: 4 each, nominal 74" high, grooved at 1" intervals, leveling bolts and caps, green epoxy finish with chromate substrate. | |
| | C. Product: Olympic Model J1824K, Post model J74K. | |
| ITEM 4 | Garbage Can, Indoor (2 Required) | N.I.C. |
| | A. This item to be furnished by others. | |
| ITEM 5 | Mop Sink (1 Required) | |
| | A. Mop Sink: floor mounted, 25-1/2"W x 32-5/8"L, 8"H water level, 2" drain, stainless steel construction, with service faucet. | |
| | B. Product: Eagle Group Model F2820-X. | |

ITEM 6 Mop Holder (1 Required)

- A. Mop Holder, 3 pole.
- B. Product: Eagle Group Model 312688-X.

ITEM 7 Stainless Steel Wall Backing

- A. This item to be furnished by others.

ITEM 8 Spare No.

ITEM 9 Spare No.

ITEM 10 Millwork Base Cabinetry - See Architectural Drawings.

- A. This item to be furnished by others.

ITEM 11 Millwork Wall Cabinetry – See Architectural Drawings.

- A. This item to be furnished by others.

ITEM 12 Microwave Oven (1 Required)

- A. Pro Commercial Microwave Oven, 1000 Watts, single shelf.
- B. Features and Characteristics:
 - 1. 10 programmable memory pads, double quantity pad, Braille touch-control keypad.
 - 2. 6 power levels, bottom energy feed.
 - 3. Stainless steel door.
 - 4. Digital display.
 - 5. Cavity: 13"Wx13"Dx8-1/16"H, 120v/60/1-ph, 13.4 amps, UL, NSF.
 - 6. NEMA 5-15.
- C. Warranty: 1 year parts and labor warranty and 3 year magnetron warranty (labor for magnetron replacement is not covered in years 2 and 3)
- D. Product: Panasonic Model NE-1054F.

ITEM 13 Proofer Holding Cabinet, Mobile (2 Required)

- A. C5™ 3 Series Heated Holding and Proofing Cabinet, with Red Insulation Armour™.
- B. Features and Characteristics:
 - 1. Mobile, full height, insulated, clear polycarbonate door.
 - 2. Removable bottom mount control module, thermostat to 200°F.
 - 3. Fixed wire slides on 3" centers.
 - 4. Capacity: (18) 18" x 26" or (34) 12" x 20" x 2-1/2" pans.
 - 5. 5" casters (two with brakes), aluminum.

6. Electrical: 120v/60/1-ph, 2000 watts, 16.7 amps, NEMA 5-20P,UL, CUL, NSF.

C. Product: Metro Model C539-CFC-4.

ITEM 14 Spare No.

ITEM 15 Spare No.

ITEM 16 Worktable, 36", Stainless Steel Top (2 Required)

- A. Deluxe Work Table, 36"W x 30"D, 16/304 stainless steel top with rolled edges front and back, square turndown ends, 18 gauge stainless steel under shelf, 1-5/8" O.D. 16 gauge stainless steel legs, uni-lok® gusset system, adjustable hi-impact plastic bullet feet.
 - 1. 2 ea. Drawer, 20" x 20", with pull flange stainless steel
 - 2. 2 st. Table Casters, 5" diameter, resilient tread, two swivel and two with brakes (set of four), 200 lb weight capacity per caster, zinc.

B. Product: Eagle Group Model T3036SEB-1X

ITEM 17 Exhaust Hood with Fire Suppression System (1 Required)

- A. Type I 7' x 54" wall canopy hood with front perforated supply plenum.
- B. Features and Characteristics:
 - 1. Built in 3" back standoff.
 - 2. 430 Stainless steel where exposed.
 - 3. Captrate Solo filters with hook, ETL listed, 4 each 16" x 16" and 1 each 16" x 20".
 - 4. Incandescent light fixture, high temperature assembly, includes 2 clear thermal and shock resistant globes. Bulbs by others.
 - 5. Ansul 3 gallon Fire Suppression System in utility cabinet.
 - 6. 2" mechanical gas shutoff valve.
 - 7. Heated makeup air gas fired.
 - 8. Exhaust fan with rain cap.

C. Product: Captive Aire Model 5424ND-2-PSP-F.

ITEM 18 Fire Suppression System

- A. This item is included in Item 17.

ITEM 19 Induction Range, Floor Model (1 Required)

- A. Induction Range, electric, 36"W, (6) 8" glass induction hobs, convection oven base w/ (3) oven racks and 1-hour oven timer, 2" vented s/s stub back, s/s exterior, 6" s/s adjustable legs, 21.6 kw, UL, NSF.
- B. Warranty: 2 yr. parts and labor warranty, lifetime oven door warranty.
- C. Electrical: 208v/60/3-ph, 69.2 amp.

D. Casters: one set, 6", (2 swivel locking, 2 rigid) for FCOF-AT3 and R36 series ranges.

E. Product: Lang Manufacturing Model RI36C-ATE.

ITEM 20 Convection Oven, Electric (1 Required)

A. Convection Oven, electric, half-section, single deck, Master 200 solid state controller with 1 hour timer.

B. Features and Characteristics:

1. (2) speed fan, porcelain enameled oven cavity, single door with glass, stainless steel front, top and sides.
2. 4" Stainless steel legs, 5.5 kW (Garland).
3. 208v/60/3-ph, 23 amps, direct.
4. 1 ea. Power cord set with plug.

C. Warranty: One year limited parts and labor warranty, covers products purchased and installed in the USA only, standard.

D. Product: Garland/US Range Model MCO-E-5-C.

ITEM 21 Stainless Steel Open Cabinet Base with Rack Guides (1 Required)

A. Stainless steel open cabinet base with rack guides and shelf, for extra rack and pan storage.

B. Product: Garland/US Range.

ITEM 22 Microwave Oven (1 Required)

A. Commercial Microwave Oven

B. Features and Characteristics:

1. Countertop, 1800 watts, medium volume, 5 power levels.
2. 10 menu pads with capacity to program 100 menus, X2 quantity pad, Braille touch pads.
3. Removable air filter.
4. S/S exterior, s/s interior w/sealed-in ceramic shelf, side hinged door, full 3-yr warranty.
5. 208-240v/60/1-ph, 2800 total watts, 13.5 amps, 5' cord and NEMA 6-20P, ETL.

C. Product: Amana® Model RFS18TS.

ITEM 23 Shelf, Microwave (1 Required)

A. Microwave Shelf, 24" x 24" 18 gauge type 430 stainless steel with marine edge on front, hole with black rubber grommet located toward the rear.

B. Product: Eagle Group Model MWS2424-X.

ITEM 24 Spare No.

ITEM 25 Spare No.

ITEM 26 Cabinet with Sinks (1 Required)

- A. Cabinet Base/3 Compartment Sink, 16 GA. 304 stainless steel, with hinged doors on left.
 - 1. With center shelf, open on right side, with backsplash and side splash.
 - 2. 1 ea. Power Force spout faucet, splash-mounted, 8" centers, swivel spout, 12" long.
 - 3. 3 ea. Lever Handle Drain, 1-1/2" or 2" NPS connection.
 - 4. Overall length appr. 10'-7"; field verify available wall-to-wall dimension.
- B. Custom Fabrication.

ITEM 27 Dishwasher, Undercounter (1 Required)

- A. Under counter Dishwasher
- B. Features and Characteristics:
 - 1. Hot water sanitization, detergent pump and factory mounted top and side panels.
 - 2. 19 Racks/Hr, one touch controls, rack guides.
 - 3. 7 KW Built-In booster, All s/s construction, 120/208(3W)/60/1.
- C. Warranty: 1 ea. Standard warranty - 1-Year parts, labor and travel time during normal working hours within the USA.
- D. Product: Hobart Model SR24H-8.

ITEM 28 Pot Rack, Wall-Mounted (1 Required)

- A. Double bar design, 48"L, with stainless steel single hooks, constructed of 3/16" x2" aluminum, NSF.
- B. Product: Eagle Group Model WM48APR-X.

ITEM 29 Rack Shelves (1 Required)

- A. Sorting Shelf
 - 1. 21" x 21", slanted, wall mounts.
 - 2. Drip tube on left side.
 - 3. Stainless steel construction.
- B. Product: Eagle Model 605380.

ITEM 30 Spare No.

ITEM 31 Spare No.

ITEM 32 Sink, Hand (1 Required)

- A. Hand Sink w/ stainless steel side splashes, 16" x 15" OA, wall mount w/bracket, 10" wide x 14" x 6" deep compartment.
 - 1. P-Trap and rear overflow, splash mount gooseneck faucet.

2. 1-1/2" Steel Construction, Wall Mount Hand Sink.

B. Product: Krowne Model HS-26.

ITEM 33 Demo Table (1 Required)

A. Demo Table, 36" x 36", 16 gauge type 304 stainless steel top with box marine edge all sides, tilting frame.

1. 24"W acrylic mirror, 304 stainless steel adjustable under shelf.
2. 1-5/8" OD stainless steel tubular legs, stainless steel adjustable feet.
3. Casters.

B. Custom Fabrication.

ITEM 34 Freezer, Reach-In, 2 Sections (1 Required)

A. Freezer, Reach-in, two-section, -10° F.

B. Features and Characteristics:

1. (6) Adjustable PVC coated shelves.
2. Stainless steel front and exterior.
3. Aluminum ends, white aluminum interior with stainless steel floor.
4. (2) Stainless steel full doors with locks.
5. Dial thermometer, 4" castors, 3/4HP, 115v/60/1-ph, 9' cord, NEMA 5-20P, 11 amps, cUL, CE, NSF, made in USA.
6. Self-contained refrigeration standard.
7. 1 ea. 4" Swivel castors, standard (adds 5" to OA height).
8. 1 ea. Left door hinged left, right door hinged right standard.

C. Warranty

1. 5 year compressor
2. 1 year parts and labor

D. Product: True Food Service Equipment Model T- 35F.

ITEM 35 Refrigerator, Reach-In, 2 Sections (1 Required)

A. Refrigerator, Reach-in, two-section, (6) shelves.

B. Features and Characteristics:

1. Stainless steel front and exterior, aluminum ends, white aluminum interior with stainless steel floor.
2. (2) Stainless steel full doors with locks.
3. Dial thermometer.
4. 1/2 HP, 115v/60/1-ph, NEMA 5-15P, 9.1 amps, ENERGY STAR®, made in USA.
5. Self-contained refrigeration.
6. 4" Swivel castors, standard (adds 5" to Over All height).
7. Left door hinged left, right door hinged right standard.
8. 1 ea. Full door bun tray rack.

- C. Warranty:
 - 1. 5 year compressor.
 - 2. 1 year parts and labor.

D. Product: True Food Service Equipment Model T-49.

ITEM 36 Dry Storage Shelving

- A. Dry Storage Shelving, 3 units
 - 1. 4 ea. Shelf, wire, 24" x 48", green epoxy finish with chromate substrate, NSF.
 - 2. 4 ea. Shelf, wire, 18" x 48", green epoxy finish with chromate substrate, NSF.
 - 3. 4 ea. Shelf, wire, 24" x 30", green epoxy finish with chromate substrate, NSF.
 - 4. 12 ea. Post 74", stationary, grooved at 1" intervals, includes leveling bolt and cap, green epoxy finish with chromate substrate, NSF.

- B. Products: Olympic Models J2448K, J1848K, J2430K, and J74K.

END OF SECTION 114000

SECTION 116133 - THEATRICAL RIGGING AND DRAPERY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. The work in this section includes but is not limited to furnishing and installing the following major elements and all associated accessories as indicated on the 'TE' series drawings.
 - 1. Consult and coordinate with other affected work and contractors throughout the course of the work contained herein.
 - 2. Dead-hung pipe grid
 - 3. Dead-hung lighting mounting pipes
 - 4. Hand-line operated traveler tracks with drapery
 - 5. Walk-draw operated drapery tracks with drapery
 - 6. Installation of roll-down projection screen
- B. Products Installed But Not Supplied Under This Section
 - 1. Roll down projection screen

1.3 RELATED SECTIONS

- A. Coordinate with all related sections of the specifications including, but not limited to:
 - 1. Division 01 – General Requirements
 - 2. Division 03 – Concrete for fastener requirements
 - 3. Division 04 - Masonry for fastener requirements
 - 4. Division 05- Metals for structural steel supporting the work of this section
 - 5. Division 09 – Finishes
 - 6. Division 11 – Equipment
 - a. Section 116163 – Theatrical Lighting Systems Dimming and Control
 - b. Section 116183 – Theatrical Audio Video Systems
 - 7. Division 23 – Mechanical for air supply/return devices
 - 8. Division 26 – Electrical for theatrical lighting wiring devices

1.4 REFERENCES

- A. References to code, standards, specifications and recommendations of technical societies, trade organizations and governmental agencies refer to the latest edition of such publications adopted and published prior to submittal of the bid. All such codes and standards will be considered a part of this specification as if they were fully included herein.
- B. If an applicable code or standard permits work of lesser quality or extent than this specification, this specification and the related drawings will govern.
- C. Comply with prevailing local codes, standards, and applicable Underwriters Laboratory standards.
- D. Comply with national, state and local labor regulations and requirements.

1.5 DEFINITIONS

- A. "Architect": All references to the "Architect", H&A Architects & Engineers will refer to the process by which the indicated action or decision regarding the work in this section will be administered. All such actions shall be initiated with or by the Architect, who will disseminate all pertinent information and documents to, as well as coordinate all efforts and site visits with, the Theater Consultant and all other project consultants who may have design responsibility relating to the work in this section.
- B. "Theater Consultant": Auerbach + Associates, Inc. (d.b.a. Auerbach Pollock Friedlander) The Theater Consultant will be party to all actions and decisions regarding the work in this section.
- C. "Other Project Consultants": Acoustical Consultant, Electrical Engineer, Structural Engineer, or Mechanical Engineer as is applicable to a particular issue.
- D. "Contractor": Manufacturer / Installer responsible for the fabrication and installation for the work contained in this section.
 - 1. Contractors involved with other work shall be indicated with a specific trade preceding the word "Contractor" (i.e. General, Electrical, etc.).
- E. "Owner": Authorized personnel representing the Miller Center, Lynchburg, Virginia.
- F. "Furnish": Purchase and/or fabricate and deliver to project site.
- G. "Install": Physically install the items in their proper location (s) on the project site.
- H. "Provide": Furnish and install.
- I. In all cases where a device or a part of equipment is referred to in a singular manner within the contract documents, it is intended that such a reference shall include all devices required to complete the installation in accordance with the project documents.

1.6 SYSTEM DESCRIPTION

- A. Provide a dead-hung pipe grid as shown on the drawings.
 - 1. The pipe grid is a rectilinear system comprised of 1-1/2" nominal I.D. steel pipes for equipment mounting arranged as shown on the drawings.
- B. Provide individual dead-hung lighting mounting pipes as shown on the drawings.
- C. Provide custom curved hand-line operated drapery tracks and drapery at the sides and front of the auditorium stage.
- D. Provide custom curved walk-draw operated tracks and drapery at the side / back surround of the auditorium stage.
- E. Provide straight walk-draw operated mirror masking tracks and drapery in the multiuse classroom / meeting room.
- F. Install a roll-down projection screen (provided under section 116183, Theatrical Audio Video Systems.)

1.7 SUBSTITUTIONS

- A. All requests for variations from the specified materials and products will be reviewed by the Architect according to the procedures outlined in Division 01.
- B. All requests for substitutions must be submitted in a timely manner, so as not to adversely impact the project schedule.
- C. Substitutions will only be accepted if, in the judgement of the Architect, the product is an equal to the specified product. No substitutions may be made without written acceptance from the Architect. All substitutions made prior to this acceptance are at the sole risk of the Contractor.
- D. A substitution must be a product of equal design, construction and performance. The Contractor must submit all pertinent information required to substantiate that the product is equal. The Contractor must submit all additional information, including test data, which may be requested in order for the Architect to fully evaluate the substitution. The burden of proof is solely on the Contractor.
- E. All additional expenses of any kind with respect to substitution(s) shall be borne by the Contractor. This shall include, but not be limited to, all fees and expenses incurred by the Architect and other related Consultants for evaluation of the substitution and subsequent integration into the project should the substitution be taken and/or additional costs of other contractors related to the substitution(s).

1.8 SUBMITTALS

- A. All submittals shall be submitted in accordance with Division 01 requirements. All submittals shall be submitted in a timely manner, allowing sufficient time for adequate review and possible re-submittals without jeopardizing the project schedule.
- B. Submittals must be reviewed, accepted and field dimension verified prior to proceeding with the fabrication of the work in this section. The Architect shall only mark one set of reproducibles per submittal with comments. Any additional sets of drawings or product data shall be returned unmarked.
- C. All submittals shall leave space available for review stamps and comments.
- D. Provide full insurance against loss or damage during shipment. Furnish certifications of such coverage to the Owner within 30 calendar days of contract award.
- E. Prior to fabrication, it shall be the responsibility of the contractor to provide a complete submittal for approval within 90 days of award of contract. Only one set of submittals will be stamped and marked, any additional sets will be returned, unmarked. This submittal shall include:
 - 1. A complete list of all draperies, indicating fabric types, fullness, color and sizes.
 - 2. Within 30 days of contract award, submit full bolt width (54") by 36-inch "quality" samples and color line swatches for all fabrics to be selected "by Architect". These samples will be approved and all colors selected prior to shop drawings submittals.
 - 3. Product Data:
 - a. Manufacturer's and Fabric Supplier's literature or cut sheets for each element of system.
 - b. Printed copy of operating instructions.
 - c. Color and style selections.
 - 4. Samples - Provide 12 inch square cutaway sample of drapery fabric and lining sewn adjacent to flameproofing certification on rear for use in Fire Marshal testing.

5. Certificates of flameproofing
- F. Submit samples for approval within 14 days of written request. These items may include, but are not limited to:
1. Pipe clamps, curved drapery track, fabric, standard hooks, swivels, ties or associated hardware.
 2. Pipe grid hanging hardware and connections, pipe grid junction hardware, drapery tracks and associated hardware.
- G. Product Data
1. Where standard manufactured parts are used, submit current product literature describing component, manufacturer's recommended applications, load ratings, safety factors and dimensions.
 2. Clearly indicate specific component and applicable options
 3. Manufacturer's and Fabric Supplier's literature or cut sheets for each element of system
 4. Copy of operating instructions
 5. Color and style selections
- H. Shop Drawings
1. Provide shop drawings on D size minimum (24 X 36) sheets.
 2. Include a cover sheet with a drawing index including the sheet number and title for each sheet in the set.
 3. Provide a minimum 4" x 4" area near the title block for review stamps and comments. This area shall be in relatively the same location on each sheet.
 4. Provide $\frac{1}{4}" = 1' - 0"$ scale plans of all locations which contain equipment in this contract based upon background drawings provided by the Architect. Show all equipment properly located dimensioned and labeled. Note all work by others in the vicinity, that may affect work in this contract. Include results of field measurements.
 5. Provide an inventory of all equipment to be supplied, including quantities, manufacturer's part number, reference to applicable drawings, etc.
 6. Provide complete, fully dimensioned, large scale detailed fabrication drawings of all major components.
 7. Provide requisite schematics, plans and sections indicating assembly and installation of components.
 8. Provide indications by arrow and boxed caption of all variations from contract drawings and specifications, except where variation is indicated as acceptable.
 9. Provide a complete list of all draperies indicating fabric types, fullness, color and size.
 10. Indicate all equipment with appropriate safety factors and/or safety equipment.
 11. Indicate Safe Working Load for each overhead element in the system.
 12. Indicate recommended load limits for each element in the system with loading requirements.
 13. Provide one-line riser diagram, power requirements and installation circuit diagrams for electrical equipment. Show all required wire sizes and counts between all components.
 14. All elements shall be engineered, approved and drawings stamped by a professional engineer licensed in the Commonwealth of Virginia. The engineer shall verify that the equipment supplied under this section meets or exceeds the design criteria of this specification.
- I. Closeout Submittals
1. At the time of acceptance testing, submit four (4) bound copies of parts lists and operations/maintenance instruction sheets.
 2. Within 60 days of the acceptance testing, submit one (1) set of reproducible "as built and approved" drawings showing all equipment as installed. These drawings shall include all adjustments made during the checkout process. In addition, submit all relevant product data sheets, manuals and as-built drawings as Adobe PDF files on a CD.

3. Submit operation and maintenance manuals with the "as built and approved" drawings. Each manual shall be bound in an individual binder with the project name on the front cover and system identification on the spine. The manuals shall include:
 - a. Complete parts list for all equipment and telephone numbers for the authorized parts and service distributors.
 - b. Instructions as to the safe operation for all equipment.
 - c. Recommended maintenance schedule for component parts that may need periodic replacement or maintenance.
 - d. Recommendations for cleaning, maintaining and touch-up of all finished surfaces.
 - e. Warranties as required in Division 01 – General Requirements.
4. Where specific elements do not require manuals, provide instruction sheets as to care and handling.
5. The record documents will be reviewed by the Architect and all modifications to the documents stemming from this review shall be made as required.
6. Above submissions are required as a condition for final approval of the work.

1.9 QUALITY ASSURANCE

A. Qualifications

1. All equipment and installation of the work in this section shall be the responsibility of a single Contractor, who shall own and operate its own shop for the fabrication of theatrical rigging equipment, and be regularly engaged in the fabrication of such equipment. Fabrication of such equipment shall comprise no less than 90% of the Contractor's business.
2. The Contractor shall have, at time of bid, a current Contractors License. This license shall be maintained throughout the course of work of this Contract.
3. Contractor shall be responsible for proper installation, operation and safety of all components and equipment. Equipment must be procured as specified. Non-specified items may be procured from any nationally recognized manufacturer.
4. Metalworking may be done by others. Responsibility in all respects shall be that of the Contractor.
5. The Contractor shall verify all system design loads.
6. The contractor's Project Manager shall be qualified and have experience in projects of similar size and scope. The Project Manager shall have binding authority to represent and act for the manufacturer of this equipment. The project manager shall be the primary conduit for all information between the supplier of this equipment and the general contractor. All information given to the Project Manager shall be considered as given to the manufacturer

B. Pre-installation Meetings: Reference Division 01, General Requirements for pre-installation meeting requirements.

C. State of the Art Development

1. The Contractor shall furnish only the latest developed appropriate product. In cases where product development from a specified manufacturer surpasses the criteria of this specification, the Contractor shall inform the Architect and make the newer product available to the project. In no case shall discontinued or obsolete equipment be acceptable. Should a newer product be suggested as a substitution for a discontinued product, or for a product that is in process of being phased out of production, that newer product shall be offered to the Owner at no additional cost.
2. Should product recall by the Manufacturer require temporary or permanent replacement of a product specified under this section, the Contractor shall notify the Owner at the earliest reasonable time and shall arrange to replace the product in question at the earliest possible time.
3. Equipment found defective or subject to recall prior to scheduled installation shall not be delivered to the jobsite.

4. Equipment defect or intended recall shall not relieve the Contractor from his contractual obligation with regard to delivery schedule of product. In this circumstance, notification shall be made to the Architect by express carrier. Arrangement for alternate product shall be made at this time.
5. Under no circumstances shall arrangement for alternate product necessarily require the Owner to accept superseded equipment except on a temporary basis.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Delivery, storage and handling shall be coordinated with the General Contractor and shall meet all requirements described in Division 01.
- B. Packing, Shipping, Handling, and Unloading
 1. All equipment shall be appropriately and substantially packed for shipment.
 2. All equipment containers shall clearly indicate the equipment contained, "front", "top", "fragile", the project name, and theater site allocation. Include packing and shipping lists for each container.
 3. All shipping costs to the job site are the responsibility of the Contractor. The shipping method/company is at the total discretion of the Contractor in order to meet the published project schedules.
- C. Acceptance at Site
 1. Coordinate responsibility for acceptance of material and equipment at job site with the General Contractor.
 2. The Contractor shall be responsible for acceptance of the Rigging System components at the job site, confirming that all quantities and counts are correct and for keeping accurate logs and records of such information.
- D. Storage and Protections
 1. Upon delivery, store the materials under cover in a clean and dry location, off the ground. Remove delivered materials which are damaged or otherwise not suitable for installation from the job site and replace with acceptable materials.
 2. Replace, at no additional cost to the Owner, all equipment and materials which are damaged during storage or handling.

1.11 PROJECT CONDITIONS

- A. Existing Conditions: Verify all conditions at job site. Promptly report variations and obstructions to the Architect. All additions and or corrections are to be requested prior to fabrication.
- B. Field Measurements
 1. Take field measurements prior to preparation of shop drawings to ensure proper fitting of work. Allow for adjustments during installation whenever taking field measurements.
 2. Should field measurement of site conditions alter the design or installation of system elements from the approved shop drawings, reissue revised shop drawings for review.

1.12 SEQUENCING AND SCHEDULING

- A. The installation of the equipment in this section shall begin following the completion of work that may be in conflict with the installation including, but not limited to:
 1. Structural upgrades
 2. Fire protection
 3. Mechanical systems
 4. Painting
 5. Application of acoustic materials

6. Stage floors

1.13 WARRANTY

- A. The Contractor shall warrant materials and workmanship of systems and equipment installed as free of defects. The Contractor shall guarantee in writing the repair or replacement within 14 days of any item found defective during a period of 1-year following date of final acceptance. Ordinary wear and defects due to improper usage may be excluded.
- B. During the warranty period, Contractor shall respond to all emergency conditions where systems failures may be hazardous or may cause severe hardship or cancellation of performances within 24 hours. Contractor shall undertake immediate action to ensure the safety of the audience and the performers.
- C. Refer to Division 01 – General Requirements.

1.14 SYSTEM START UP, OWNER'S INSTRUCTION, AND COMMISSIONING

- A. Operation Instruction
 1. Following the equipment demonstration, inspection and final adjustments, instruct the Owner's designated staff or representatives in the use, care and maintenance of all items.
 2. Deliver all copies of approved Operations Manual to Owner during instruction session, and review it as part of that session.
 3. Provide in-depth training of the user's staff in the operation and maintenance of all systems included herein.
 4. Provide six (6) hours of staff training on equipment and systems specified herein. This shall include basic safety in the use of the systems.
 5. All training shall be by technical staff of Theatrical Rigging System Contractor.

1.15 MAINTENANCE

- A. Extra Materials: Deliver stock of maintenance material to Owner. Furnish the following to match those installed and taken from the same production run, packaged with protective covering for storage and identified with appropriate labels.
 1. Furnish 12 compression sleeves of each type in the system.
 2. Furnish 4 shackles of each type in the system.
 3. Furnish 12 thimbles of each type in the system.
 4. Furnish 12 bolts and nylock nuts of each type in the system.
 5. Furnish 12 lockwashers of each type in the system.
 6. Furnish 1 master track carrier of each type in the system.
 7. Furnish 4 other track carriers of each type in the system.
 8. Furnish 4 turnbuckles of each type in the system.
- B. Pack and ship all fabric remnants from the manufacture of the theatrical draperies to the Owner as part of the theatrical drapery package.
- C. Maintenance Services
 1. One year following date of final acceptance, provide a factory engineer to examine, adjust and repair the equipment included in this sections as required. This service shall not cover adjustments, repairs or replacement of parts due to negligence, misuse, abuse or accidents caused by persons other than the Contractor. All labor and materials that are required to perform this service shall meet or exceed these specifications and shall not compromise the performance of the equipment in any way.

2. Following this inspection and maintenance service, provide the Owner and Theatre Consultant with a written report itemizing the results of the inspections and the warranty work, which was conducted. Include in this written report recommendations for any corrective actions that the Contractor feels should be taken with respect to the equipment included in this section, but are outside the scope of the warranty agreement.

PART 2 - PRODUCTS

2.1 CONTRACTORS

- A. The systems described herein shall be provided by a Theatrical Rigging Contractor who will be responsible for furnishing all services described herein including but not limited to coordination and supervision of the engineering, shop drawings, fabrication and provision for all systems specified herein and shown in the drawings.
- B. To establish comparative standards of quality, the theatrical rigging and drapery systems shall be by one of the following contractors.
 1. Barbizon Lighting Company
6437 G General Green Way
Alexandria, Virginia, 22312
(703) 750-3900
 2. Texas Scenic Company
611A Lofstrand Lane
Rockville, Maryland, 20850
(800) 292-7490
 3. I. Weiss
815 Fairview Avenue, Unit #10
Fairview, New Jersey, 07022
(888) 325-7192
- C. Contractor may install hardware as manufactured by the following, or an approved equal:
 1. Automatic Devices Company
 2. H & H Specialties Inc.
 3. J.R. Clancy, Inc.
 4. Texas Scenic Company
- D. Contractor may install drapery as manufactured by the following, or an approved equal:
 1. Gerriets International
 2. I. Weiss
 3. Rose Brand
 4. Stage Decoration and Supply
 5. Texas Scenic Company

2.2 MATERIALS

- A. General
 1. In all cases where a device or a part of equipment is referred to in a singular manner within the Contract Documents, it is intended that such a reference shall include all devices required to complete the installation in accordance with the Contract Documents.
 2. All equipment and components shall be new and complete. No used or reconditioned equipment shall be acceptable unless otherwise noted.
 3. All equipment to have pertinent labels.
- B. Materials shall conform to the following minimum standard specifications:
 1. AISI 1045 for steel shafts

2. ASTM A36 for structural steel shapes
3. ASTM A47 for malleable iron casting
4. ASTM A48 for gray iron casting
5. ASTM A1011 for side plates
6. ANSI B18.2.1&2 for square and hex bolts and nuts

C. Hardware

1. Include all mounting hardware.
2. All bolts and fasteners must be Grade 5 or better.
3. All bolted attachments to have lock washers or other self-locking fasteners.

D. Design Factors: Design all overhead rigging elements including but not limited to mounting hardware, wire rope, wire rope fittings, and shackles with a mechanical safety factor of 10X of their rated breaking strength.

2.3 PIPE GRID

A. Provide pipe grids as shown on the contract drawings. Pipe battens shall be 1½" nominal diameter Schedule 40 black steel pipe as per standard industry practice.

B. All hardware to be finished with flat black matte epoxy paint.

C. Pipe splices to be 18" close fitted internal sleeves secured by two (2) bolts perpendicular to floor on each side of joint. ¼" x 20 cap screws through-bolted with nylock nuts. Holes 6" on center, 3" from ends.

D. Provide rigid supports to overhead structure as shown in drawings and as required to meet specified loading criteria as well as local seismic codes. Confirm final support design with structural engineer.

E. Provide lateral support to building structure as shown in drawings and as required to meet specified load criteria.

1. Grid wall flange SSRC #WF or equal

F. Load criteria

1. 30 lbs/lin. ft. uniform load.
2. 90 lbs. maximum point loads at center of spans.
3. Maximum working load is 2 tons.

G. Pipe grid hangers:

1. Full batten clamp
2. Rated hot dip galvanized jaw/ open thread turnbuckle with 6" of take-up, locking hardware and safety wire mouse (after adjustment)
3. Threaded rod sized as appropriate for load / safety factor
4. Bolted connection through tube or Unistrut beam spanning existing 2x12 ceiling joists

H. Pipe grid junction connections:

1. Provide J.R. Clancy or SSRC full cross grid connector, or approved equal
2. Pipe grid junction connections shall be located at all grid pipe junctions.

2.4 DEAD-HUNG LIGHTING MOUNTING PIPES

A. Provide dead-hung pipes as shown on the contract drawings in the Auditorium.

- B. Pipe battens shall be 1½" nominal diameter Schedule 40 black steel pipe as per standard industry practice.
- C. All hardware to be finished with flat black matte epoxy paint.
- D. Pipe splices to be 18" close fitted internal sleeves secured by two (2) bolts perpendicular to floor on each side of joint. ¼" x 20 cap screws through-bolted with nylock nuts. Holes 6" on center, 3" from ends.
 - 1. Pipe splices shall be located within 1'-0" of pipe hanger.
- E. Provide rigid supports to overhead structure as shown in drawings and as required to meet specified loading criteria as well as local seismic codes. Confirm final support design with structural engineer.
- F. Load criteria
 - 1. 30 lbs/lin. ft. uniform load.
 - 2. 90 lbs. maximum point loads at center of spans.
- G. Pipe hangers:
 - 1. Full batten clamp
 - 2. Rated hot dip galvanized jaw/ open thread turnbuckle with 6" of take-up, locking hardware and safety wire mouse (after adjustment)
 - 3. Threaded rod sized as appropriate for load / safety factor
 - 4. Bolted connection through tube or Unistrut beam spanning existing 2x12 ceiling joists

2.5 CURVED HAND-LINE OPERATED DRAPERY TRACK ASSEMBLY

- A. Furnish and install tracks for the mirror masking drapery, as indicated on Drawings complete with all necessary accessories (CWANA).
 - 1. Horizontal diverter for operating shall be used at the live end to locate operation location away from track as shown on the drawings.
- B. Provide all attachment hardware to mount curtain track to ceiling joists or pipe grid, as shown on the drawings.
- C. Track
 - 1. Track to be black enamel painted or black anodized extruded aluminum formed to follow curve shown on the drawings.
 - 2. Track to be designed to allow hand lines to be routed internally through track extrusion.
 - 3. Track assemblies to be single piece, free of burrs, dents or irregularities.
 - 4. Hanger fittings and clamps for attachment to pipe batten spaced at 4'-0" on center maximum.
 - 5. Drapery track shall be ADC Tripl-I-Trac 420 series, 4200BL track, 520 nylon wheel system, or better.
- D. Carriers
 - 1. Provide master carrier with two (2) nylon tired-ball-bearing wheels.
 - 2. Provide single carriers with two (2) nylon tired-ball-bearing wheels.
 - 3. One single carrier for each 1'-0" of curtain length.
- E. Hand Lines: Each hand line to be a single length, first quality, 3/8" diameter black braided cotton cord.

2.6 CURVED WALK-DRAW TRACK ASSEMBLIES

- A. Furnish and install tracks for the mirror masking drapery, as indicated on Drawings complete with all necessary accessories (CWANA).
- B. Provide all attachment hardware to mount curtain track to pipe grid and ceiling joists, as shown on the drawings.
- C. Track
 1. Track to be black enamel painted extruded aluminum formed to follow curve shown on the drawings for the stage surround drapery.
 2. Track assemblies to be single piece, free of burrs, dents or irregularities.
 3. Hanger fittings and clamps for attachment to pipe batten spaced at 4'-0" on center maximum.
 4. Drapery track shall be ADC Tripl-I-Trac 420 series, 4200BL track, 520 nylon wheel system, or better.
- D. Carriers
 1. Provide master carrier with four (4) nylon tired-ball-bearing wheels.
 2. Provide single carriers with two (2) nylon tired-ball-bearing wheels.
 3. One single carrier for each 1'-0" of curtain length.
- E. Hand Lines: Each hand line to be a single length, first quality, 3/8" diameter black braided cotton cord.

2.7 STRAIGHT WALK-DRAW TRACK ASSEMBLIES

- A. Track
 1. Track to be medium-duty black anodized channel type, 12 gauge extruded aluminum formed to provide parallel double tracks for carrier wheels and totally enclosed except for bottom carrier slot.
 2. Track assemblies to be single piece, free of burrs, dents or irregularities.
 3. Hanger fittings and clamps for attachment to pipe batten spaced at 4'-0" on center maximum.
 4. Drapery track shall be ADC Silent Steel 280 series, 2800ABL track, 384-R neoprene wheel system, or better.
- B. Carriers
 1. Provide master carrier with manual walk-along rope pull line for each section of drape. Master carriers with four (4) paired neoprene wheels with ball bearings.
 2. Single carriers to have two (2) neoprene wheels with ball bearing with "hollow center" design to bypass the operating line.
 3. One single carrier for each 1'-0" of curtain length.
- C. Pull-lines: Each pull-line to be a single length, first quality, 3/8" diameter black braided cotton cord.

2.8 DRAPERY FABRIC, MAIN CURTAIN, MASKING DRAPERY, MIRROR MASKING DRAPERY

- A. The face material of the stage masking curtains shall meet or exceed the following criteria:
 1. 100% cotton velour
 2. 21 oz. per lineal yard (per 54" bolt width)
 3. 41 backing ends per inch
 4. 20 pile ends per inch

5. 30 picks per inch
6. 702 pile tufts per square inch
7. 83/1000 inch pile height
8. Acceptable products:
 - a. JB Martin "#5600 Bolero"
 - b. KM Fabrics "Majestic"
 - c. Gerriets International "Clivia 54"
 - d. Approved equal by DeBall

- B. The color of all stage masking draperies shall be chosen by the Architect from the manufacturer's standard color choices.
- C. Sew with nylon thread or cotton thread. Color to match face material. Thread shall have no apparent sheen with relationship to the velour.
- D. Side edges of drapery panels are to be faced back with at least 2" hems. Hand-tack entire height with continuous catch stitching spaced 4" apart.
- E. Tops reinforced with 3½" black webbing with black snap hooks, 12" O.C.; double snap hooks at both ends. Center snap hooks on webbing. Provide double layer of webbing (3½" square) at each snap hook.
- F. Bottoms of all floor-length maskings to have 6" double-turned hems with #8 zinc coated chain in separate pocket inside hem. Weight pocket to be 1" short of finished hem. Ends of weight pockets to be secured with 1" wide black hook-and-loop fastener for the full height of the pocket opening.
 1. Weights shall be shipped separately from draperies and installed in weight pockets in the field.
 2. A pull-line or tape shall be placed within each weight pocket prior to shipping. The pull line shall be provided to facilitate installation of weights in the field.

2.9 DRAPERY FABRICATION

- A. Construction to conform to the best trade practices and to the requirements outlined herein.
- B. Each drapery to have identification tag sewn to the webbing at the upper edge of the goods, offstage corner. Identification tag should contain the following information:
 1. Manufacturer's Name
 2. Manufacturer's Date
 3. Finished size of goods
 4. Recommended cleaning instructions
- C. Fabric runs to be full height without joints or intermediate seams.
- D. In no case shall a seam between fabric runs fall directly at the finished end of a piece of goods. Provide 1'-0" minimum from end of goods to a seam, either on the front or back face.
- E. Nap of velour sewn down unless otherwise specified.
- F. Allow for final hang-out and trimming.

2.10 FINISHES

- A. Machine-finish all operating parts to standard trade tolerance, fits and finishes.

2.11 SOURCE QUALITY CONTROL

- A. All equipment and components shall be factory tested prior to shipping.

PART 3 - EXECUTION

3.1 INSTALLERS

- A. The work on this section shall be installed by an experienced installer in the employ of the Contractor for the equipment in this section.

3.2 EXAMINATION

- A. Site Verification of Conditions: Examine areas and conditions under which the equipment is to be installed and notify the General Contractor in writing of conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in an acceptable manner.

3.3 ERECTION, INSTALLATION, APPLICATION

- A. Install all work in this section in accordance with the Architect's direction, specifications, approved shop drawings, pertinent Contract Drawings, established trade practices and applicable code requirements.
- B. Install all work securely, complete with all bolts, nuts, washers, clips, fittings, supports, and other items required for proper installation and operation.
- C. Position all items accurately as indicated on Drawings and true to plumb, line and level. Maintain maximum headroom and clearances at all points.
- D. Coordinate work with all other trades to avoid causing delays in construction schedule.
- E. All field welding requires prior approval of the Architect and Contractor's Structural Engineer.
- F. Perform approved field welding in full accordance with the appropriate sections of "Specifications for the Design, Fabrication and Erection of Structural Steel Buildings" of the American Institute of Steel Construction (AISC).
- G. Perform all cutting, drilling, tapping and approved welding required to properly install work. Obtain Architect's prior approval for cutting and drilling of existing structural work.
- H. Clean structural steel and fabricated steelwork of rust, scale and foreign matter by grinding; prime with one (1) coat of chromated primer; finish with one (1) coat of first quality machinery enamel free of skips, runs and saps. Touch up all field connections, welds and abraded places with primer and enamel.

3.4 FIELD QUALITY CONTROL

- A. Site Tests, Inspection
 1. The installation of the equipment indicated in this section shall be supervised by qualified personnel who are regularly employed by the Contractor for supervision of equipment installation similar to that indicated herein.
 2. Arrange for all tests and inspections required by the General Conditions.

3.5 ADJUSTING

- A. Adjust all equipment and components for operation in accordance with the specifications, approved shop drawings and pertinent Contract Drawings prior to the demonstration indicated herein.

3.6 CLEANING

- A. Touch up minor abrasions and imperfections as required.
- B. Remove all unnecessary equipment and materials from the area(s) of this work upon completion; remove from the job site and dispose of legally at no additional cost to the Owner.

3.7 DEMONSTRATION

- A. Installed equipment to be inspected for quality by the Architect and the Owner.
- B. Make adjustments or modifications as directed by the Architect and the Theatre Consultant.
- C. Following the equipment demonstration, inspection and final adjustments, instruct the Owner's designated staff or representatives in the use, care and maintenance of all items. Provide minimum six (6) hours of staff training.
- D. Schedule tests and instruction in conformance with project construction schedules and the availability of the Architect and the Owner.
- E. Cost of re-inspection and additional testing by the Architect or Theatre Consultant, if required, due to lack of completion and/or errors and omissions shall be paid by the Contractor or the General Contractor respective to the area of work concerned. This work will be conducted on a time and materials basis, including standard hourly rates, and shall be scheduled and approved in writing prior to the re-inspection/testing session between the Architect, Theatre Consultant, the Owner, and the contractor(s). All travel expenses, if required, shall be provided.

3.8 PROTECTION

- A. Take suitable precautions to protect the equipment in this section from damage after installation and prior to acceptance by the Owner.

END OF SECTION 116133

SECTION 116163 - THEATRICAL LIGHTING DIMMING AND CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and General Requirements

1.2 SUMMARY

- A. The work in this section includes, but is not limited to, furnishing and commissioning the following major elements and all associated accessories as indicated on the 'TL' series drawings.
 - 1. Consult and coordinate with other affected work and contractors throughout the course of the work contained herein.
 - 2. Theatrical and Architectural dimmers and equipment racks
 - 3. Auxiliary equipment/electronics racks
 - 4. Theatrical lighting relay panels
 - 5. Architectural lighting emergency transfer panels
 - 6. Lighting systems computers
 - 7. Theatrical lighting Ethernet data networks
 - a. Network racks
 - b. Network components
 - c. Network devices
 - d. Network receptacles
 - 8. Theatrical lighting control consoles and peripherals
 - a. Theatrical control panels and receptacles
 - b. Video display monitors
 - 9. Architectural lighting control systems
 - a. House lighting controls
 - b. Architectural control panels and receptacles
 - 10. Theatrical lighting wiring devices
 - 11. Extension cables
- B. Products installed but not supplied under this section: The work of this section includes supervision of the termination of all control wiring in panels and racks. All control cabling related to this section shall be installed under Division 26.
- C. Products furnished But Not Installed Under This Section: All infrastructure and installed equipment shall be installed and terminated under Division 26.
 - 1. Portable or system peripheral equipment shall be installed under this section.

1.3 RELATED SECTIONS

- A. Coordinate with all related sections of the specifications including, but not limited to:
 - 1. Division 01 – General Requirements
 - 2. Division 03 – Concrete for fastener requirements
 - 3. Division 04 - Masonry for fastener requirements
 - 4. Division 05 - Metals for structural steel supporting the work of this section
 - 5. Division 09 – Finishes
 - 6. Division 11, Equipment
 - a. Section 116133 - Theatrical Rigging and Drapery
 - b. Section 116183 – Theatrical Audio Video Systems
 - 7. Division 23 – Mechanical

8. Division 26 – Electrical
 - a. Conduit, wire, pull boxes, junction boxes and miscellaneous hardware and components as required for a complete electrical installation.
 - b. Terminations and testing of system continuity
 - c. Architectural LED fixture, dimming and emergency bypass
 - d. Section 265561, Theatrical Systems Electrical Installation

1.4 REFERENCES

- A. References to code, standards, specifications and recommendations of technical societies, trade organizations and governmental agencies refer to the latest edition of such publications adopted and published prior to submittal of the bid. All such codes and standards will be considered a part of this specification as if they were fully included herein.
- B. If an applicable code or standard permits work of lesser quality or extent than this specification, this specification and the related drawings will govern.
- C. Comply with prevailing local codes.
- D. Comply with applicable national, state and local labor regulations and requirements.
 1. NEC: National Electric Code
 2. UL: Underwriters Laboratories
 3. IEEE: Institute of Electronic and Electrical Engineers
 4. IESNA: Illuminating Engineering Society of North America
 5. ANSI: American National Standards Institute
 6. AISC: American Institute of Steel Construction
- E. Equipment shall have pertinent labels.

1.5 DEFINITIONS

- A. "Architect": All references to the "Architect", H&A Architects & Engineers will refer to the process by which the indicated action or decision regarding the work in this section will be administered. All such actions shall be initiated with or by the Architect, who will disseminate all pertinent information and documents to, as well as coordinate all efforts and site visits with, the Theater Consultant and all other project consultants who may have design responsibility relating to the work in this section.
- B. "Theater Consultant": Auerbach + Associates, Inc. (d.b.a. Auerbach Pollock Friedlander) The Theater Consultant will be party to all actions and decisions regarding the work in this section.
- C. "Other Project Consultants": Acoustical Consultant, Electrical Engineer, Structural Engineer, or Mechanical Engineer as is applicable to a particular issue.
- D. "Contractor": Manufacturer / Installer responsible for the fabrication and installation for the work contained in this section.
 1. Contractors involved with other work shall be indicated with a specific trade preceding the word "Contractor" (i.e. General, Electrical, etc.).
- E. "Owner": Authorized personnel representing the Miller Center, Lynchburg, Virginia.
- F. "Furnish": Purchase and/or fabricate and deliver to project site.
- G. "Install": Physically install the items in their proper location (s) on the project site.
- H. "Provide": Furnish and install.

- I. In all cases where a device or a part of equipment is referred to in a singular manner within the contract documents, it is intended that such a reference shall include all devices required to complete the installation in accordance with the project documents.

1.6 STATE OF THE ART DEVELOPMENT

- A. The successful Manufacturer shall supply only the latest developed appropriate product. In cases where product development from a specified manufacturer surpasses the criteria of this specification, the Manufacturer shall inform the Architect and make the newer product available to the project. In no case shall discontinued or obsolete equipment be acceptable. Should a newer product be suggested as a substitution for a discontinued product, or for a product that is in process of being phased out of production, that newer product shall be offered to the Owner at no additional cost. The same requirement applies to control console programs developed/updated during the warranty period.
- B. Should product recall by the Manufacturer require temporary or permanent replacement of a product specified under this section, the Manufacturer shall notify the Owner at the earliest reasonable time and shall arrange to replace the product in question at the earliest possible time.
 1. Equipment found defective or subject to recall prior to scheduled installation shall not be delivered to the jobsite.
 2. Equipment defect or intended recall shall not relieve the Manufacturer from his contractual obligation with regard to delivery schedule of product. In this circumstance, notification shall be made to the Architect by fax and express carrier. Arrangement for alternate product shall be made at this time.
 3. Under no circumstances shall arrangement for alternate product necessarily require the Owner to accept superseded equipment except on a temporary basis.

1.7 SUBSTITUTIONS

- A. All requests for variations from the specified materials and products will be reviewed by the Architect according to the procedures outlined in Division 01.
- B. All requests for substitutions must be submitted in a timely manner, so as not to adversely impact the project schedule.
- C. Substitutions will only be accepted if, in the judgment of the Architect, the product is an equal to the specified product. No substitutions may be made without written acceptance from the Architect. All substitutions made prior to this acceptance are at the sole risk of the Manufacturer.
- D. A substitution must be a product of equal design, construction and performance. The Manufacturer must submit all pertinent information required to substantiate that the product is equal. The Manufacturer must submit all additional information, including test data, which may be requested order for the Architect or Architect's sub-consultant to fully evaluate the substitution. The burden of proof is solely on the Manufacturer.
- E. All additional expenses of any kind with respect to substitution(s) shall be borne by the Manufacturer. This shall include, but not limited to, all fees and expenses incurred by the Architect and other related Architect's sub-consultants for evaluation of the substitution and subsequent integration into the project should the substitutions be taken and/or additional cost of the other contractors related to the substitution(s).

1.8 SUBMITTALS

- A. All submittals shall be submitted in a timely manner, allowing sufficient time for adequate review and possible resubmittals without jeopardizing the project schedule.
- B. All submittals shall leave 4" x 4" space available for review stamps and comments.
- C. Submittals must be reviewed and accepted prior to proceeding with the fabrication of the work in this section. The Architect and Architect's sub-consultants will only mark one set of documents per submittal with comments. Any additional sets of drawings or product data will be returned unmarked,
- D. Review all pertinent project Contract Documents. Following this review, provide to the Architect and Construction Manager any additional information required to make a fully functioning system. In addition, the Manufacturer shall indicate the maximum accepted wire size as it relates to termination points on their equipment.
- E. Product Data: Submit catalog or standard data sheets for component parts as part of the shop drawing submittal. The data shall include all information, which indicates compliance with the specifications herein. Clearly indicate the manufacturer of each component and part.
- F. Bill of Materials: Submit a full Bill of Materials indicating quantity, products, manufacturer and manufacturer's part numbers.
- G. Verify wire type, count and routing for all required low voltage wire sizes between all components for conduit sizing and routing by Division 26. Verify and coordinate all line voltage power input required by systems components that shall be provided under Division 26.
- H. Shop Drawings
 - 1. Provide shop drawings on C size minimum (24 X 36) sheets.
 - 2. Include a cover sheet with a drawing index including the sheet number and title for each sheet in the set.
 - 3. Provide an inventory of all equipment to be supplied, including quantities, manufacturer's part number, reference to applicable drawings, etc.
 - 4. Provide complete, fully dimensioned, large-scale detailed drawings of all major components. Include results of field measurements.
 - 5. Provide requisite schematics, plans and sections indicating assembly and installation of components.
 - 6. Provide indications by arrow and boxed caption of all variations from contract drawings and specifications, except where variation is indicated as acceptable.
 - 7. Provide detailed one-line riser diagrams and installation circuit diagrams indicating all control and/or data electrical requirements and point to point connections. These shall be submitted within 30 days of Contract Award.
- I. Samples: Submit samples for approval of the following.
 - 1. Panel engraving or silk screen.
 - 2. Distribution device engraved lamacoid label showing attachment method.
- J. Additional samples shall be submitted within 14 days of Architect's written request.
- K. Project Record Documents:
 - 1. Submit documents in accordance with Division 01 and as specified herein.
 - 2. At the time of acceptance testing, submit three (3) bound copies of parts lists and operation/maintenance instruction sheets.

3. Within 60 days of the acceptance testing, submit one (1) complete set of "as built drawings" of the final state of the installed system to the Owner. These drawings shall include all adjustments made during the checkout process.
4. Provide three (3) bound complete sets of all system electrical schematics to the Owner.
5. Provide three (3) bound complete sets of all pertinent systems operation and maintenance manuals to the Owner.
6. Provide one (1) complete set of all relevant warranty information to the Owner.

1.9 QUALITY ASSURANCE

- A. Provision of all equipment and services under this section shall be the responsibility of a single Manufacturer as specified herein.
- B. Qualifications:
 1. The Manufacturer shall own and operate its own manufacturing facility for the fabrication of theatrical lighting dimming and control equipment, and be regularly engaged in the fabrication of such equipment. Fabrication of such equipment shall comprise no less than 90% of the Manufacturer's business.
 2. The Manufacturer shall have been continuously engaged in the manufacturing of theatrical lighting dimming and control systems for at least five years.
 3. The Manufacturer shall maintain a full-time factory employed field engineering staff available in the Western Virginia area on an emergency basis of at least two people trained in electronic lighting control systems and Ethernet systems services.

1.10 DELIVERY, STORAGE AND HANDLING

- A. Delivery, storage and handling shall be coordinated with the General Contractor and shall meet all requirements described in Division 01.
- B. Packing, Shipping, Handling & Unloading:
 1. Pack all equipment appropriately and substantially for shipment.
 2. All equipment containers shall clearly indicate the equipment contained, "front", "top", "fragile", and the project name and theatre site allocation. Include packing and shipping list for each container.
 3. All shipping costs to the job site are the responsibility of the Manufacturer. The shipping method/company is at the total discretion of the Manufacturer in order to meet the published project schedules.
- C. Acceptance at Site
 1. Delivery of all materials shall be coordinated with the General Contractor.
 2. The Manufacturer shall be responsible for acceptance of the Lighting System components at the jobsite, confirming that all quantities and counts are correct and for keeping accurate logs and records of such information.

1.11 PROJECT / SITE CONDITIONS

- A. Existing Conditions: Verify all conditions at jobsite. Promptly report variations and obstructions to the Architect. All additions and or corrections are to be requested prior to fabrication.
- B. Field Measurements
 1. Take field measurements prior to fabrication to ensure proper fitting of work. Allow for adjustments during installation whenever taking field measurements.
 2. Should field measurement of site conditions alter the design or installation of system elements from the approved shop drawings, reissue revised shop drawings for review.

1.12 SEQUENCING AND SCHEDULING

- A. The installation of the lighting system wiring devices shall not occur until all painting in the area has been completed.
- B. Do not install computer grade network components, dimmer rack processors and modules, and any other equipment sensitive to construction debris and dust in any space until doors and any windows are installed, all dust producing construction and finishing is completed and all debris and dust has been removed,. Typical "office" cleanliness shall be required in rooms in which computer grade equipment is to be installed.
- C. The unpacking and installation of theatrical lighting consoles and peripheral devices shall not occur until the control room is secure and climate controlled.

1.13 WARRANTY

- A. The Manufacturer shall warrant materials and workmanship of systems and equipment installed as free of defects. The Manufacturer shall guarantee in writing the repair or replacement within 14 days of any item found defective during a period of 2-years following date of final acceptance. Ordinary wear and defects due to improper usage are excepted and are not covered under Manufacturer's warranty.
- B. During the warranty period, respond to all emergency conditions where systems failures may be hazardous or may cause severe hardship or cancellation of performances within 24 hours. Take immediate action to ensure the safety of the audience and the performers.

1.14 SYSTEM STARTUP, OWNER'S INSTRUCTIONS & COMMISSIONING

- A. Operation Instruction:
 - 1. Instruct Owner and Owner's operating personnel on operation and care of system for not less than eight hours total in two (2) separate training sessions. Instruction shall include, but not be limited to, proper general maintenance of the system, replacement procedures for user replaceable parts and operating procedure to obtain maximum usage of system.
 - 2. Deliver all copies of approved Operations Manual to Owner prior to first instruction session, and review it as part of that session.
 - 3. The first session shall take place in the presence of the Architect or Architect's sub-consultant, and shall occur directly after finish of Completion Checkout. If Owner, Architect judge that any work inspected fails to conform to the specification, or is not substantially complete at time of Completion Checkout, postpone instruction session until Owner and Architect judge the entire Lighting System to conform with specification.
 - 4. The second session shall occur at a time arranged by the Owner no sooner than one (1) day and no later than one (1) month after first session.
- B. Console Operator Instruction: Instruct Owner or Owner's selected key Lighting Control Console Operators on the detailed operation of Console. This training shall take place in two (2) separate sessions. Each session shall be no less than four hours and shall take place on site.
- C. Timing for all sessions shall be scheduled by the Owner at its convenience.
- D. Instruction must be by qualified expert operators who have actual experience with systems in performance conditions. Submit instructor's qualifications to the Architect for approval at least two (2) weeks prior to Completion Checkout. If the Architect rejects instruction personnel, schedule new instruction sessions with instructor(s) pre-approved by the Architect.

1.15 MAINTENANCE

A. Maintenance Service

1. One year following date of final acceptance, provide a factory engineer to examine, adjust and repair the equipment included in this section is found to require warranty work prior to the end of the warranty period. This service shall not cover adjustments, repairs or replacement of parts due to negligence, misuse, abuse or accidents caused by persons other than the Manufacturer. All labor and materials which are required to perform this service shall meet or exceed these specifications and shall not compromise the performance of the equipment in any way.
2. Following this inspection and maintenance service, the Manufacturer shall provide the Owner and Theatre Consultant with a written report itemizing the results of the inspections and the warranty work, which was conducted. The Manufacturer shall also include in this written report recommendations for any corrective actions which the Manufacturer feels should be taken, with respect to the equipment included in this section, but are outside the scope of the warranty agreement.

B. Extra Materials: Deliver stock of maintenance material to Owner. Furnish the following to match those installed and taken from the same production run, packaged with protective covering for storage and identified with appropriate labels.

1. Provide four (4) spare dimmer modules for each type of dimmer module in the system.
2. Provide one (1) spare node or complete internal components of each type of node in the system.
3. Provide four (4) circuit breakers of each size in the system.
4. Provide a package of spare parts for all user serviceable portions of the dimmer and control systems and distribution apparatus.
 - a. Provide 10% of total quantity of each type of small component or part in system as spare parts (minimum of one).
 - b. Label all spare parts with Manufacturer's part number, designation and description, and location(s) where used.
 - c. Provide durable, clearly labeled, storage containers for all spare parts, including special static free containers for electronically sensitive parts.
 - d. Quantity - Package shall include, but not be limited to:
 - 1) Five (5) 4GB USB flash drives or other appropriate data storage medium.
 - 2) One (1) spare of each pushbuttons, pushbutton lamps, pushbutton caps of each color, key switches.
 - 3) Knobs, handles, nuts, bolts, screws, fuses, fuse holders, indicator lights and SSR assemblies.
 - 4) Caps, screws, crimp connectors and crimping tool, stage pin plugs, multipin connector spare parts, nuts and washers.
 - 5) Six (6) pilot lights, two LED array of each type in the system.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. The systems described herein shall be provided by a Theatrical Lighting Manufacturer who will be responsible for furnishing all services described herein including but not limited to coordination and supervision of the engineering, shop drawings, fabrication and provision for all systems specified herein and shown in the drawings.
- B. Primary dimming and theatrical control shall be by a single manufacturer, one of the following:
 1. Electronic Theatre Controls
3030 Laura Lane
Middleton, Wisconsin 53562
(800) 688-4116

2. Strand Lighting
10911 Petal Street
Dallas, Texas 75238
(214) 647-7970

- C. The Manufacturer's services may be provided through a local authorized dealer and servicer of all of the equipment specified herein.
 1. The local authorized dealer shall maintain a full-time Manufacturer trained and certified field engineering staff of at least two people available in the western Virginia area on an emergency basis. Staff shall employed by the local authorized dealer and be trained in electronic lighting control systems and Ethernet systems services.
 2. The local authorized dealer shall have been in the theatrical lighting distribution and installation business continuously for a minimum of five years and shall have provided complete engineering and installation services on a minimum of five (5) jobs of similar scope in the past five years.
 3. To establish comparative standards of quality, the equipment of the theatrical lighting systems shall be by one of the following authorized dealers.
 - a. Barbizon Lighting Company
6437 G General Green Way
Alexandria, Virginia, 22312
(703) 750-3900
 - b. Texas Scenic Company
611A Lofstrand Lane
Rockville, Maryland, 20850
(800) 292-7490
 - c. Vincent Lighting
920 Vista Park Drive
Pittsburgh, Pennsylvania, 15205
(800) 922-5356
- D. Manufacturer shall provide the Warranty and Maintenance services specified herein.
- E. Manufacturer shall engineer, design, produce shop drawings and fabricate all custom equipment required in this section.

2.2 GENERAL

- A. All equipment and components shall be new and complete. No used or reconditioned equipment shall be acceptable.
- B. Include all mounting hardware.
 1. All bolts and fasteners required to mount equipment to mounting hardware shall be Grade 5 or better.
- C. All equipment and components shall be factory tested prior to shipping.
- D. All bolted attachments shall have lock washers or other approved self-locking hardware.
- E. All internal wiring shall be factory completed and clearly marked. All field connections shall be by connector, terminal strip or other device specified herein. Any terminal strip connections shall be clearly labeled as to terminal designation.

- F. All wire sizes and insulation shall comply with NEC, NFPA and UL standards and all other applicable national and local codes.
- G. All wiring to be harnessed and bound. No loose or randomly routed wires shall be permitted.
- H. All control wire counts shall include 10% spares.
- I. All microprocessor controls shall utilize a non-volatile memory. System configuration, operating parameter, preset, etc. shall be protected against system power failure for a minimum of 48 hours.
- J. Systems components shall be modular in nature. Individual dimming modules shall slide in and be easily disconnected from power and removed from the rack without disturbing adjacent components and shall require no special tools for these tasks. Control circuitry shall be contained on plug-in printed circuit cards. Plug-in circuit cards shall be individually removable without disturbing adjacent components.
- K. All fixed components including dimmer modules, non-dim modules, circuit breakers, and cabinets shall be labeled sequentially for ease of maintenance.
- L. No manufacturer's logo shall appear on control station faceplates or any other device located in public areas.
- M. Supplementary or auxiliary equipment necessary for the operation of the system shall be supplied with overload and short-circuit protection.

2.3 DIMMER RACKS AND DIMMER MODULES

- A. Provide theatrical dimming equipment as indicated on the drawings, drawing schedules and specified herein. The dimmers and dimmer racks shall be one of the following:
 - 1. Theatrical and House lighting racks and dimmers:
 - a. ETC Sensor+ Racks and 500 microsecond rise AF dimmers.
 - b. Strand Lighting C21 500 microsecond rise dimmers.
- B. Dimmer Equipment Racks:
 - 1. The entire dimmer rack assembly shall be UL listed. Rack finishes shall be manufacturer's standard baked enamel color.
 - 2. Dimmer racks shall be floor mounted, dead front switch boards complete with all dimmers, control electronics, timers, circuit breakers, and wiring terminations. No external components shall be required.
 - 3. Dimmer slots shall be sequentially numbered and labeled on both sides of the dimmer slots.
 - 4. Each dimmer rack shall be labeled as indicated on the drawings or as listed in dimmer schedules. Engrave and fill or silk-screen labels.
 - 5. Dimmer racks shall be completely wired internally by the Manufacturer. The Electrical Contractor shall provide input feed wiring, load wiring, low voltage wire pulls and individual cabinet disconnects. All terminals shall be clearly and permanently marked and numbered.
 - 6. Dimmer racks shall be constructed of #14 or #16 US gauge cold rolled sheet steel.
 - 7. Provide access panels or knockouts for bottom feed and top load/control wires.
 - 8. All internal components shall be accessible from the front for testing and adjusting while system is operating. No rear access shall be needed for installation or future service.
 - 9. Power distribution shall be by copper buss bars. Aluminum buss bars are not acceptable.
 - 10. Theatrical and Architectural dimmer racks shall be 120/208 volt, 3 phase, 4 wire, size for minimum 600-amp feeds, as indicated on Division 26 contract documents.

11. Theatrical and architectural dimmer rack load, neutral and ground terminals shall accept up to #2 AWG wire.
12. Individual rack disconnects shall be provided under Division 26. Coordinate fault current requirements with the Architect.
13. All internal wiring shall terminate in pressure wire or clamp type terminals for installation of Electrical Contractor's wiring. No wire nuts or crimps shall be acceptable.
14. All wiring provided by the Electrical Contractor under Division 26 shall be individually labeled at both ends of wire and at all splice locations.
15. Each branch load circuit must have an individual neutral to the dimmer cabinet terminals. Common neutrals shall not be acceptable for any load wire from the load to the dimmer cabinet terminals. Clearly note this requirement on all documentation.
16. Standard advertised product dimensions are to be considered maximum and are not to be increased. Reduced sizes are acceptable with prior approval of Architect.
17. Location of dimmer racks shall be as shown on drawings. Provide quantities of cabinets dictated by dimmer quantity indicated herein.
18. Provide requisite ancillary, current modifying, regulating, and monitoring devices required for operation of a complete fully functioning system.
19. Dimming panels may be cooled by free convection without the use of cooling fans or by fans or blowers with screened air inlet and outlet grilles. Regardless of cooling method, dimming panels shall operate within a maintained ambient room temperature range of no less than 32°F and no more than 95°F degrees.
20. Provide cabinet overheat sensor and pilot light for each cabinet mounted in face of cabinet. Automatic shut off of the dimming system components shall occur should maximum safe operating temperatures of the cabinet be exceeded. Over heat sensor shall be duplicated to provide remote-warning messages located on the theatrical lighting control console.
21. The interior construction of the entire electrical assembly shall be designed for a minimum standard fault current of 50,000 AIC with the capability for increased protection to 100,000 AIC, if required.
22. Noise generated shall not exceed 55dbc per cabinet, as measured with a Type 2 sound level meter at a distance of three feet from the cabinet in installed dimmer location.
23. The racks shall be mounted on Neoprene Isolation Mounts, Type "W" as manufactured by Mason Industries, "Sheer-Flex" by Vibration Mounting or approved equal.
24. Dimmer bank shall accept USITT standard DMX-512/1990 protocol digital control signal or Category 5, or greater Ethernet control signal in addition to any proprietary protocol control signal supported by the Manufacturer. Ethernet dimmer rack shall provide two (2) data inputs functioning on a Highest Takes Precedence basis.
25. Selection of signal protocol shall be automatic and shall not require use of mechanical transfer relays.
26. Control signal input of each individual dimmer rack shall be fully opto-isolated from control signal input of any other rack, and fully opto-isolated from any control signal output.

C. Dimmer Modules:

1. Quantities and capacities of dimmers shall be as indicated on the drawings and specified herein. Dimmers shall meet all dimming performance criteria as listed in this section.
2. Dimmer electronics shall be completely solid state. Silicon controlled rectifiers shall be used to control AC power supplied to the loads.
3. Dimmers shall operate properly on 60 Hz, 120 - 140 volts AC input. Dimmer output shall be AC, containing less than 1% DC component. At maximum input signal, the dimmer shall produce a full sine wave. With the input signal at zero, the dimmer output shall be zero voltage at any load with regulation set OFF. Output shall be symmetrical to the zero voltage axis at any control setting prior to any electronic enhancement.
4. Dimmer efficiency shall be at least 97% at any voltage and with any load to maximum capacity.

5. AC voltage control components shall be rated at a minimum of two times the rated capacity of the dimmer and shall sustain a total short circuit for a sufficient length of time to open primary circuit protection.
 6. Incandescent dimmers (line and low voltage) shall be capable of hot patching cold tungsten loads up to full rated capacity without malfunction or change in operating characteristics regardless of control setting.
 7. Speed of response of system processor modules to control signal changes shall be no more than 25 milliseconds.
 8. Dimmer output shall repeat with respect to the control signal input unit value without hysteresis.
 9. Dimmers set to equivalent control signals with equal types and amperage of loads shall not vary from one to another by more than one percent (1%) at any place in the control signal range from full-off to full-on. Dimmer response shall not be phase sensitive with respect to control signal. There shall be exact tracking from one dimmer to the next with no variation.
 10. There shall be no visible dimming resolution stepping or flickering regardless of length of fade time or control fader settings.
 11. Provide protection from overloads, short-circuiting, and transient voltage. Protection devices requiring reset or replacement must be accessible on the face of the dimming module or dimming cabinet.
 12. Circuit Breakers:
 - a. Provide input fully magnetic circuit breaker(s) mounted on the face of each dimmer module or cabinet faceplate. Provide one input breaker for each individual dimmer within a module (e.g. one for single module, two for dual modules, etc.).
 - b. Input breakers must be rated for full load of the dimmer and must trip at 125% of rated capacity. Input breakers shall be rated for a minimum fault current of 10,000 AIC (120V) or 14,000 AIC (277V).
 - c. Acceptable manufacturers: Airpax or approved equal
 13. Provide dimmers with a ferrous core toroidal filter choke. This filter choke shall suppress lamp filament or transformer hum and vibration, prevent electromagnetic interference in professional quality audio, video, and computer equipment and limit objectionable harmonics. Laminated E.I. or C.I. type chokes are not acceptable.
 - a. Theatrical and House Lighting Dimmers: Rise Time Full Load: Voltage rise time shall not be less than 500 microseconds measured and installed on site at 90 degree conduction angle from 10% to 90% of output wave form with dimmer operating at maximum load.
- D. Dimmer Control Electronics:
1. Dimmers shall utilize two silicon-controlled rectifiers in back-to-back electrical configuration and all required gating circuitry on high voltage side of an integral optocoupled control voltage isolator.
 2. Rectifiers shall be mounted on ceramic substrate, and encapsulated along with other components in epoxy-filled high-impact plastic case.
 3. All dimmer modules shall be able to operate as “non-dims” with selection of this function through dimmer rack and control console software.
 - a. When selected as a “non-dim”, incoming control signal level is interpreted as either full on or full off signal.
 - b. Level of control signal required to initiate turn-on and turn-off shall be user selectable from 0% to 100%.
 - c. Non-dim function shall operate regardless of load type or wattage.
 4. Control electronics shall use digital electronic circuitry, be microprocessor based, and designed specifically for the control of dimming systems. All user operated controls shall be low voltage; use Class II wiring and be electrically isolated from power wiring by means of a UL listed Class II transformer. Appropriate analog to digital conversion shall be acceptable provided circuitry is integral to the control system and not a stand-alone component.

5. System configuration, operating parameters, presets, levels and fade times shall be able to be field modified and shall not require components to be returned to the Manufacturer for such modifications.
 6. System configuration, operating parameters, presets, levels and fade times shall be protected against system power failure for a minimum of 10 years. The state of the system status upon restoration of power shall be user selectable.
 7. The dimmer control electronics may be capable of being addressed by the IEEE 802.3 Ethernet protocol.
 - a. The dimmer control electronics shall be capable of being addressed by the USITT DMX512/1990 protocol when any lighting control console utilizing the same protocol is plugged into a DMX In Node.
 8. Dimmers shall regulate output voltage to remain constant output RMS voltage as long as input remains over 120V per phase.
 9. Dimmer output RMS voltage versus control input signal shall have not more than 0.5% variation from the modified square law dimming curve as defined below. The dimmer curve shall be stable and shall not require individual curve adjustment devices. The dimming curve shall be predetermined and shall not vary unless modified through control device software.
 - a. Modified square law curve shall be as listed in the Acceptable Curve Settings Schedules included with this specification Section as a relationship of control signal output setting to dimmer output voltage:
 - b. Other optional curves shall be available for installation through rack and/or control console operations software.
 - c. Field adjustment of dimming curve shall not be required.
- E. Theatrical and House Lighting Dimmer Quantities:
1. Provide theatrical dimmer modules in types and quantities as shown in the appendix.
 2. Provide house lighting dimmers as specified herein. Coordinate exact quantities with architectural lighting / electrical drawings.
 3. Provide the spare modules as called out in this specification Part One Article, "Extra Materials."

2.4 EMERGENCY TRANSFER PANELS

- A. Provide Emergency Transfer Panel for the automatic transfer of branch circuits from normal to emergency power when normal power fails. The system shall consist of power transfer switches and a control circuitry interconnected to provide complete, automatic protection.
- B. The Emergency Transfer Panel shall have the following characteristics.
 1. The Emergency Transfer Panel shall be mounted in a NEMA 1 type enclosure. It shall be equipped with a hinged locking door. Material shall be no less than 14 gauge steel.
 2. The Emergency Transfer Panel shall transfer designated lighting load branch circuits from dimmers control outputs to a second power source in the event of a loss of power to the dimmer rack, a normal system failure, and a panic condition.
 3. The system shall comply with ANSI/UL1008, NFPA 110 and ANSI/NFPA 70 (NEC), including Article 700 and 701, safety standards. The system shall be UL Listed 1008.
 4. The Emergency Transfer Panel shall contain no more than 24 transfer poles and shall be 36" H. x 30" W. x 9" D.
 5. The Emergency Transfer Panel shall provide power distribution and branch circuit protection for all emergency power circuits.
 6. The transfer switch shall be electrically-operated and mechanically held. The electrical operator shall be a single-solenoid mechanism transfer switch unit.
 7. The switch shall be positively locked and unaffected by voltage variations or momentary outages so constant contact pressure is maintained and temperature rise at the contacts is minimized.
 8. The switch shall be mechanically interlocked to ensure only one of the two possible positions, either Normal or Emergency.

9. All switch main contacts shall be silver plated.
 10. Overload and endurance testing of the transfer switch shall comply with UL1008 Tables 25.1, 25.2, 27.1, and 27.2 for mixed loads.
 11. The transfer switch shall be rated to withstand the RMS symmetrical short circuit current without welding contacts.
 12. Switch contacts shall withstand transfer without welding, with 180° phase displacement between Normal and Emergency power sources, both sources energized and 100% load.
 13. Transfer switch contacts shall be rated for mixed loads, including high intensity discharge lamps and tungsten filament lamps.
 14. The control circuitry shall direct the operation of the transfer switch.
 15. Interfacing relays shall be a covered industrial control grade plug-in type.
 16. The voltage of each phase of the normal source shall be monitored, with pickup adjustable from 85 to 100% and dropout adjustable from 75 to 98% of pickup setting. These settings shall be adjustable in increments of 1%. Repetitive accuracy of settings shall be 2% or better over a temperature range of -20°C to 70°C. Factory set to pickup at 90% and dropout at 85%.
 17. Single-phase voltage sensing of the Emergency source shall be provided with a pickup adjustable from 85 to 100% and dropout fixed at 84 to 86% of pickup. Frequency sensing shall be provided with pickup adjustable from 90 to 100% and dropout fixed at 7 to 89% of pickup. Repetitive accuracy of settings shall be 2% or better over a temperature range of -20°C to 70°C. Factory set to pick up at 90% voltage and 95% frequency.
 18. The control module shall include four time delays that are field adjustable in increments of at least 13 steps over the entire range, as follows.
 - a. Time delay to override momentary Normal source outages, to delay all transfer switch and engine starting signals, Adjustable from 0 to 6 sec. Factory set at 1 sec.
 - b. Transfer to Emergency time delay, from 0 to 5 min. Factory set at 0 min.
 - c. Retransfer to Normal time delay. Time delay is automatically bypassed if Emergency source fails and Normal source is acceptable. Adjustable from 0 to 30 min. Factory set at 1 min.
 - d. Emergency generator cool-down cycle. Adjustable from 0 to 60 min. Factory set at 5 min.
 19. Control power for all logic and transfer functions shall always seek the acceptable power source. This shall prevent the system from locking up in one position if either of the power sources is available, regardless of the sequence of failure events.
 20. A self-supervising isolated signal input shall be provided for connection to the facility fire alarm. It shall automatically transfer loads to the Emergency power source when the facility fire alarm is activated.
 21. A key-operated double-throw, momentary test switch shall be provided to manually control the Emergency Transfer Panel. All automatic functions shall override this control. Two indicator lights shall be provided to show the position of the transfer switch.
- C. All automatic functions shall override remote control functions. Any combination of open or shorted wiring to remote stations shall not affect automatic functions, or disable the local switch.
- D. Provide an emergency transfer system for designated architectural circuits connecting to dimmer panels as called out on Electrical drawings.
1. ETC – ELTS
 2. Union Connector – Emergency Transfer Panel

2.5 LED LIGHTING INTERFACES

- A. Architectural lighting fixtures with LED sources will be dimmed via DMX data signals generated by the theatrical lighting dimming and control system.

1. Interface devices required between DMX signals and the LED fixtures shall be provided under Division 26 work.
2. Emergency bypass for power and signal to the LED fixtures shall be provided under Division 26.
3. Provide close coordination with Division 26 for dimming of LED fixtures.

2.6 NETWORK COMPONENTS:

- A. Provide network switches as required for operation of the network system. Switches shall have the following characteristics and functions:
1. Switches shall contain (24) dual speed auto-sensing ports, supporting both 100BASE-T and 10BASE-T and PoE per IEEE 802.3af.
 2. Switches shall support IEEE 802.3i Type 100BASE-T standard.
 3. Switches shall be rack-mounted in standard 19" racks.
 4. Switches shall have front panel LED's that shall report switch traffic, collisions and expansion status. Per port LED's shall indicate link and partition status for individual connections.
 5. Switches shall have UTP ports on its front face for connecting to nodes and taps via standard 19" patch panel.
 6. Should Ethernet wire runs exceed 300 feet, provide switches with fiber ports equal to the number of fiber runs in the system.
 7. Acceptable Product: Cisco SFE2000P or Approved equal
- B. UTP network patch panels
1. Provide Category 5E Patch Bay (or bays as required) for termination of Category 5E wire runs.
 2. All terminations of Category 5E cable shall be under the responsibility of this Section.
 3. Provide Category 5E patch cords as required for connection between the patch bay (or bays), switches and Ethernet Power Supply.
 4. Patch bays shall be rack-mounted in standard 19" racks.
 5. Provide rack mounted standard 19" cable management system for each patch panel.
 6. Patch bays and cable management panels shall be finished in a black anodized finish and shall contain black Category 5E connectors as required.
 7. Acceptable Manufacturers: Hubbell or Approved equal.
- C. Network UTP Cabling:
1. The copper cabling and connecting hardware must fully comply with the existing TIA/EIA 568B Standard and with the standard installation of Category 5E products.
 2. The copper cabling must also comply with the TIA/EIA Category 5E standard.
 3. Acceptable Manufacturers:
 - a. For non-plenum rated applications:
 - 1) CommScope 55N4 Ultra II Enhanced Category 5 UTP cable
 - 2) Belden 1583A
 - b. For plenum rated applications;
 - 1) CommScope 5504M Ultra II Enhanced Category 5 UTP cable or approved equal.
 - 2) Belden 1585A
- D. Network Devices: All DMX Nodes
1. DMX nodes shall be located as noted on drawings. Nodes shall be connected via the Ethernet data network on Category 5E wire.
 2. XLR connectors at each node shall be able to be configured to output or allow input for any one frame of DMX 512 with normal assignment being sequential. All nodes indicated in the system shall be able to operate simultaneously without data collision or corruption while maintaining recommended minimum and maximum DMX-512/RS485 frame length, packet size and refresh rates.

3. DMX distribution over the data network shall be independent of all devices on the system. Regardless of dedicated theatrical lighting devices that may be connected to the various nodes, the DMX distribution system shall be configurable from a PC or other independent control device. The PC or other independent control device shall be provided under this section. Saving and loading of the system configuration to disk shall be supported.

E. CC panels:

1. Provide device with two RJ-45 receptacles, one double duplex "clean power" receptacle, and a portable house light control receptacle.
2. RJ-45 receptacles shall be connected via Category 5E cable to the Ethernet network and shall allow full function nodes or other peripheral portable nodes to be connected to the network.
3. Label each receptacle with appropriate designations. All labels to be engraved with white core fill.
4. CC panels shall be mounted at fixed locations and wired as indicated on the drawings.
 - a. Back box and faceplate shall be finished flat black.

2.7 THEATRICAL LIGHTING CONTROL CONSOLES

A. Provide one desktop Theatrical Lighting Control Console.

1. Console shall be microprocessor-based system designed specifically for theatrical lighting control application. Consoles shall be engineered for ease and clarity of operation and shall incorporate visual display to assist operator in modes of operation.
2. The console shall be capable of operation in both blind (preview/non-live) mode and in live (stage) mode.
3. Console shall be able to organize data for channels other than those associated with dimmer levels through the use of special grouping or numbering schemes. Simply flagging channels with a new color in the video display shall not be acceptable.
4. Console shall organize information, particularly for automated luminaires, must be graphically organized to allow easy identification of the large groups of channel numbers involved with such fixtures. Assignment of pan and tilt functions of automated luminaires shall be supported by either spinners, track pad or a mouse associated with the console. In addition, the pan and tilt axis of multiple luminaires shall be able to be assigned to a single device, such as a spinner, track ball or mouse, to allow multiple automated fixtures to track together to a single point on stage.
5. Console shall be capable of pan and tilt operation through external devices with virtual focus software (such as WSYWIG) or automated tracking devices (such as AUTOPILOT).
6. The console shall allow cues to be modified while they are running. The console shall support color print outs to mimic color displayed on video screens.
7. Console shall have MIDI In/Thru/Out, parallel printer, and RS-232 ASCII port interfaces.
8. The Console and central processors (if needed in the system) shall be connected through uninterrupted power supplies as needed to protect console and network operations for at least 30 minutes in the event of power failure.
9. The console shall be equipped with all currently advertised features and components indicated in the most recently published product literature plus features described in Part 1, System Performance.
10. The console shall be capable of controlling the lighting network by being plugged directly into any network tap.
11. Basis of Design for Theatre:
 - a. ETC – Ion 2000 with 2 x 20 wing panel
 - b. Strand – Basic Palette II

2.8 VIDEO MONITORS

- A. Portable monitors shall be high resolution; 15" color flat-screen LCD monitors capable of displaying all console video display information. Monitors shall have connectors to mate directly with Net3 Remote Video Interface and shall have front mounted controls for contrast, brightness, vertical hold, and horizontal hold.
- B. Provide: Quantity per Appendix.
 - 1. Furnish 1 - 25' video extension cable for each monitor.
 - 2. Furnish 1 - 25' power extension cable for each monitor.
 - 3. Provide one protective cover for each monitor.

2.9 ARCHITECTURAL CONTROL SYSTEMS

- A. House Lighting Control System
 - 1. Description: House lighting control system shall be a microprocessor-based control system that works in conjunction with the theatrical lighting control console to set and control auditorium house lighting levels. The system shall also control the remote switching of work lighting circuits on the stage and auditorium. The system shall operate through control panels located at the control desk and on either side of the stage.
 - 2. The house lighting control system shall have the following characteristics and functions:
 - a. When in use, the theatrical console shall override preset levels on a highest takes precedence basis and shall directly control only those dimmed architectural circuits within the Auditorium.
 - b. The system shall accept a minimum of six (6) inputs from a touch screen table-top graphical user interface, as provided under Section 116183 work. Inputs shall be used to recall presets stored in the house light control system to provide both dimmer intensity levels and fade timing between presets.
 - c. Switching between panels shall not cause flicker or change in lighting levels when setting on panels or Auxiliary control console are identical.
 - d. The system shall be a microprocessor based lighting control system. System operating program shall be stored in electrically erasable programmable read only memory (EEPROM).
 - e. Data storage facilities shall retain memory for an indefinite period of time. In case of power failure, the control module shall retain preset memory for minimum of 72 hours.
 - f. The House lighting control system allows programming and selection for playback a minimum of 99 different preset lighting states and control of the fade time between presets.
 - g. The System shall be configured to allow multiple active presets to control work lights and theatrical lights simultaneously through the use of multiple room assignments.
 - h. Provide control system configuration software operating on a PC platform to allow configuration and preset level setting.
 - i. Provide the quantity of system processors to have the ability to "snapshot" DMX levels from Theatrical lighting console and record in to architectural preset for all DMX assigned values including dimmed circuits, relay circuits, moving lights and scrollers in the system.
 - 3. Basis of Design:
 - a. ETC Paradigm Architectural System
 - 1) Provide LightDesigner Software
 - 2) Provide ControlDesigner Software
 - b. Strand Vision Net Architectural System
 - 1) Provide Vision Net Software

2.10 ARCHITECTURAL LIGHTING CONTROL PANELS

A. General:

1. Control electronics shall use digital electronic circuitry, be microprocessor based and designed specifically for the control location, overall dimensions, and quantities of control devices shall be as shown on drawings.
2. Control device back boxes, where required, shall be standard deep masonry boxes by Square D or equal.
3. Controls shall be low voltage type and use N.E.C. Class II, low-voltage wiring.
 - a. Only Belden control cables or approved equal shall be acceptable.
 - b. Faceplates shall attach to the device with no visible mounting screws. No manufacturer's logo or other marking shall appear on faceplates unless otherwise noted.
 - c. Faceplate finishes shall be manufacturer's standard finish unless otherwise noted by Architect. Selection of finish, custom or standard color shall be by Architect .
 - d. Provide control devices with appropriate zone and/or scene descriptions. These descriptions shall be furnished to the Manufacturer prior to fabrication by the Architect or Lighting Consultant and shall be engraved and filled with color to be selected by Architect. Any silk screened borders, logos, potentiometer graduations, etc. shall use a chemically bonded graphic process which resists removal by scratching, cleaning, or other light abrasive scouring.
 - e. All slider potentiometers shall have a minimum travel of one inch (1") and shall have a graduated scale marked adjacent to the slider.

B. Architectural Entry Stations 'EP': Provide pushbutton entry stations in flush mounted box in locations as shown on the drawings. Station shall recall designated presets and may be disabled by the main system control.

1. Provide black sheet metal back box. Do not exceed 4" in depth without prior approval.
2. Provide anodized sheet metal cover plate with chamfered edges, color as per architect

2.11 NETWORK CONTROL RACKS

A. Network control rack is specified in Section 116183, Theatrical Audio Video Systems. Coordinate equipment and installation schedule with Theatrical Audio Video contractor.

2.12 THEATRICAL WIRING DEVICES

A. Provide all theatrical wiring devices as indicated on the drawings and as specified herein, for installation by Division 26. All wire termination shall be by Division 26.

1. Coordinate size of device, orientation of circuits and mounting detail to suit site condition.
2. Devices constructed of sheet metal, finished flat black. Provide requisite mounting holes, conduit knockouts, etc.
3. All 20 amp and 60 amp stage pin receptacles shall be of the same manufacture.
4. Flush mounted female receptacles shall have a screw driven locking spring to ensure firm fit on face panel.
5. For 20A stage pin connectors, provide one of the following:
 - a. Union Connector 20-2P&G series.
 - b. Rosco 2000 series.
 - c. Bates Connectors.
6. Provide all requisite mounting hardware for installation of theatrical wiring devices. Coordinate all device mounting requirements with Division 26.
7. Provide all wiring devices with either internal terminal strips or exterior terminal boxes for interconnection to the dimming system. All wiring devices may be internally wired at the factory prior to shipping.

- a. Size all terminals as required based on wire sizes indicated on the Electrical Documents. Terminal strips shall be grounded to the device enclosure.
 - b. Sheet metal construction, finish flat black. Reinforce base of terminal boxes as required to take load from multicable.
 - c. Back box to be clearly labeled with circuit numbers.
8. Terminal Boxes: Provide terminal boxes factory assembled with numbered terminal blocks for field connection by others, as indicated in the drawings and schedules. All terminal boxes regardless of quantity of circuits shall be the same size. Provide six (6) spare terminals in each terminal box in addition to the spare circuits indicated in the schedules. Provide four (4) ground lugs per box. Size all lugs and terminal box as required based on wire sizes indicated on the Electrical Documents.
9. Labeling: Label each receptacle with appropriate circuit designation indicated on distribution schedule and drawings. All labels to be engraved on black (with white core) lamacoid tags with chamfered edges. Tags to be securely mechanically fastened to wiring device.
10. Mounting:
- a. Devices shall be surface, flush or recess mounted at locations and mounting heights as indicated on drawings.
 - b. All holes in mounting bracket to have 1" minimum slotted hole to enable adjustment for field conditions. Provide lock washers on bolts.
11. The Manufacturer is responsible for providing all wiring devices to meet all requirements as stated by the National Electrical Code and local code in reference to separation, isolation, and clearances for all different voltages specified, as well terminal sizes for all the different cable sizes, cable entry sizes and exit routes and standoff.
- B. Plugging Strip with Flush Receptacles - type "PSR".
- 1. Provide plugging strip devices with flush mounted 20A stage-pin grounded female receptacles. See drawings for locations of devices and distribution device schedule for device type and circuit quantity.
 - 2. Provide receptacles with a screw driven mounting clamp mechanism to provide secure mounting regardless of metal thickness.
 - 3. Back boxes and faceplates of sheet metal, finished flat black. Provide requisite mounting holes, conduit knockouts, etc.
 - 4. Label each receptacle with appropriate circuit designation indicated on distribution schedule and drawings.
 - 5. Provide brackets and hardware for mounting boxes. All holes in mounting bracket to have 1" minimum slotted hole to enable adjustment for field conditions. Provide lock washers on bolts.
- C. Plug Boxes with Flush Receptacles - Type "PBR".
- 1. Provide plug boxes with flush mounted 20A stage-pin grounded female receptacles. See drawings for locations of devices and distribution device schedule for device type and circuit quantity.
 - 2. Provide receptacles with a screw driven mounting clamp mechanism to provide secure mounting regardless of metal thickness.
 - 3. Back boxes and faceplates of sheet metal, finished flat black. Provide requisite mounting holes, conduit knockouts, etc.
 - 4. Label each receptacle with appropriate circuit designation indicated on distribution schedule and drawings.
 - 5. Provide brackets and hardware for mounting boxes. All holes in mounting bracket to have 1" minimum slotted hole to enable adjustment for field conditions. Provide lock washers on bolts.

2.13 STAGE CABLE

- A. Jumpers: All jumpers shall be Extra Hard Usage cable utilizing 20A two-pin grounded pin connectors. Provide two (2) affixed black sash cord tie lines.

1. Provide with 20A connectors and 12/3 SOW-A cable.
 2. Provide quantities as shown in Appendix.
- B. Two-Fers: All two-fers shall be 36" long, #12 individual stranded cables in fiberglass sheaths or a 12/3 SO cord in a molded assembly appropriate strain relief as approved.
1. Provide quantities as shown in Appendix.

2.14 FABRICATION

- A. Fabricate all work in this section in accordance with the Architect's direction, specifications, approved shop drawings, pertinent project drawings, established trade practices and applicable code requirements.
- B. Machine finish all operating parts to standard trade tolerance, fits and finishes.
- C. Perform shop welding in full accordance with the appropriate sections of "Specifications for the Design, Fabrication and Erection of Structural Steel Buildings" of the American Institute of Steel Construction (AISC).
- D. Fabrication, assembly and wiring shall be neat and workmanlike throughout.
- E. Control desks, racks and cabinets shall be welded assemblies of sheet steel or aluminum or of bar size angles, channels and tees or aluminum extrusions forming rigid enclosures to support internal components.
- F. All face panels shall be fully supported on all edges, either internally or by rolling interior edges of panels.
- G. Wood furniture/cabinet work for control desks acceptable with prior approval.
- H. Operating elements shall be mechanically safe and electrically "dead".
- I. All steel parts and panels shall be cleaned and primed with rust inhibiting primer. Exterior finishes shall be epoxy resin or baked enamel in matte black or in anodized black aluminum where approved.
- J. Control element working face panels shall be heavy aluminum or bakelite. Legends and control and protective device designations shall be engraved in panels, or in permanently attached plates, and located for ready identification.
- K. Operating instructions shall be similarly engraved and appropriately located on designated equipment.
- L. All panel engraving shall be in Helvetica Regular, height as indicated herein. Engraving shall be 1/4" or 3/16" as shown in drawings. In no case shall the engraving be less than 3/16" high without Architect's approval.
- M. All internal wiring shall be factory completed and clearly marked.
- N. Field connections shall be made by connector devices and cables as specified in preceding sections.
- O. Dimmer modules, dimmer controllers and other plug-in components may have spade lug and/or receptacle devices for connection.

- P. Control relays wherever possible shall be the glass or polycarbonate enclosed plug-in type. Relays shall be acoustically damped.
- Q. Uniform components shall be used throughout the system. All dimmer, fader and preset controllers shall be physically similar; they may vary in voltage according to the Theatrical Lighting Manufacturer circuit requirements.
- R. All wire sizes and insulation to comply with UL standards and local codes and meet or exceed electronics industry standards.
- S. All wiring to be harnessed and bound. No loose or randomly routed wires permitted.
- T. All printed circuit cards to be suitably racked with numbered and indexed guides. Legends to be provided on panel door.
- U. Key all components in this section with locks or keyswitches alike. Provide six (6) keys minimum.
- V. Each receptacle within a wiring device must have a home run to the dimmer racks of its hot and neutral. Circuits with more than one receptacle must be paralleled at the dimmer rack. The method of termination must not void UL listing. Circuits with more than one receptacle within a single wiring device may be paralleled within the device and require only one home run of the hot and neutral to the dimmer racks.
- W. Minimize feeder inductance by twisting the hot and neutral conductors in long connector strips. Neutral conductor must be at least the same size or greater than the hot conductor.
- X. All wiring to be harnessed and bound. No loose or randomly routed wires permitted.

2.15 SOURCE QUALITY CONTROL

- A. Assemble in factory any and all system assemblies and subassemblies at Architect or Architect's sub-consultant's request, for testing in presence of Architect or Architect's sub-consultant, prior to shipment. Notify Architect at least 3 weeks prior to date when equipment is complete and ready for testing. Make equipment available to Architect or Architect's sub-consultant in Manufacturer's factory for period of at least 2 weeks for testing prior to shipment.
- B. During the test provide test equipment for all testing required and any other testing requested by the Architect or Architect's sub-consultant.
 1. Test Equipment shall consist of any item that is proprietary to the testing of manufacture's equipment. Meters and oscilloscope need not be supplied.
- C. Control Testing:
 1. Theatre Lighting Control Console and Network system shall be assembled in factory and tested for control console update time, video refresh rate, remote video picture quality, and any other function requested by Architect.
 2. Architect shall be sole judge of extent of testing necessary and sole judge of acceptability of any system tested.
- D. Verification of Performance:
 1. Provide Architect with all test results for verification of system performance.
 2. For equipment that requires in house testing, do not ship any piece of equipment without either written verification of factory testing or written waiver of factory testing from Architect for that particular piece of equipment.

PART 3 - EXECUTION

3.1 SITE RESPONSIBILITIES

- A. Provide site supervision during the installation of electrical work associated with the Theatrical and Architectural Lighting system elements.
- B. Field verify all dimensions prior to fabrication.

3.2 EXAMINATION

- A. Verification of Conditions: The Manufacturer shall examine areas and conditions under which the equipment is to be installed and shall notify the Construction Manager in writing of conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in an acceptable manner.

3.3 INSTALLATION

- A. Install all work in this section in accordance with the Architect's direction, specifications, approved shop drawings, pertinent Contract Drawings, established trade practices and applicable code requirements.
- B. Coordinate work with all other trades to avoid causing delays in construction schedule.
- C. Perform all cutting, drilling, tapping and approved welding required to properly install work. Obtain Architect's prior approval for cutting and drilling of existing structural work.

3.4 ADJUSTING AND CLEANING

- A. Adjust all equipment and components for operation in accordance with the specifications, approved shop drawings and pertinent project drawings prior to the demonstration indicated herein.
- B. Touch-up minor abrasions and imperfections as required.
- C. Remove all unnecessary equipment and materials from the area(s) of this work upon completion; remove from the job site and dispose of legally at no additional cost to the Owner.

3.5 DEMONSTRATION

- A. Installed equipment to be operated for approval, and inspected for quality by the Architect and the Owner.
- B. Adjustments or modifications shall be made as directed by the Architect and the Theatre Consultant.
- C. Following the equipment demonstration, inspection and final adjustments, the Owner's designated staff or representatives shall be instructed in the use, care and maintenance of all items.
- D. Tests and instruction to be scheduled in conformance with project construction schedules and the availability of the Architect and the Owner.

- E. Cost of re-inspection and additional testing by the Architect or Theatre Consultant, if required, due to lack of completion and/or errors and omissions shall be paid by the Contractor or the General Contractor respective to the area of work concerned. This work will be conducted on a time and materials basis, including standard hourly rates, and shall be scheduled and approved in writing prior to the re-inspection/testing session between the Architect, Theatre Consultant, the Owner, and the contractor(s). All travel expenses, if required, shall be provided.

3.6 PROTECTION

- A. Suitable precautions shall be taken to protect the equipment in this section from damage after installation and prior to acceptance by the Owner.
- B. Remove all equipment protection and clean components thoroughly prior to the demonstration session

3.7 SCHEDULES

- A. Refer to 'TL' drawings for distribution and control device schedules related to the work in this section.

3.8 APPENDIX

- A. Refer to attached appendix for quantities.

END OF SECTION 116163

SECTION 116163 - THEATRICAL LIGHTING DIMMING AND CONTROL
Appendix

ITEM #	ITEM DESCRIPTION	QUANTITY
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Dimmers & Racks

1	Full Size Dimmer Rack	1
2	2.4 kw Dual Dimmer Modules (500ms) Std Rise	31
3	20A Dual Relay Modules	2
4	Blank Module	As Required
5	3 Circuit Emergency Transfer Panel	1

Theatrical Control

6	Ion or Light Palette (2K outputs) w/ 2 monitors	1
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Theatrical Network

7	Network Equipment: switch, patch panel, cable management	As Required
8	Rack Mount UPS/Power Conditioning	1
9	Ethernet Node w/ 2 DMX	7

House Lighting Control

10	House / Work Light - Processor	1
11	Preset Station	3

Distribution & Faceplates

12	Performance Lighting Distribution Faceplates as shown on Drawings	As Required
13	Performance Lighting Control Faceplates as shown on Drawings	As Required

Extension Cables

14	Twofer - 20 amp	15
15	Jumper cable - 20 amp - 5'	15
16	Jumper cable - 20 amp - 10'	15
17	Jumper cable - 20 amp - 25'	10
18	DMX Extension Cable - 5'	4
19	DMX Extension Cable - 10'	4
20	DMX Extension Cable - 25'	4
21	Ethernet Patch Cable - 3'	As Required
22	Ethernet Extension Cable - 5'	2
23	Ethernet Extension Cable - 10'	2

Note:

This equipment list specifies major systems components and equipment, and should not be interpreted as a "bill of materials". This list may not detail all equipment required for complete, working systems. It is the Lighting Systems Contractor's responsibility to provide complete, working systems regardless of the completeness of this list.

SECTION 116173 - THEATRICAL LIGHTING FIXTURES AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and General Requirements

1.2 SUMMARY

- A. All materials, components and services required to provide the work as complete functioning equipment shall be integrated with the installed systems specified elsewhere in the project documents and/or as shown on related drawings.
- B. Section includes, but is not limited to, Theatrical and studio lighting fixtures and accessories:
 - 1. Ellipsoidal reflector spotlights
 - 2. Fresnels
 - 3. Cyclorama strips
 - 4. Accessories
 - 5. Spare lamps
- C. Equipment delivery and preparation: Coordinate delivery schedules with the Owner.
 - 1. Unpack fixtures, install lamps, attach hanging clamps, hang fixtures and provide general focus for basic setup.

1.3 RELATED SECTIONS

- A. Coordinate with all related sections of the specifications including, but not limited to:
 - 1. Division 01 – General Requirements
 - 2. Division 11, Equipment
 - a. Section 116163, Theatrical Lighting Dimming and Control

1.4 UNIT PRICES

- A. Prior to contract award, provide unit pricing for the following elements:
 - 1. Provide unit prices for all specified equipment as indicated the Section 116173, Equipment List.
 - 2. Each line to be complete with all necessary accessories.

1.5 REFERENCES

- A. Reference to codes, standards, specifications and recommendations of technical societies, trade organizations and governmental agencies will refer to the latest edition of such publications adopted and published prior to submittal of the bid. All such codes and standards will be considered a part of this specification as if they were fully included herein.
- B. If an applicable code or standard permits work of lesser quality or extent than this specification, this specification will govern.
- C. Comply with prevailing local codes, applicable UL standards.
- D. Comply with national, state and local labor regulations and requirements.
- E. Equipment to have pertinent labels.

1.6 DEFINITIONS

- A. "Architect": All references to the "Architect", H&A Architects & Engineers will refer to the process by which the indicated action or decision regarding the work in this section will be administered. All such actions shall be initiated with or by the Architect, who will disseminate all pertinent information and documents to, as well as coordinate all efforts and site visits with, the Theater Consultant and all other project consultants who may have design responsibility relating to the work in this section.
- B. "Theater Consultant": Auerbach + Associates, Inc. (d.b.a. Auerbach Pollock Friedlander) The Theater Consultant will be party to all actions and decisions regarding the work in this section.
- C. "Other Project Consultants": Acoustical Consultant, Electrical Engineer, Structural Engineer, or Mechanical Engineer as is applicable to a particular issue.
- D. "Contractor": Manufacturer / Installer responsible for the fabrication and installation for the work contained in this section.
 - 1. Contractors involved with other work shall be indicated with a specific trade preceding the word "Contractor" (i.e. General, Electrical, etc.).
- E. "Owner": Authorized personnel representing the Miller Center, Lynchburg, Virginia.
- F. "Furnish": Purchase and/or fabricate and deliver to project site.
- G. "Install": Physically install the items in their proper location (s) on the project site.
- H. "Provide": Furnish and install.
- I. In all cases where a device or a part of equipment is referred to in a singular manner within the contract documents, it is intended that such a reference shall include all devices required to complete the installation in accordance with the project documents.

1.7 SUBSTITUTIONS

- A. All requests for variations from the specified materials and products will be reviewed by the Owner and Theatre Consultant.
- B. All requests for substitutions must be submitted in a timely manner, so as not to adversely impact the project schedule.
- C. Substitutions will only be accepted if, in the opinions of the Owner and Theatre Consultant, the product is an equal to the specified product. No substitutions may be made without written acceptance from the Owner. All substitutions made prior to this acceptance are at the sole risk of the Contractor.
- D. A substitution must be a product of equal design, construction and performance. The Contractor must submit all pertinent information required to substantiate that the product is equal. The Contractor must submit all additional information, including test data, which may be requested in order for the Owner and Theatre Consultant to fully evaluate the substitution. The burden of proof is solely on the Contractor.

- E. All additional expenses of any kind with respect to substitution(s) shall be borne by the Contractor. This shall include, but not be limited to, all fees and expenses incurred by the Owner and Theatre Consultant's evaluation of the substitution and subsequent integration into the project should the substitution be taken and/or additional costs of other contractors related to the substitution(s).

1.8 SUBMITTALS

- A. All submittals shall be submitted in accordance with Division 01. All submittals shall be submitted in a timely manner, allowing sufficient time for adequate review and possible resubmittals without jeopardizing the project schedule.
- B. Submittals must be reviewed, accepted and field dimensions verified (where applicable) prior to proceeding with the fabrication of the work in this section. The Theatre Consultant shall only mark one set of drawings per submittal with comments. Any additional sets of drawings or product data shall be returned unmarked.
- C. All submittals shall leave minimum 4" x 4" space available for review stamps and comments.
- D. Provide full insurance against loss or damage during shipment, storage, installation and testing. Furnish certification of such coverage to the Owner within 30 calendar days of contract award.
- E. Submit manufacturer's technical data sheet for all items specified as part of the shop drawing submittal. Those items for which a standard data sheet does not exist will require a shop drawing.
 - 1. Where pertinent, and if requested, the manufacturer shall supply performance data for the specified fixtures conforming to the "recommended practice for reporting photometric performance of incandescent lighting units", as prepared by the joint IES-SMPTE Committee on equipment performance rating.
- F. Shop Drawings: Include the following:
 - 1. Inventory of all equipment to be supplied, including manufacturer's item number, manufacturer's catalog number, quantities, etc. Clearly indicate the type and quantity of lamps being supplied for each fixture.
 - 2. Complete, fully dimensioned, large scale shop drawings of all non-standard components. Include item-identifying number.
- G. Product Data: Submit catalog or standard data sheets for component parts as part of the shop drawing submittal. The data shall include all information which indicates compliance with the specifications herein. Clearly indicate the manufacturer of each component part.
- H. Project Record Documents:
 - 1. At the time of delivery, submit four (4) bound copies of parts lists and operation/maintenance instruction sheets.
 - 2. Each manual shall be bound in an individual binder with the project name on the front cover and system identification on the spine. The manuals shall include:
 - a. Complete parts list for all equipment and telephone numbers for the authorized parts and service distributors.
 - b. Instructions as to the safe operation of all equipment.
 - c. Recommended maintenance schedule for component parts that may need periodic replacement.
 - d. Recommendations for cleaning, maintaining and touch-up of all finished surfaces.
 - e. Warranties as required in Part One, Article herein.

3. Where specific elements do not require manuals, provide instruction sheets as to care and handling.
4. The record documents will be reviewed by the Owner and all modifications to the documents stemming from this review shall be made as required.
5. Above submissions are required as a condition for final approval of the work.

1.9 QUALITY ASSURANCE

- A. All equipment shall be manufactured by a recognized national manufacturer, as specified herein.
- B. Contractor Responsibility:
 1. Equipment shall be supplied by a recognized national distributor/contractor.
 2. The Contractor shall be a factory authorized distributor and servicer for all of the specified equipment.
 3. The Contractor shall assume full and complete responsibility for materials, parts, and workmanship on all equipment and for its overall safety and performance.

1.10 PACKING AND SHIPPING

- A. All connectors shall be attached to fixtures before shipment to site.
- B. All equipment shall be appropriately and substantially packed for shipment.
- C. All equipment containers shall clearly indicate the equipment contained, "front", "top", "fragile", the project name, and theatre site allocation. Include packing and shipping lists for each container.
- D. All shipping costs to the job site are the responsibility of the Contractor. The shipping method/company is at the total discretion of the Contractor in order to meet the published project schedules.
- E. Upon delivery, store the materials under cover in a dry and clean location, off the ground. Remove delivered materials which are damaged or otherwise not suitable for from the job site and replace with acceptable materials.
- F. Replace, at no expense to the Owner, all equipment and materials that are damaged during storage or handling.

1.11 PROJECT/SITE CONDITIONS

- A. Verify all conditions at jobsite. Promptly report variations and obstructions to the Architect. All additions or corrections must be requested prior to fabrication.

1.12 SEQUENCING AND SCHEDULING

- A. Delivery of all equipment to each venue within the building shall be the responsibility of the Contractor.

1.13 WARRANTY

- A. The Contractor shall warrant materials and workmanship of all equipment supplied under the work of this section as free of defects. The Contractor shall guarantee in writing the repair or replacement within 14 days of all items found defective during a period of 1-year following the date of final acceptance. Ordinary wear and defects due to improper usage are excepted.

- B. During the warranty period above, respond to all emergency conditions where system failures may be hazardous or may cause severe hardship or cancellation of performances within 24 hours. Take immediate action to ensure the safety of the audience and performers.

1.14 OWNER'S INSTRUCTION

- A. Supply instruction to Owner's representatives and Owner's operating personnel on operation and care of equipment for not less than 4 hours. Instruction shall include, but not be limited to, proper maintenance of all equipment, replacement procedures for user replaceable parts, and operating procedures to obtain maximum usage of equipment.
- B. Deliver all copies of approved Operations Manual to Owner prior to first instruction session, and review it as part of that session.
- C. Timing of instruction session shall be scheduled with the Owner's Representative at their convenience.
- D. Instruction must be by qualified expert operators who have actual experience with equipment in performance conditions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS/CONTRACTORS

- A. The Contractor must have been engaged in the installation of equipment of the type indicated herein for no less than 5 full years.

2.2 ACCEPTABLE MANUFACTURERS/CONTRACTORS

- A. Manufacturers: The equipment herein shall be by the following manufacturers (as applicable for each fixture).
 1. Altman Stage Lighting Company
57 Alexander Street
Yonkers, NY 10701
(914)476-7987
 2. Electronic Theatre Controls
3030 Laura Lane
Middleton, WI 53562
(608)831-4116
 3. Selecon / Strand Lighting, Inc.
6603 Darin Way
Cypress, California 90630
(714) 230-8200
 4. Strand Lighting, Inc.
6603 Darin Way
Cypress, California 90630
(714) 230-8200

B. Contractors: The following distributors may package the equipment indicated herein as manufactured by the above. Any additional distributors must be approved prior to bid.

1. Barbizon Lighting Company
6437 G General Green Way
Alexandria, Virginia, 22312
(703) 750-3900
2. Texas Scenic Company
611A Lofstrand Lane
Rockville, Maryland, 20850
(800) 292-7490
3. Vincent Lighting
920 Vista Park Drive
Pittsburgh, Pennsylvania, 15205
(800) 922-5356

2.3 MATERIALS

A. Equipment and Components: All shall be new and complete.

1. Provide pipe clamps for each fixture unless specified otherwise.
2. All equipment and components shall be factory tested prior to shipping.
3. Housings shall be sheet steel, cast aluminum or a combination of both, in thickness and gauges conforming to prevailing industry standards.
4. Lighting instruments shall be adequately ventilated for the largest lamp that the instrument is designed to accommodate. Vents shall be baffled to prevent emission of direct light from filament and reflector and to reduce to a minimum the stray light and secondary reflections.
5. Unless otherwise specified, reflectors shall be Alzak processed aluminum with contours and surfaces suited to the optical requirements of the specified instrument. "Cold mirror" fixtures shall have a dichroic-coated glass reflector.
6. The exterior finish of all instruments shall be baked wrinkle or epoxy resin. The interior finish in all instruments shall be flat black except for sockets and reflectors.
7. All lenses shall be heat-resistant, of size, type, and spread specified.
8. All ellipsoidal reflector spotlights shall be provided with a positively locking means for adjusting the filament reflector-lens relationship to provide proper centering of the optical train.
9. All ellipsoidal reflector spotlights shall have a yoke and/or cap assembly(ies) that enables relamping when the spotlight is pointed straight down/in line with yoke.
10. All instruments shall be supplied with 3'-0" sheathed Teflon insulated leads terminating in a 20A 2 Pin and Ground stage plug (Bates, Union Connector, Rosco or approved equal) unless otherwise indicated. In all cases, all connectors shall be wired to units prior to delivery.
11. All instruments shall be provided complete with all necessary accessories to be fully functioning.

2.4 EQUIPMENT

A. Provide equipment as listed in the Appendix at the end of this section.

2.5 FABRICATION

- A. Furnish all work in this section in accordance with these specifications, approved shop drawings, pertinent project drawings, established trade practices and applicable code requirements.
- B. Machine finish all operating parts to standard trade tolerance, fits and finishes.
- C. Carry out shop welding in full accordance with the appropriate sections of "Specifications for the Design, Fabrication and Erection of Structural Steel Buildings" of the American Institute of Steel Construction (AISC).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Examine areas and conditions under which the equipment is to be installed and notify the General Contractor in writing of conditions detrimental to proper and timely completion of work.

3.2 DEMONSTRATION

- A. Following the equipment demonstration, inspection and final adjustments, instruct the Owner's designated staff or representatives in the use, care and maintenance of all items.
- B. Make adjustments or modifications as directed by the Owner.
- C. Schedule tests and instruction in conformance with project construction schedules and the availability of the Owner.
- D. Cost of reinspection and additional testing by the Owner, if required, due to lack of completion and/or errors and omissions shall be paid by the Contractor. This work will be conducted on a time and materials basis, including the Owner's standard hourly rates, and shall be scheduled and approved in writing prior to the re-inspection/testing session between the Owner and the contractor. All travel expenses, if required, shall be provided on a first class basis.

3.3 INSTALLATION

- A. Immediately after demonstration, provide site labor to unpack fixtures, install lamps, attach hanging clamps, hang fixtures and provide general focus for basic setup.
- B. Dispose of packing materials after installation.

3.4 PROTECTION

- A. Take suitable precautions to protect the equipment in this section from damage after installation and prior to acceptance by the Owner.

APPENDIX

See attached appendix for equipment list.

END OF SECTION 116173

SECTION 116173 - THEATRICAL LIGHTING FIXTURES AND ACCESSORIES
Appendix

ITEM #	ITEM DESCRIPTION	MANUFACTURER	QUANTITY
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Lighting Instruments

1	19 Degree Ellipsoidal, 120v / 575w	ETC	10
2	26 Degree Ellipsoidal, 120v / 575w	ETC	15
3	36 Degree Ellipsoidal, 120v / 575w	ETC	15
4	50 Degree Ellipsoidal, 120v / 575w	ETC	10
5	6" Fresnel, 120v / 500w	Strand	15
6	Aurora Cyc Light, 120v / 500w Single cell unit with hanging hardware	Selecon	10

Accessories

7	Spare C-Clamp	ETC	4
8	Barndoors for 1Kw Fresnels (4 way)	Strand	15
9	Drop In Iris	City Theatrical	2
10	Pattern holders for Ellipsoidal	ETC	8
11	Dounut for 19-50 deg. Ellipsoidal	City Theatrical	8
12	Spare Safety Cable (36in)	ETC	14
13	Spare 19-50 Degree Color Frame (6.25")	City Theatrical	8
14	20A 2P&G Connector		4

Spare Lamps

15	Source 4 120v / 575w	Phillips, Osram, GE	10
16	6" Fresnel, 120v / 500w	Phillips, Osram, GE	3
17	Aurora Cyc Light, 120v / 500w	Phillips, Osram, GE	2

Notes

Provide 2P&G bates connector, C-clamp, lamp, safety cable, and color frame for all lighting instruments

SECTION 116183 - THEATRICAL AUDIO-VIDEO SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and General Requirements

1.2 SUMMARY

- A. The work in this section includes Theatrical Audio Video (AV) Systems within the auditorium and associated support areas as indicated on the 'TA' series drawings.
- B. Provide fully coordinated and engineered equipment, installation, supervision and commissioning for the following major systems and associated accessories as required. Consult and coordinate with other affected work and contractors throughout the course of the work contained herein:
 - 1. Sound reinforcement/playback system
 - 2. ADA assistive listening system
 - 3. Production intercom (headset communication) system
 - 4. Video projection systems and projection screen
 - 5. Control system
 - 6. Base system portable equipment package
 - 7. Supervision of AV Systems low voltage signal wire pulling and termination
 - 8. Coordination of empty conduit, backboxes and AC power wiring provided by the Electrical Contractor
- C. Products Furnished But Not Installed Under This Section
 - 1. Furnish all non-standard panel and device back boxes; including custom panel back boxes, floor boxes, recessed ceiling loudspeaker back boxes, etc. as specified for installation under Division 26.
 - 2. Furnish connector panel floor boxes, as specified for installation under Division 26.
 - 3. Furnish all AC power receptacles within system equipment racks for termination under Division 26.
- D. Furnish all AV systems low voltage signal wire for installation and termination by Division 26.

1.3 RELATED SECTIONS

- A. Coordinate with all related sections of the specifications including, but not limited to:
 - 1. Division 01 – General Requirements
 - 2. Division 03 – Concrete
 - 3. Division 05 - Metals
 - 4. Division 9 - Finishes
 - 5. Section 11 61 33 - Theatrical Rigging
 - 6. Section 11 61 63 - Theatrical Lighting Dimming and Control
 - a. Interface with AV control system
 - 7. Section 12 24 13 – Roller Window Shades
 - a. Interface with AV control system
 - 8. Division 23 – Heating, Ventilating and Air Conditioning
 - 9. Division 26 – Electrical
 - a. General requirements for all Electrical work, including installation of system cable trays, terminal cabinets, empty conduit, junction/pull boxes and back boxes for system devices and panels (Division 26).

- b. Conduit routing / sizing information.
 - c. Electrical terminations (AC power and grounding only) to all equipment racks and isolated ground AC power receptacles (Division 26).
 - d. Provision and installation of all conduit and back boxes (Division 26).
 - e. Electrical services and main circuit protection (Division 26).
 - f. Distribution system equipment (Division 26).
 - g. Conduit, wire, pull boxes, junction boxes and miscellaneous hardware and components as required for a complete electrical installation.
 - h. Terminations and testing of system continuity
 - i. Section 265561, Theatrical Systems Electrical Installation
10. Division 27 – Communications for structured cabling systems
11. Division 28 – Electronic Safety and Security
- a. Fire detection and Alarm Interfaces – For sound reinforcement and playback systems, coordinate mute of sound systems by fire alarm signal.

1.4 UNIT PRICES

- A. Prior to contract award, provide unit pricing for all specified equipment as indicated in “Appendix A” at the end of this section.

1.5 REFERENCES

- A. Reference to codes, standards, specifications and recommendations of technical societies, trade organizations and governmental agencies refer to the latest edition of such publications adopted and published prior to submittal of the bid. All such codes and standards will be considered a part of this specification as if they were fully included herein.
- B. If an applicable code or standard permits work of lesser quality or extent than this specification, this specification and the related drawings will govern.
- C. Comply with prevailing local codes, applicable UL standards.
- D. Comply with national, state and local labor regulations and requirements as noted herein:
 - 1. NEC: National Electric Code.
 - 2. UL: Underwriters Laboratories.
 - 3. SMPTE, IEEE, NEMA and ANSI guidelines, and recommendations by manufacturers' associations or professional and engineering societies including the Audio Engineering Society (AES), and guidelines and practices outlined in the following texts:
 - a. Audio Systems -- Design and Installation, Giddings, Howard W. Sams, 1990.
 - b. Sound System Engineering (3rd Edition), Davis and Davis, Focal Press, 2006.

1.6 DEFINITIONS

- A. “Architect”: All references to the “Architect”, H&A Architects & Engineers, will refer to the process by which the indicated action or decision regarding the work in this section will be administered. All such actions shall be initiated with or by the Architect, who will disseminate all pertinent information and documents to, as well as coordinate all efforts and site visits with, the Theater Consultant and all other project consultants who may have design responsibility relating to the work in this section.
- B. “Theater Consultant”: Auerbach + Associates, Inc. (d.b.a. Auerbach Pollock Friedlander) The Theater Consultant will be party to all actions and decisions regarding the work in this section.
- C. “Other Project Consultants”: Acoustical Consultant, Electrical Engineer, Structural Engineer, or Mechanical Engineer as is applicable to a particular issue.

- D. "Contractor": Manufacturer / Installer responsible for the fabrication and installation for the work contained in this section.
 - 1. Contractors involved with other work shall be indicated with a specific trade preceding the word "Contractor" (i.e. General, Electrical, etc.).
- E. "Owner": Authorized personnel representing The Miller Center.
- F. "Furnish": Purchase and/or fabricate and deliver to project site.
- G. "Install": Physically install the items in their proper location (s) on the project site.
- H. "Provide": Furnish and install.
- I. In all cases where a device or a part of equipment is referred to in a singular manner within the contract documents, it is intended that such a reference shall include all devices required to complete the installation in accordance with the project documents.

1.7 SYSTEM DESCRIPTION

- A. Sound Reinforcement and Playback System:
 - 1. The sound reinforcement system shall be used for the reinforcement and monitoring of live stage sound, archival recording, lecture/narration, amplification and for the distribution of prerecorded audio (CD, DVD, MP3, etc) throughout the audience environment. The primary sound control position shall be located in the rear of the auditorium.
 - 2. Loudspeakers will be suspended overhead on the pipe grid to provide even coverage of the audience seating area. These loudspeaker systems include:
 - a. Main Loudspeaker System: This loudspeaker system is required to provide primary sound coverage to the main floor audience seating area, using separate left-right arrays.
 - b. Additional portable loudspeakers will be provided for on-stage monitoring (foldback) and side-stage fill purposes. Power amplifiers for passive loudspeakers will be located in the local amplifier rack room.
 - 3. The sound system will not provide emergency paging capability. All installed sound system loudspeakers shall be configured to be automatically muted by the building life safety system in the event of an emergency (life safety system provided under Division 28). Muting shall be initiated upon receipt of a dry contact closure signal from the building life safety system to relay contacts on the digital signal processor. Coordinate requirements with Division 28.
 - 4. A mixing console will be provided for use at the control booth at the back of the house. The console will accommodate the various live and recorded program inputs during performances and rehearsals. Playback, archival recording and signal-processing equipment will be located in an equipment rack adjacent to the mixing console.
 - a. Microphone and line-level audio signal distribution will be accomplished using traditional shielded-pair copper wiring.
 - b. The wiring infrastructure will accommodate the in-house equipment and permit easy interface of future portable or rented equipment, and equipment brought in by outside performers.
- B. ADA Assistive Listening System:
 - 1. An assistive-listening system shall make use of wireless radio frequency transmission technology. This system shall assist patrons with a hearing impairment to better hear the performance by means of wireless receivers.
 - 2. Receivers are included in quantities and types according to the current guidelines and requirements of the Americans with Disabilities Act (ADA).

3. Program signal shall be normally derived from the program monitor microphone. Additional signal sources shall be patched as required.
 4. Receivers shall be in the form of wireless headsets, which shall provide additional capability to interface to individual induction-loop and other devices to permit more direct coupling of the received signal to a patron's compatible hearing aid device.
 5. The system shall transmit the audio signal via a remote FM antenna located in the Theatre. Coordinate FM transmitter frequency selection to ensure that a clear channel is used.
- C. Production Intercom (headset communication) System:
1. A local single-channel wireless intercom system shall provide technical full duplex voice communication between the control room and stage manager positions. Portable belt packs and headsets will be provided. Provide an interface to traditional wired intercom systems for connection to rental equipment or for use by outside groups.
 2. The wired portion of the system shall consist of a power supply, a network of wiring and plugging points to which "belt-pack" stations, headsets and handsets may be connected. These stations shall provide local amplification, call-light signaling circuitry and microphone on/off and headset loudspeaker volume control. All stations shall operate in full-duplex mode (simultaneous listen/talk).
- D. Video Projection System:
1. The video projection system shall consist of a high brightness, high resolution video projector and video playback equipment. The video projector will be mounted on a shelf above the control area, on the centerline of the projection screen. The projector shall have a minimum native resolution of 1,366 x 768, 10,000:1 contrast ratio and 9,600 ANSI lumen light output (center lumen).
 2. The video presentation system shall consist of an input switcher capable of accepting composite video, HDMI, HD/SDI, RGBHV, S-video, computer video and line level audio signals. The switcher shall also have an integrated scaler, and allow for seamless switching of video and audio. Video sources shall include DVD/BluRay playback and laptop audio/video connections ("LAP" AV plates).
 3. Video playback equipment shall be mounted in an equipment rack in the control area and include a DVD/Blu-ray player as well as connections for hard disk playback, laptop computers, etc.
 4. A motorized roll-down projection screen will be mounted on the ceiling above the stage to provide for image viewing at multiple aspect ratios, including 4:3 (standard video) and 16:9 (widescreen/HD video). Motorized screen masking will not be provided. The projection screen will provide a maximum image size of 9'-0" high X 16'-0" wide (16:9 aspect ratio). Control of the roll-down screen will be located at the control area.
- E. Control System
1. This system shall permit the control of the following devices: video projector, digital switching system, audio DSP, sound system amplifiers and audio/video sources permanently installed.
 2. This system shall interface with and issue preset commands to the architectural lighting processor and the roller window shade system.
 3. One password protected desktop control panel shall be provided in the control area.
 4. A password protected wireless touch panel device will be provided to be used at the stage or audience areas.
 5. This system shall permit the following functions:
 - a. Overall system on/off (including powering down amplifiers, sources and DSP processors).
 - b. System mode preset selection and sound level controls.
 - c. Video source selection, including transport and audio levels control and projector mute.
 - d. Recall lighting preset (minimum of 6 presets)

- e. Recall roller window shades system presets (minimum of 6 presets)
- f. Control individual window shade up/down/stop movement.
- 6. The system shall have a minimum of (2) different access levels/user modes:
 - a. Lecture. This level shall only allow preset selection and associated controls.
 - b. Advanced user. This level shall allow more detailed control over specific controlled devices.
- 7. System Preset Modes:
 - a. Lecture mode - This mode of operation will permit the use of the system without the presence of an operator in the control area, and will permit the following operations:
 - a) Log In/Log out.
 - b) Power Up/Down
 - c) Screen up/Down/Stop
 - d) Projector On/Off/Mute.
 - e) AV Source Selection (multiformat player in rack or device connected to LAP plate)
 - f) Multiformat player transport controls
 - g) This mode of operation will only use the microphone inputs labeled as "Lecture System", which will be on automixing mode in the DSP. A general level control over the microphone mix will be provided in the touchscreen interfaces.
 - h) This mode of operation will NOT make use of the digital mixing console and associated devices in the Control Area.
 - i) A general level control for the reproduction of AV sources will be provided in the touchscreen interfaces.
 - j) A general audio mute as well as overall sound system control will be provided in the touchscreen interfaces.
 - b. Advanced user mode - This mode of operation will require the presence of an operator in the control area. Audio will be fed to the system from the digital audio console in the Control area. The system will permit the following operations:
 - a) Log In/Log out.
 - b) Power Up/Down.
 - c) Screen Up/Down/Stop.
 - d) Projector On/Off/Mute.
 - e) Projector management (zoom, focus, lens offset, source selection, life lamp query, distortion adjustments).
 - f) Video Source selection
 - g) Multiformat player transport controls
 - h) General Audio Mute
 - c. The following parameters will be set and recalled on system startup:
 - 1) Projection geometry.
 - 2) Sound levels for Lecture mode.
 - 3) Sound levels for Advanced user mode.
- F. Other AV Systems Device Plates and Panels provide industry-standard receptacles for connection of microphone, line-level, loudspeaker, video, intercom, control and other AV equipment with the house AV wiring systems. AV patch panels shall provide audio and video tie line points as needed.
- G. Portable equipment, including wired and wireless microphones, loudspeakers, cables, intercom equipment, patch cords and stands and assistive listening receivers, is listed in Appendix A. Additional equipment may be provided by the Owner (direct purchase).

1.8 SUBSTITUTIONS

- A. All requests for substitutions must be submitted in a timely manner, so as not to adversely impact the project schedule.
- B. Substitutions will only be accepted if, in the judgement of the Architect and Theatre Consultant, the product is an equal to the specified product. No substitutions may be made without written acceptance from the Architect and Theatre Consultant. All substitutions made prior to this acceptance are at the sole risk of the Contractor.
- C. A substitution must be a product of equal design, construction and performance. The Contractor must submit all pertinent information required to substantiate that the product is equal. The Contractor must submit all additional information, including test data, which may be requested in order for the Architect and Theatre Consultant to fully evaluate the substitution. The burden of proof is solely on the Contractor.

1.9 SUBMITTALS

- A. All submittals shall be submitted in a timely manner, allowing sufficient time for adequate review and possible resubmittals without jeopardizing the project schedule.
- B. Submittals will be reviewed, accepted and field dimensions verified prior to proceeding with the fabrication of the work in this section. The Theatre Consultant will only mark one set of reproducible per submittal with comments. Any additional sets of drawings or product data will be returned unmarked.
- C. Provide full insurance against loss or damage during shipment, storage, installation and testing. Furnish certification of such coverage to the Client within 30 calendar days of contract award.
- D. Confirm that all power feeds, conduit routes, counts and sizes as indicated on the electrical and theatrical drawings will adequately meet system requirements. This confirmation shall be in writing within 30 calendar days of contract award. All costs associated with additions to the scope of the electrical work because of insufficient wire count and/or sizes after this confirmation shall be borne by this Contractor. This information shall be submitted to the Architect.
- E. Product Data: Submit catalog or standard data sheets, including quantities, for component parts as part of the shop drawing submittal. The data shall include all information which indicates compliance with the specifications herein. Clearly indicate the manufacturer of each component part.
- F. Shop Drawings shall include the following:
 - 1. Inventory of all equipment to be supplied, including quantities, manufacturer's part number, reference to applicable drawings, etc.
 - 2. Requisite schematics, plans and sections indicating assembly and installation of components.
 - 3. Complete wiring diagrams, based upon the Contract Documents but including cable types, identification and color codes, and detailed wiring of connections, both at equipment and between equipment racks and wiring in conduit.
 - 4. Provide ¼" = 1'- 0" plans of all locations which contain equipment in this contract. Show all equipment properly located, dimensioned, and labeled. Note all work by others in the vicinity, which may affect work in this contract. Include results of field measurements.
 - 5. Complete, fully dimensioned, large scale detailed mounting drawings of all major components.

6. Provide plans detailing, but not limited to, the following:
 - a. Audio and video patch panels, custom connector panels and wall plates, with dimensions.
 - b. Details for all consoles, equipment enclosures, supports, brackets, tables, etc.
 - c. Location of all equipment in racks, consoles or on tables, with dimensions; wire routing and cabling within housings; AC power outlet and terminal strip locations.
 - d. Loudspeaker location, orientation and support and aiming systems.
 - e. Schematic drawings of any custom circuitry or equipment modifications, including connector pinouts and component lists. Show all required wire sizes and counts between all components.
7. Indicate all elements with appropriate safety factors and/or safety equipment.
8. Indicate length of all Category 5/5e/6 cables in the system. No data/network cable of this type shall exceed 90m/295ft. Contractor is responsible to structure data/network cabling to ensure this length restriction is not broken.
9. Engineer, design and draft all shop drawings to represent actual fabrication and installation drawings and details.
10. Copies or tracings of the Contract Drawings are NOT acceptable as shop drawings and will be rejected.

G. Samples:

1. Label samples to indicate product, characteristics and location. Samples will be reviewed for color and appearance only. Compliance with all other requirements is the exclusive responsibility of the Contractor. Submitted samples may be used within the actual systems once its use has been accepted.
2. Submit samples of the following for approval:
 - a. A typical AV panel faceplate showing details of finishing, engraving and connector mounting. This plate shall contain one of each type of connector and switch used on the project.
 - b. A typical gang-box faceplate.
3. Label samples to indicate product, characteristics and location. Samples will be reviewed for color and appearance only. Compliance with all other requirements is the exclusive responsibility of the Contractor.
4. Additional samples shall be submitted within 14 days of Architect's written request

H. Project Record Documents:

1. Submit documents in accordance with Division 01.
2. At the time of acceptance testing, submit six (6) bound copies of parts lists and operation/maintenance instruction sheets.
3. Within 60 days of the acceptance testing, submit one (1) set of reproducible "as built and approved" drawings showing all equipment as installed. These drawings shall include all adjustments made during the checkout process.
4. Submit operation and maintenance manuals with the "as built and approved" drawings. Each manual shall be bound in an individual binder with the project name on the front cover and system identification on the spine. The manuals shall include:
 - a. Complete parts list for all equipment and telephone numbers for the authorized parts and service distributors.
 - b. Instructions as to the safe operation of all equipment.
 - c. Recommended maintenance schedule for component parts which may need periodic replacement.
 - d. Recommendations for cleaning, maintaining and touch-up of all finished surfaces.
 - e. Warranties as required in Part One herein.
5. Where specific elements do not require manuals, provide instruction sheets as to care and handling shall be provided.
6. Provide a data table with the following test results for all Cat 5/5e/6 data/network cables:
 - a. 100MhZ sweep test, polarity checks, near-end cross talk, signal attenuation, noise, DC loop back resistance, and pair-by-pair continuity.

- b. Installed length.
- 7. The record documents will be reviewed by the Architect and Theatre Consultant and all modifications to the documents stemming from this review shall be made as required.
- 8. Above submissions are required as a condition for final approval of the work.

1.10 QUALITY ASSURANCE

- A. All equipment and installation to be the responsibility of the single Contractor, who shall own and operate its own shop for the fabrication of sound, video and communication systems, and be regularly engaged in the fabrication of such equipment. Fabrication of such equipment shall comprise no less than 90% of the Contractor's business.
- B. All variations from the specified materials and product must be approved by the Architect and Theatre Consultant.
- C. State of the Art Development:
 - 1. Contractor shall supply only the manufacturer's latest developed product. In cases where product development surpasses the criteria of this specification, the Contractor shall inform the Architect and make the newer product available to the project at no additional cost. In no case shall discontinued or obsolete equipment be acceptable. The same requirement applies to software programs developed/updated during the warranty period.
 - 2. Should product recall by the manufacturer require temporary or permanent replacement of a product specified under this section, the Contractor shall notify the Architect at the earliest reasonable time and shall arrange to replace the product in question at the earliest possible time.
 - a. Equipment found defective or subject to recall prior to scheduled installation shall not be delivered to the jobsite.
 - b. Equipment defect or intended recall shall not relieve the manufacturer from his contractual obligation with regard to delivery schedule of product.
 - c. Under no circumstances shall arrangement for alternate product necessarily require the Owner to accept superseded equipment except on a temporary basis.
 - 3. Following the warranty period, the Contractor shall advise the Owner in writing each time any software program is updated, giving the Owner the opportunity to upgrade the software should they so desire.

1.11 DELIVERY, STORAGE AND HANDLING

- A. Pack all equipment appropriately and substantially for shipment.
- B. All equipment containers shall clearly indicate the equipment contained, "front", "top", "fragile", the project name, and site allocation. Include packing and shipping lists for each container.
- C. All shipping costs to the job site are the responsibility of the Contractor. The shipping method/company is at the total discretion of the Contractor in order to meet the published project schedules.
- D. Coordinate responsibility for acceptance of material and equipment at job site with the General Contractor.
- E. Upon delivery, the materials shall be stored under cover in a dry and clean location, off the ground. Delivered materials which are damaged or otherwise not suitable for installation shall be removed from the job site and replaced with acceptable materials.
- F. Replace, at no expense to the Client, all equipment and materials which are damaged during storage or handling.

1.12 PROJECT/SITE CONDITIONS

- A. Verify all conditions at jobsite. Promptly report variations and obstructions to the Architect and Theatre Consultant. All additions or corrections are to be requested prior to fabrication.
- B. Take field measurements prior to preparation of shop drawings to ensure proper fitting of work. Allow for adjustments during installation whenever taking field measurements.
- C. Equipment is classified according to its susceptibility to construction conditions that may effect its operation. Classes shall be defined by the following paragraphs.
 - 1. Class 1:
 - a. Cable and distribution apparatus, structural elements, electrical back boxes, face plates, terminal boxes, and empty equipment rack frames may be stored in weather protected spaces under "normal" construction site conditions provided that no electronic components are contained within devices, that storage boxes are sturdy and well sealed, and that equipment is protected with imperforate inner plastic sheeting.
 - b. Contractor may install this class of equipment in weather-protected spaces under "normal" construction site conditions provided that equipment is protected from dust and moisture by sturdy imperforate plastic sheeting and completely covered with corrugated cardboard held securely in place by duct tape. Cardboard covers shall not be removed until area is broom cleaned. Under no circumstances shall equipment remain uncovered overnight during installation or while work which causes high dust or moisture levels in area of placement is taking place.
 - 2. Class 2:
 - a. Control panels, spare parts, test and other equipment (except as listed under Class 3), not subject to damage by concrete dust or dirt shall be stored and protected per Class 1 devices.
 - b. Contractor shall not install equipment in this class until area of installation is broom cleaned, "blown" clean with pressurized air, mopped, air conditioned and secure. Contractor may install control panels with electronic components under Class 1 conditions, but electronic components must be removed and not installed until area of installation meets Class 2 conditions.
 - 3. Class 3: Mixing consoles, filled equipment racks and other electronic equipment shall not be shipped to site until the rack and control rooms are finished, air conditioned, dust free, broom and mop cleaned, secure, and in all respects complete and ready for occupation. This class of equipment shall not be unpacked until the system is complete in all other respects. Under no circumstances may any equipment in this class be removed from the rack and control rooms into or through spaces which are not cleaned, air conditioned, and complete.

1.13 SEQUENCING AND SCHEDULING

- A. The installation of the equipment in this section shall begin following the completion of work which may be in conflict with the installation including:
 - 1. Installation of structural steel.
 - 2. Electrical and mechanical work in ceiling.
 - 3. Principal foundation work.
 - 4. Installation of associated electrical work.
 - 5. Installation of floor and machine room structure.
 - 6. Construction sequencing for the delivery of large elements to the site must be coordinated with the General Contractor. It is the responsibility of the AV Contractor to coordinate with the General Contractor to arrange for a means to deliver large components of the systems described herein.

- B. Prior to the contract award, Contractor shall submit a project schedule (critical path) which shall indicate coordinated functions with other trades and project requirements.
- C. The installation of the AV Systems equipment, panels and devices shall not occur until all painting in the area has been completed.

1.14 WARRANTY

- A. The Contractor shall warrant materials and workmanship of all equipment supplied under the work of this specification as free of defects. The Contractor shall guarantee in writing the repair or replacement within 14 days of all items found defective during a period of 1 year following the date of final acceptance. Ordinary wear and defects due to improper usage are excepted.
- B. During the warranty period above, respond to all emergency conditions where system failures may be hazardous or may cause severe hardship or cancellation of performances within 24 hours. Take immediate action to ensure the safety of the audience and performers.

1.15 SYSTEM STARTUP, OWNER'S INSTRUCTIONS AND COMMISSIONING

- A. Provide in-depth training of the end-user staff in the operation and maintenance of all systems included herein.
- B. Provide five days of training of a maximum of six (6) end user staff members on the use and operation of the AV Systems.
- C. Training shall include information on the repair and maintenance of the AV systems and equipment including diagnostic testing, trouble shooting, component replacement and routine service.
- D. All training shall be by approved instructors.

1.16 MAINTENANCE

- A. Maintenance Service: One year following date of final acceptance, provide a factory engineer to examine, adjust and repair the equipment included in this section as required. This service shall not cover adjustments, repairs or replacement of parts due to negligence, misuse, abuse or accidents caused by persons other than the Contractor. All labor and materials which are required to perform this service shall meet or exceed these specifications and shall not compromise the performance of the equipment in any way. Deliver stock of maintenance material to Client. Furnish to match those installed, packaged with protective covering for storage and identified with appropriate labels.
- B. Maintenance Agreement: provide a proposal for ongoing regular maintenance to the Owner including all recommended service labor.
- C. Extra Materials:
 - 1. Submit an inventory of recommended spare parts for all equipment provided. This shall include expendable mechanical parts, electronic elements such as processors, power supplies, miscellaneous boards, fuses and the like. Provide necessary test equipment for repair and maintenance of the Master Control system. Provide a price quote for this equipment with unit costs. The price shall be held for 90 days.
 - 2. This inventory will be reviewed by the Theater Consultant and recommendations made to the Owner concerning parts and equipment that should be purchased.

PART 2 - PRODUCTS

2.1 CONTRACTORS

- A. To establish comparative standards of quality, the Theatrical Audio Video Systems included herein may be provided and installed by, but are not limited to, the following contractors:
1. Avitecture
1 Export Drive
Sterling, VA 20164-421
 2. Clair Bros
One Clair Boulevard
Manheim, PA 17545
 3. Washington Professional Services
11242 Grandview Avenue
Wheaton, MD 20902
 4. Whitlock
12820 West Creek Parkway
Richmond, VA 23238
- B. A contractor who wishes to be listed, and has not been pre-approved, must submit qualification information to the Architect and Theatre Consultant. Proposal must include all of the information listed below:

2.2 CONTRACTOR APPROVAL PROCESS

- A. Any contractor who wishes to bid must submit qualification information to the Architect and AV Theatre Consultant. Proposal must include all of the information listed below.
1. Submit the following additional information with proposal:
 - a. Statements of financial responsibility for past five fiscal years showing assets and liabilities.
 - b. List of principal officers and design and service engineers in an organizational structure flow chart.
 - c. List of not less than five (5) projects of similar size and scope completed within the five years on which contractor has provided full services: product engineering, shop drawings, manufacture, installation and commissioning. In each instance, indicate specifics of scope of fabrication and installation. Include a contact list: name, address and phone numbers of person(s) directly responsible for operation and maintenance of equipment in each facility.
 - d. List of current projects and approximate contract value and completion dates. Include list of names, phone numbers and addresses of owner, owner's representatives and architect.
 - e. For each above described project, list of names of persons who supervised preparation of shop drawings, manufacture of components, and installation of equipment.
 - f. List of names of persons who would do project management, product engineering, supervision of shop drawing, supervision of installation should this contract be awarded.
 - g. Contract Bond Company information indicating that Contractor has bonding capacity for full duration of project. Include list of other bonded projects coinciding with this project.

- h. Evidence of ability to undertake custom product engineering to meet specific requirements of project specifications. Provide sample project engineering drawings for custom products and contact information for facility operators where those products have been installed.
- 2. Standards of acceptance:
 - a. Contractor must have been engaged in the manufacture and installation of sound, video and communications systems for a minimum of five years and maintain its own facility and staff for this purpose.
 - b. Contractor must have successfully installed a minimum of five (5) projects with a contract value of minimum \$250,000.
 - c. Ability to undertake the work within the time available, judged against other currently contracted work.
 - d. Ability to meet specifications and project requirements
- B. The system shall be comprised of components that are of professional quality. Manufacturers shall be as listed per item in the Appendix at the end of this section.

2.3 DRAWINGS

- A. The layouts of the various items of equipment, accessories, specialties and wiring on the Drawings are diagrammatic, unless specifically dimensioned, and do not necessarily indicate every item required for a complete installation.

2.4 MATERIALS

- A. All equipment and components shall be new and complete. No used or reconditioned equipment shall be acceptable.
- B. All mounting hardware is to be included.
- C. All equipment and components shall be factory tested prior to shipping.
- D. All bolts and fasteners must be Grade 5 or better.
- E. All bolted attachments to have lock washers or other approved self-locking hardware.
- F. All microprocessor controls shall utilize a non-volatile memory. System configuration, operating parameters, presets, etc. shall be protected against system power failure for a minimum of 48 hours.
- G. All internal wiring shall be factory completed and clearly marked. All field connections shall be by connector, terminal strip or other device previously specified. Any terminal strip connections shall be clearly labeled as to terminal designation.
- H. All wire sizes and insulation shall comply with UL standards and local codes.
- I. All wiring to be harnessed, bound, and routed neatly. No loose or randomly routed wires will be permitted.
- J. All analog control wire counts shall include 10% spares.
- K. No manufacturer logo shall appear on control station face plates or any other device located in public areas.

- L. Supply supplementary or auxiliary equipment necessary for the operation of the system supplied with overload and short-circuit protection.
- M. Do not purchase or fabricate any materials, components or items to be used in the sound, video and communication systems prior to review of shop drawings, unless otherwise directed by Theatre Consultant.
- N. Use only materials, components and items that conform with industry practice and applicable code standards. Use only components that are new and never previously used. Take care during installation to prevent scratches, dents, chips, etc.
- O. Install all rack-mounted equipment with 10-32 button head machine screws with Phillips head.
- P. Custom rack panels shall be 3/16" thick aluminum, standard EIA sizes, brushed black anodized finish unless otherwise noted. (Brush in direction of aluminum grain only.) Custom connector plates (loudspeaker, microphone, video, etc.) are typically stainless steel. It is the responsibility of the Contractor to verify plate finish with the Theatre Consultant. Plastic plates will not be accepted.
- Q. All engraving shall be 1/8" block unless noted otherwise. Except where noted to the contrary, on dark panels or pushbuttons, letters shall be white; on stainless steel or brushed natural aluminum plates, or light-colored pushbuttons, letters shall be black.
- R. Connections shall be made with approved connectors and/or terminal blocks equal to Cinch 140 series or as indicated. Mount trim potentiometers, custom circuit cards, relays and transformers (except large 70V units) in shielded enclosures, and mark their function and connections with engraved lamacoid labels.
- S. Per IEC-268 standard, all XLR connectors, within equipment or out, shall be wired pin 2 hot (high), pin 3 low, and pin 1 shield (screen).
- T. Unless otherwise stated, all rack-mounted electronic and electrical equipment and components shall conform to EIA 19" standard. Any devices not specifically designed to be rack mountable shall be adapted, by professionally acceptable methods, to meet the EIA standard.
- U. The rack height of all equipment and components in this specification is in 1.75" units denoted "U", i.e., a 5.25" device, which is three rack spaces high is denoted as "3U".
- V. All internal wiring shall be factory dressed and clearly marked. All field connections shall by connector, terminal strip or other approved method specified herein. All terminal strips connection shall be clearly labeled.
- W. All switches used in these systems (whether or not mentioned or shown in this specification) shall have sufficient voltage and amperage rating to cover the use for which they are required with a safety factor of at least 2. All switches handling audio circuits shall use gold contacts and shall meet JAN-S-23 or MIS-S-3950A specifications or equivalent.
- X. Audio transformers shall be of appropriate impedance ratio and power-handling capacity for the function intended and, unless otherwise noted herein, shall have a frequency response within ± 1 dB from 20-20,000 Hz.
- Y. Provide a -10dB to +4dB balancing transformer for any unbalanced audio equipment used within the system.

2.5 SOURCE QUALITY CONTROL

- A. Contractor shall demonstrate to the Theatre Consultant the operation of all custom-designed equipment such as paging interfaces and communication control panels prior to shipping such equipment to the site. Other equipment such as mixing consoles, loudspeaker systems, equipment racks and other equipment shall also be inspected at this time. Testing shall be performed at a time to be determined by the Theatre Consultant.

2.6 EQUIPMENT AND SYSTEMS

- A. General
 1. Provide Theatrical Audio-Video Systems described herein and on the Drawings.
 2. Regardless of the length or completeness of the device descriptions herein, each device shall meet all of its published manufacturer's specifications. Verify performance as required. Where two or more acceptable products are listed, the Contractor may use either at his option. Equipment other than that listed shall not be substituted without specific written approval of the Theatre Consultant.
 3. Equipment quantities, if not specifically called out below, shall be as indicated on the Drawings, unless otherwise noted. The Contractor shall provide the higher quantity should a discrepancy between the Drawings and this Section exist.
 4. Certain equipment is shared among multiple systems. Such equipment is listed here only once, in the system that constitutes the primary use of such equipment.
- B. Sound, Video and Communication Systems Equipment: Refer to Appendix A at the end of this section for major component and equipment list.
 - a. Appendix A equipment list specifies major systems components and equipment, and shall not be interpreted as a "bill of materials". Appendix A may not detail all equipment required for complete, working AV Systems.
 - b. The AV Systems Contractor shall provide complete, working systems regardless of the completeness of the Appendix A equipment list.
- C. AV Equipment Mounting - General Requirements:
 1. All mounting hardware to be included.
 2. All bolts and fasteners must be Grade 5 or better.
 3. All bolted attachments to have lock washers or other self-locking fasteners.
 4. Provide all required mounting brackets and framing, hardware and components, safety systems and rigging systems using the following minimum design factors (given as ratio of working load limit (WWL) : rated breaking load):
 - a. 5:1 – Minimum design factor for all mounting components regardless of mounting condition.
 - b. 5:1-8:1 – Minimum design factor for manufacturer provided mounts and assemblies where engineered stamped documentation and destructive testing data is provided by manufacturer.
 - c. 10:1 – For all hardware and connecting assemblies between manufacturer rated assemblies when AV equipment is hung above the general public. This includes but is not limited to wire rope, bolts, shackles, turnbuckles, beam clamps, supplemental steel provided by AV contractor and other connecting hardware.
 - d. Design factor calculations to be provided with all equipment mounting details.
 5. Provide all integral redundancy components, including safety cables, rated at 10:1 for all equipment mounted above head height. This includes but is not limited to loudspeaker arrays, ceiling loudspeakers, wall loudspeakers, video monitors, video projectors, video cameras etc.
 6. Provide loudspeaker field adjustments and alignments after installation. All component orientations must be within + 5-degrees of the specified angles, with an allowable adjustment range of + 10-degrees.

7. AV Contractor shall coordinate required additional blocking, supplemental steel or unistrut supports with General Contractor and specific trade contractors.
8. All mounting systems requiring the combining of multiple manufacturer mounting systems or where all hardware is not provided as a single rated system shall be engineered, approved, and drawings stamped by a professional engineer licensed in the Commonwealth of Virginia. The engineer shall verify that the equipment supplied under this section meets or exceed the design criteria of this specification.

D. Racks, Patching Panels and other Permanent Equipment

1. Loudspeaker Patch Panel - AVP Universal Bulkhead.
 - a. Patch panel shall be assembled using AVP Universal Bulkhead panels populated with Neutrik Speakon NL2/NL4 connectors per system block diagrams. Unused Bulkhead spaces are to be provided with blank cover insert.
 - b. Each 1RU row shall have no more than eight (8) Neutrik Speakon jacks. For every 2RU of patching provide 1RU blank plate. Provide two (2) parallel Neutrik Speakon jacks per each amplifier output. (For a total of 4 jacks per stereo amplifier)
 - 1) Speakon jacks for Channel A shall be as follows:
 - a) Pins 1+/1-: Channel A
 - b) Pins 2+/2-: Channel B
 - 2) Speakon jacks for Channel B shall be as follows:
 - a) Pins 1+/1-: Channel B
 - b) Pins 2+/2-: No connection
 - c. Provide non-normalizing Neutrik Speakon jacks for speaker lines from AV panels and wall receptacle plates as shown on schematic drawings.
 - d. Provide designation strips above each patch row engraved with both the appropriate signal level and circuit location description for each patch jack, and the consecutive circuit numbers; 1 through 8 for both the top and bottom rows.
 - e. Legends shall correspond with AV receptacle panel legends where applicable. Refer to detail drawings.
 - f. Provide plastic laminate designation labels at left and right of the patch panel to indicate reference letter (A, B, C, etc.) of the individual patch panel. Labels mount on the steel rack ears.
 - g. Color shall be black.
 - h. See drawings for additional information.
2. General Purpose Patch Panel - AVP Universal Bulkhead.
 - a. Patch panel shall be assembled using AVP Universal Bulkhead panels populated with connectors per system block diagrams. Unused Bulkhead spaces are to be provided with blank cover insert.
 - b. Provide designation strips above each patch row engraved with both the appropriate signal level and circuit location description for each patch jack, and the consecutive circuit numbers; 1 through X for both the top and bottom rows.
 - c. Legends shall correspond with AV receptacle panel legends where applicable. Refer to detail drawings.
 - d. Color shall be black.
 - e. See drawings for additional information.
3. General Purpose Input Panel – Extron AAP Bulkhead.
 - a. Panel shall be assembled using an Extron AAP 2RU bulkhead populated with AAP connector plates per system block diagrams. Unused Bulkhead spaces are to be provided with blank cover insert.
 - b. Provide designation strips above each patch row engraved with both the appropriate signal level and circuit location description for each patch jack, and the consecutive circuit numbers; 1 through X for both the top and bottom rows.
 - c. Legends shall correspond with AV receptacle panel legends where applicable. Refer to detail drawings.
 - d. Color shall be black.
 - e. See drawings for additional information.

4. Equipment Racks and Panels
 - a. Racks shall be EIA 19" standard racks as specified in Appendix A equipment list and/or drawings.
 - b. Provide the following (as applicable):
 - 1) Provide one (1) switched incandescent light bulb per rack with magnetic base to provide work light in back of rack. Middle Atlantic WL-60 or approved equal.
 - 2) Provide matching blank panels in all spare rack spaces. See "blank panels" section. Maximum individual blank panel height shall be 3RU.
 - 3) Provide matching 1U ventilation panels above and below all DSP units.
 - 4) Amplifiers shall be stacked on top of each other, without spacing between. *Do not* provide ventilation panels above and below amplifiers unless required by manufacturer.
 - 5) Provide one (1) Middle Atlantic Products CLAW patch cord holder for each rack group containing mic/line level or loudspeaker patch panels.
 - 6) Provide one (1) rack mount AC power receptacle strip for each rack group. Receptacle strip shall mount to the front of one rack and be connected to an unswitched AC power circuit. Hammond 1582T8A1BK or approved equal.
 - 7) Use approved pan or truss head type panel mounting screws with non-metallic flat washers to secure all rack-mounted equipment.
 - 8) In racks containing amplifiers or digital signal processors and NOT located in public areas or control areas provide temperature controlled exhaust units. Middle Atlantic MW-#FT###CFM series or approved equal. Contractor to determine fan CFM after completing individual thermal management calculations.
 - 9) Provide Middle Atlantic Products BB-40 2" wide heavy copper busbar in each rack for connection of isolated ground circuits. Bond busbars together with grounding conductor in a "star" configuration equal in AWG to conductor provided by Electrical Contractor to local AV panel board for interface with the sound system isolated ground network. Refer to AC power grounding detail on drawings for further information.
 - 10) All racks shall have the same color finish (Textured Black).
5. AV Receptacle Panels and Wall Plates, Custom Fabrication:
 - a. Methods and materials:
 - 1) Single or multiple signal level and circuit receptacle panels for connection of AV Systems devices throughout the facility. Panels may include any combination of circuits and connectors for these signal levels: microphone, line level audio, video, intercom, control, and low volt/impedance loudspeaker. Connectors shall be identified as to signal level, circuit type, and circuit number by clearly engraved and coordinated legends on each panel. Exceptions as noted.
 - 2) Refer to device plans for locations.
 - 3) Refer to AV Systems Connector Panel Schedule for back box type, size, and depth, and mounting information.
 - 4) Conduit and AV back boxes shall be supplied and installed by others.
 - 5) AV panel faceplates shall be by the AV Contractor, except as noted.
 - 6) Wire shall be supplied, pulled, and terminated by the Contractor.
 - 7) Circuit/connector quantity: As shown on detail drawings and as specifically indicated in the AV Panel Schedule. Exceptions as noted.
 - 8) Connector: Panel or chassis types, as indicated below. Mount on AV Panel as shown on drawings and fasten with stainless steel machine screws, hex nuts, and lock washers (screw head style, color, and thread size to match connector body; slot or phillips drive to match wall plate screws). Refer to connector specification paragraph below. Exceptions as noted.
 - 9) Microphone level ("M" series): Female XLR-3.
 - 10) Line level ("L" series): Male and female XLR-3 pairs.

- 11) Partyline intercom ("PL" series): Male XLR-3.
 - 12) Network line ("N" series): Neutrik "EtherCon CAT6" Female RJ-45.
 - 13) Low volt/impedance loudspeaker ("LS" series): Neutrik NL4 "speakon" series.
- b. Laser etched/engraved legend: Details as indicated below. Locate legends on AV Panel as shown on drawings. Characters shall be laser etched/engraved and entire panel sealed. Exceptions as noted.
- 1) Legends shown on drawings are typical. Refer to AV Systems block diagrams and/or submit proposed layout to Theatre Consultant for review.
 - 2) Similar groups of connectors on AV Panels are typically labeled with an appropriate signal level and circuit location title (e.g., microphone lines terminate in "M" series connectors on the "MICROPHONE" section of the panel).
 - 3) Individual connectors are labeled with the corresponding patch panel reference (e.g., "M-A11" indicates a microphone line terminating at patch panel row A, jack number 11), or other appropriate circuit reference (e.g., production intercom "CH A"). Refer to "Part 3 - Execution: Installation - Equipment - Labeling".
 - 4) Signal level title legend size shall be 0.1875" or 0.250" high characters of medium weight (as required).
 - 5) Patch panel reference legend size shall be 0.125" high characters of medium weight.
 - 6) Legend color typically references the specific signal level and follows guidelines found in "Part 3 - Execution: Installation - Equipment - Labeling".
- c. Termination: Refer to general termination guidelines in "Part 3 - Execution: Installation - Wiring - Termination" for further explanation of the following methods. Exceptions as noted.
- 1) XLR-type connectors: Solder wire directly to connector in the field.
 - 2) BNC-type connector: Attach double crimp-type (crimp-crimp) straight plug to end of coaxial cable for connection directly to the feed-through jack. Ensure integrity of coaxial cable shield isolation from back box by insulating connectors (and/or any adapters) with a shroud or hood of shrink tubing, or similar material. Plastic "electrical" tape is not acceptable.
 - 3) Neutrik NL4 series connectors: Attach properly sized crimp-type female disconnect terminals to large gauge loudspeaker wire and mate with male disconnect terminals on the Neutrik connectors. Securely strain relief loudspeaker wires to connector body or wall plate to ensure integrity of the electrical/mechanical disconnect termination.
 - 4) Neutrik Ethercon series RJ-45 connectors: 110 punchdown at patchbays; Male RJ-45 crimp to panel passthrough connector in field.
- d. Wall Connector plates (sizes as shown on drawings and schedules), all details as in (a) above, with the following additional requirements:
- 1) Refer to AV Symbol and Device Schedule for back box type, size, and depth, and mounting information.
 - 2) All plates shall be flush type for mounting to recessed back boxes or surface mount Wiremold-type boxes.
 - 3) Wall plate: Standard, x-gang (size "x" to match detail drawings), type 302 stainless steel (heavy gauge), bright brushed or satin finish, flush-type electrical wall plate. Mount to back box with 6-32 stainless steel, slot or phillips drive, oval head machine screws. Exceptions as noted below.
 - 4) Plates in public areas to have finish by Architect.
- e. AV panels (sizes as shown on drawings and schedules), all details as in (a) above, with the following additional requirements.

- 1) Panel: Fabricated of type 5052-H32 aluminum, 0.125" minimum thickness, lightly brushed (vertical direction), with black anodized and clear sealed finish. Panel dimensions to match back box size. Edges of panel shall be ground square and flat. Corners of panel to have small radius. Exceptions as noted below.
- 2) Panels in public areas to have finish selected by Architect.
- 3) Panels that are flush mounted shall be oversized by ½" on all sides to cover the transition from backbox to wall treatment.
- 4) Back Box: Provided by div 26, Hoffman type with a minimum depth of 6". Color: Black. Exceptions as noted below. Coordinate with Electrical Contractor.
- 5) Panels 8" wide and larger shall have Keystone Electronics Corporation aluminum black anodized oval instrumentation handles as shown on AV systems panel detail drawings. Handles shall be 1.75" deep.

f. Floor Boxes

- 1) All details as in (a) above, with the following additional requirements.
- 2) Panel (inside box): Fabricated of type 5052-H32 aluminum, 0.125" minimum thickness, lightly brushed (vertical direction), with black anodized and clear sealed finish. Panel dimensions to match opening size of floorpanel or as required by floor pocket manufacturer. Edges of panel shall be ground square and flat. Corners of panel to have small radius. Exceptions as noted below.
- 3) All floor box lids to have finish selected by Architect.
- 4) Floor Back Box: Furnished by AV contractor, available from floor pocket manufacturer. Exceptions as noted below. Coordinate with Electrical Contractor. Refer to Drawings for back box types.
- 5) Installation of floor pocket and back box requirement of floor box shall be by Electrical Contractor.
- 6) Floor boxes shall be as per the Appendix A equipment list.

E. Connectors

1. Connectors, as specified below, to properly install and terminate all AV Systems components.
 - a. Provide a minimum of five percent (5%) spare parts, for each connector series listed below, including all shells, pins, sockets, modules, strain reliefs, latches, etc. Exceptions as noted.
2. Audio Connectors
 - a. XLR Type
 - 1) XLR-3 (Microphone, Line, Communication, Loudspeaker): Neutrik NC3MD-L-1 (male) and NC3FD-L-1 (female) panel mount connectors; Neutrik NC3MX (male) and NC3FX (female) cable connectors. Silver contacts and nickel shells throughout.
 - 2) Note wiring:
 - a) Balanced mic/line: pin 1 = shield (screen), pin 2 = high (hot), pin 3 = low.
 - b) Unbalanced mic/line: pin 1 = shield/common, pin 2 = high, pin 3 = tie to pin 1.
 - c) Production intercom: pin 1 = shield/common, pin 2 = +30VDC, pin 3 = audio/signal.
 - d) In no case shall pin 1 be tied to case of connector.
 - 3) XLR-4 (Production Intercom Headset/Handset): Neutrik NC4MC (male) and NC4FC (female) cable connectors. Silver contacts and nickel shells throughout.
 - b. 1/4" Phone Plugs and Jacks
 - 1) Plug: Neutrik NP2C 2-pole and NP3C 3-pole cable plugs. Nickel contacts and nickel shells.

- 2) Jack: Neutrik NJ3FC6C latching 2- or 3-pole cable jack. Silver contacts and nickel shells.
- 3) Note wiring:
 - a) 3-pole: Sleeve = ground/shield, ring = low, tip = high (hot).
 - b) 2-pole: Sleeve = common/ground/shield, tip = high.
- c. 1/8" Mini Plug - 1/8" T/R/S "Walkman-type" stereo mini plug. Metal shell required.
- d. Phono (RCA) plugs and jacks
 - 1) Plug: Neutrik ProFi NF2C-B-2 RCA plug (available in pairs of black and red). Gold plated nickel contacts and brass shell.
 - 2) Jack: Neutrik NF2D-B-X cable jack. Nickel plated brass contacts and shell. Use isolation washer color as required (black/red/yellow/green/blue/white)
- 3. Video / RF connectors
 - a. 75-ohm BNC Type (Video) - Canare BCJ-JRU insulated double female (feedthru) recessed panel mount connector; BCP-C7 double crimp-type straight plug (with long body sleeve for 75-ohm precision coaxial cable). Gold plated center contact and beryllium copper external contact.
- 4. Data/Networking Connectors
 - a. RJ-45 Type (Data Network) - Neutrik Ethercon CAT6 NE8FDY-C6-B D-shape panel mount jack.
- 5. Multipin Audio Connectors
 - a. Wireworks AV2000 "G" Series modular connector.
 - 1) Panel mount receptacle assembly (G1, G2, G3) up to 19-channel
 - a) Wireworks G123-CF (G1, 23 pins, Chassis, Female)
 - b) Wireworks G246-CF (G2, 46 pins, Chassis, Female)
 - c) Wireworks G369-CF (G3, 69 pins, Chassis, Female)
 - 2) Cable plug assembly (G1, G2, G3) up to 19-channel
 - a) Wireworks G123-LM (G1, 23 pins, Cable End, Male)
 - b) Wireworks G246-LM (G2, 46 pins, Cable End, Male)
 - c) Wireworks G369-LM (G3, 69 pins, Cable End, Male)
 - 3) Provide Wireworks Broadway Latching System Option (BLS) on all panel mount and cable plug G1, G2 and G3 Series modular connectors
 - a) Wireworks WWRP21502 1 pair "latch" component for cable plug connectors
 - b) Wireworks WWRP21503 1 pair "keeper" component for patch mount connectors
 - 4) Refer to manufacturer's pinout diagrams for wiring details.
 - 5) Wire and assemble connectors only according to the manufacturer's instructions.
 - 6) Use only those assembly tools supplied by the manufacturer for these contacts:
 - a) Wireworks / AMP "Certi-Crimp" hand crimping tool (or better: i.e., stripping/crimping machine) and all necessary crimping dies for specified contacts.
 - b) Wireworks / AMP 91002-1 insertion tool for formed contacts.
 - c) Wireworks / AMP 305183 extraction tool for all contacts.
 - 7) Provide ten percent (10%) spare pins and sockets.
 - 8) Provide ten percent (10%) spare Wireworks Broadway Latching System latch and keeper components, minimum one (1).
- 6. Control - XLR Type:
 - a. XLR-4: Neutrik NC4MD-L-1 (male) NC4FD-L-1 (female) panel mount connectors; Neutrik NC4MX (male) and NC4FX (female) cable connectors. Silver contacts and nickel shells throughout.

F. Wire and Cable

- 1. Conduit Installation: Refer to Wire and Cable Schedule located on the drawings for specific wire type information.

2. Flexible Drop Multicable (where required): Provide Hubbell Kellems Deluxe metal mesh cord type grips correctly sized to restrain permanently attached multi-conductor cables to junction boxes.
- G. AC Power Equipment: Provide AC Receptacle Strip, as specified in 11 61 83-A equipment list and/or drawings
1. Receptacle strips shall be permanently mounted inside equipment racks.
 2. Wiring to AC power switcher and intermediate junction boxes shall be in flexible conduit (greenfield).
 3. Provide a sufficient quantity and configuration of AC receptacle strips to support the specified equipment in each equipment rack group, plus a minimum of 50% spare outlets.
 4. Isolated ground conductors shall be wired directly to the copper busbar in each rack. Busbars are bonded together in a "star" configuration with 3/0 AWG welding cable and connected to the branch circuit panelboard via heavy-gauge cable (wiring and connection to panelboard by the Electrical Contractor). Refer to AC power grounding detail on drawings.

2.7 SPARE PARTS

- A. Spare Parts Package
1. Provide a package of spare parts for all user-serviceable portions of the AV Systems.
 2. A minimum quantity of ten percent (10%) of all connectors, bulbs, fuses, knobs, switches and other miscellaneous parts shall be supplied, in addition to any spare parts specifically listed in individual product specifications.
 3. Label all spare parts with manufacturer's part number, designation and description, and location(s) where used.
 4. The spare parts shall be delivered to the Owner after completion of the Commissioning procedure.

2.8 FABRICATION

- A. Fabrication, assembly and wiring shall be neat and workmanlike throughout.
- B. Control desks, racks and cabinets shall be welded assemblies of sheet steel or aluminum or of bar size angles, channels and tees or aluminum extrusions forming rigid enclosures to support internal components.
- C. All face panels shall be fully supported on all edges, either internally or by rolling interior edges of panels.
- D. Wood furniture/cabinet work for control desks acceptable with prior approval.
- E. Operating elements shall be mechanically safe and electrically "dead".
- F. All steel parts and panels shall be cleaned and primed with rust inhibiting primer. Exterior finishes shall be epoxy resin or baked enamel in matte black or in anodized black aluminum where approved.
- G. Control element working face panels shall be heavy aluminum or bakelite. Legends and control and protective device designations shall be engraved in panels, or in permanently attached plates, and located for ready identification.
- H. All panel engraving shall be in Helvetica Regular, height as indicated herein. In no case shall the engraving be less than 1/4" high without Theatre Consultant approval.

- I. All internal wiring shall be factory completed and clearly marked.
- J. Control relays wherever possible shall be the glass or polycarbonate enclosed plug-in type. Relays shall be acoustically damped.
- K. All wire sizes and insulation to comply with UL standards and local codes and meet or exceed electronics industry standards.
- L. All wiring to be harnessed and bound. No loose or randomly routed wires permitted.
- M. Key all components in this section with locks or keyswitches alike. Provide six (6) keys minimum.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Examine the areas to receive the Work and the conditions under which the Work will be performed. Contractor shall remedy conditions detrimental to the proper and timely completion of the Work. Do not proceed until unsatisfactory conditions have been corrected. Confirm by site visit all field conditions that may affect manufacture and installation of AV Systems equipment prior to fabrication. The Contractor shall ensure by drawing review and field survey that the conduit/raceway and power/grounding infrastructure is sufficient for the proper installation of the specified and required wire and cable, and/or any approved-substitute types of wire and cable. Submit any necessary changes to equipment and mounting details to Theatre Consultant for review prior to fabrication.
- B. The AV Contractor shall not begin pulling AV Systems wiring through the empty conduit until all conduit, pull boxes, etc. for each given run (point-to-point) are completely installed by others and ready for such wire and cable installation. The Contractor shall undertake a field inspection of the conduit system and pull boxes, reporting any missing conduit, sharp edges, missing bushings or drag lines, blocked runs and so forth, prior to attempting installation of wire and cable.

3.2 INSTALLATION

- A. General: Provide in accordance with final submittals and the manufacturer's written recommendations and as set forth herein. Verify measurements and dimensions at the project site and coordinate with the Work of other trades. Install at locations shown, in correct alignment and elevation, plumb, level, straight and true. Use procedures that prevent damaging and soiling the Work during installation.
- B. Coordinate work with all other trades to avoid causing delays in construction schedule.
- C. Mount equipment and enclosures plumb and square. Permanently installed equipment to be firmly and safely held in place. This shall include loudspeakers, conduit, cables control equipment, rack equipment, etc. Fastenings and supports shall be adequate so support their loads with a safety factor of at least three. All switches, jacks, outlets, cables. All equipment shall be installed in such a fashion as to present no safety hazard to operating personnel.
- D. All equipment except portable equipment shall be securely held in place with a safety factor of at least three; except that all equipment rigged overhead shall be so done using safe rigging practices and with rated hardware selected to meet a safety factor of at least ten. All equipment shall be installed in such a fashion as to present no safety hazard to operating personnel.

- E. Cover edges of cable pass-through holes in chassis, racks, boxes, etc, with rubber grommets or Brady GRNY nylon grommeting.
- F. If any panel, distribution box, or other device requires relocation or change of mounting detail, and this fact is not known until after shipment due to sequence of work, modify equipment or provide new equipment to fit revised location or mounting detail. Notify Theatre Consultant of any such changes, and submit all changes to Theatre Consultant for review prior to fabrication.
- G. Equipment Racks
 - 1. Mount equipment in racks and consoles and fully wire and test before delivery to job site.
 - 2. Provide ventilation adequate to keep temperature within the rack below 100 degrees F. Provide approved low-noise ventilation fan in each rack only if temperature in rack rises above 100 degrees with power on for five continuous hours.
 - 3. All metal cabinets connected to the sound system audio ground shall be effectively isolated from any conduit or other metallic component that is connected to the building electrical safety ground.
- H. Wiring
 - 1. The Contractor shall take such precautions as are necessary to prevent and guard against electromechanical/electrostatic/radio frequency interference. For line-level audio signals, flat cable shields at the output of source device. Refer to Drawings.
 - 2. Exercise care in wiring; damage to cables or equipment will not be accepted. Isolate cables of different signals or different levels and separate, organize and rout to restrict channel crosstalk or feedback oscillation in any amplifier section. Between racks, cabinets, consoles or modules all cables shall be well-supported and shall be neatly laced and dressed.
 - 3. All joints and connections shall be made with rosin-core solder or with mechanical connectors approved by the Theatre Consultant. Where spade lugs or other crimp-type terminals are used, crimp properly with ratchet type tool. Between racks, cabinets, consoles or modules, all cable shall terminate in approved terminal connectors, strips, blocks or boards.
 - 4. Route unbroken microphone audio line and control wiring from receptacle plate/chassis to patch panel/rack. Remove spliced cables and replace without additional charge to Owner. No splices shall exist in any length of wire run except where noted on drawings.
 - 5. Connect all loudspeakers electrically in phase, using the same wire color code for loudspeaker wiring throughout the project.
 - 6. All wiring and connections shall be completely visible and labeled in rack. Termination resistors shall be 1/2 watt metal film one percent (1%) tolerance; fully visible and not concealed within equipment or connectors.
 - 7. All terminations of shielded cables shall consist of a PVC or neoprene heat shrink sleeve covering the shield drain wire and an overall PVC or neoprene heat shrink sleeve covering the point at which the cable jacket and shield end.
 - 8. Run vertical wiring inside rack in properly sized raceway with snap-on covers (Panduit type E series). Horizontal wiring in rack to be neatly tied in manageable bundles with cable lengths cut to minimize excess cable slack but still allow for service and testing. Provide horizontal support bars for cable bundle sag. Neatly bundle excess AC power cable from rack-mounted equipment with plastic cable ties. Rack wiring to be bundled with plastic cable ties or lacing twine. Electrical tape and adhesive-backed cable tie anchors are not acceptable.
 - 9. Category 5/5e/6 lengths shall not exceed the maximum rated length of 295ft. Contractor is responsible to ensure that no data/network cable exceeds this length.
 - 10. Refer also to guidelines noted under "References," and "Examination."

I. Labeling and Marking

1. All portable cables and patch cords shall be color coded by length using a heat-shrink polyolifin sleeve near the male end of the cable. This sleeve shall be hot-stamped with the name of the facility. Color coding is to be as follows:

Black	=	5'
Red	=	10'
Yellow	=	25'
Blue	=	50'
White	=	100'

2. All AV Systems wire and cable shall be logically and permanently marked. All wire shall be identified at each termination point, and shall be marked to indicate the discrete destination (i.e., a wire shall show the reference number of the jack or connector to which it's other end is terminated). All cable markers shall bear the alphanumeric characters of the circuit shown on the approved shop drawings.
3. Wire and cable shall be marked with an approved system of durable identification markers, such as slip-on type PVC or neoprene sleeves, or with directly heat stamped characters. Cloth or vinyl tape type markers are not acceptable.
4. The individual pairs of multipair cable and individual conductors of multiconductor cable shall be readily identified by permanent color coding of the wire insulation. Multipair or multiconductor cable that is identified only by means of the form or order of lay of individual wire is not acceptable.
5. All spare wire shall be marked "spare" at both ends and numbered consecutively. A "spare schedule" shall be provided indicating spare wire and cable numbers, locations and types.
6. Provide engraved lamacoid labels at the front and rear of all rack-mounted mixers, signal processing equipment, power amplifiers and other active equipment. Mount labels in a neat, plumb and permanent manner. Labels to include device name and schematic designation, and the devices the equipment controls. Embossed labels are not acceptable.
7. All wall receptacle plates shall be laser etched/engraved to indicate the reference number of the circuit to which each is attached. Such numbers will, when applicable, be referenced to the patch panel jack to which the circuit connects. Refer to the Drawings for reference numbers and designations.
8. Panels and receptacles must be readable in dim lighting. Quality of laser etching/engraving, letter sizes, etc. shall comply with the specification and as approved by the Theatre Consultant through shop drawing and sample submittal.
9. All legends shall be laser etched/engraved in a color as indicated on the drawings, unless otherwise noted below.

J. Audio Shielding / Grounding

1. All shielded cables shall have their shields isolated from both the conduit system and any other shielded cables. Shields shall be continuous from source to input points. Shields shall be connected at input points only, with shields lifted at the source, except as noted below.
2. Microphone wiring shall have continuous shields from the microphone receptacle to microphone patch jack, and if normalled to a console microphone input, continuous to that point.
3. Tie-line patch points shall have continuous shield connection from one patch jack to another with no permanent connection to the audio ground network.
4. Unbalanced wiring, such as used in certain communication systems, shall have audio shields connected at device inputs and floated at device outputs. Strap shield to "low" side of unbalanced input.

5. No "doubling up" of ground points on multi-pin connectors or terminal blocks shall be allowed.
6. Shielded audio cables that normal through patch panels shall utilize a normalling type jack which has an isolated switching "break" circuit. This shall be used for sleeve normalling.

K. AC Power and Grounding:

1. Coordinate final connection of power and ground wiring to racks. Hard wire power wiring directly to power contactors or internal AC receptacles to ensure uninterrupted operation.
2. Install approved isolated-ground receptacles in wireway in each rack. Provide a minimum of two spare outlets in each rack. Label each outlet as to which AC circuit is feeding it and provide the same information in the circuit breaker panel.
3. Install a copper ground buss bar top to bottom in each rack, insulated from the rack. Ground equipment chassis not having a three-wire power cord to these busses. Connect green ground wire from each AC outlet in rack to this busbar.
4. AC power for the AV Systems is distributed at 120VAC, 60Hz, on the same electrical phase, building wide.
5. Isolated-ground (audio ground) distribution.
 - a. The sound system "isolated ground", including ground source, ground conductors, and ground distribution points shall be installed by the Electrical Contractor. The isolation and ground continuity of this network, although the responsibility of the Electrical Contractor, shall be reconfirmed by the AV Contractor prior to installation of equipment.
 - b. Except at the ground source, the audio ground shall be totally isolated from all other electrical grounds. Therefore, if the connection between the audio ground network and the ground source is disconnected, no continuity between the audio ground and the building electrical ground shall exist.
 - c. All equipment racks containing active electronics shall be connected to the audio ground, except as otherwise noted in this specification. Caution must be exercised so that these racks are not permanently, or in any way during operation, capable of being accidentally connected to the building safety ground.
 - d. All conduits and back boxes containing AV Systems wiring shall be permanently connected to the building electrical safety ground.
 - e. Note: Modulated video devices, being unbalanced in nature, shall not be connected to the sound system audio ground network. Care shall be taken when intermixing such video and audio equipment.

L. Electrical Safety

1. No voltage in excess of 25V RMS AC or 24V ripple free DC shall be exposed to touch in normal use or in any equipment by the withdrawal of modules or of any plug or connector or without the removal of suitably indelibly labeled covers.
2. Unless specifically excepted, all live electrical parts above 50V RMS AC or 60V ripple free DC, including terminals, shall remain completely shrouded by insulation or grounded metal when the main access panels are removed. The separate shrouds or covers shall require a tool to remove them to prevent inadvertent contact with live parts.
3. In addition, where enclosures or items of equipment containing predominantly control, computer, or similar low voltage signals also contain voltages in excess of 50V RMS AC or 60V ripple free DC, clear standard warning notices indicating the maximum voltage present shall be provided on all removable access panels. Similar warning notices shall be provided where voltages exceeding 120V are present in any enclosure or item of equipment and such a voltage would not reasonably be expected to be present.
4. Within enclosures, racks and panels identify with prominent, standard, and indelible signage which circuit breakers or disconnects are to be switched off in order to isolate the equipment totally. Warning notices shall also be provided on all equipment which contains live terminals after operation of its circuit breaker or disconnect. These terminals must be completely shrouded to prevent inadvertent contact.

5. All equipment, control stations, equipment racks, enclosures, and all metal cases, raceways, and conduit shall be efficiently grounded. Special hand held or portable equipment which is not double insulated shall have duplicated grounding connections. All grounding shall be in accordance with the current edition of the National Electrical Code and as identified within this specification.

M. Noise from Equipment

1. The residual noise and hum output of the systems shall be such that PNC-15 or below can be measured at the center of main floor, and the character of the remaining noise must be random, with no audible discrete frequency components.
2. Where a control panel or rack is to be used or located in an operational area, such as on the fly chamber, gallery, or control room, there shall be no acoustic noise associated with the panel. No internal cooling fans or similar moving or magnetic equipment shall be permitted unless approved by the Theatre Consultant in writing.
3. Operation of switches, pushbuttons, relays, solenoids, and similar shall not be audible to members of the audience.

3.3 FIELD QUALITY CONTROL

- A. Engineering Testing: Prior to energizing of AV systems, perform complete system check-out to verify that all items are correctly installed and shall safely operate as specified herein.

B. Field Testing and Adjustment

1. Perform required tests and adjustments upon completion of installation of AV System, including but not limited to those specified herein.
2. Contractor shall provide sufficient field service personnel (minimum of 2) to perform all tests specified below. Contractor shall furnish sufficient workmen to operate all equipment and to assist in all tests specified below. Contractor shall provide ladders and other devices, to allow access to all devices to be tested and communication between parties.
3. Contractor shall carry out the following inspections of the AV systems and submit to the Theatre Consultant the written results at each inspection for inclusion on the permanent records of the sound system. Follow EIA standards RS-160 and RS-219 in performing test. Make corrections necessary to bring system(s) into compliance with the specifications.
4. Verifying Basic System Operation
 - a. Inspect all device labels to ensure that devices are correctly and clearly labeled.
 - b. Test all circuits for proper labeling, wiring, polarity, and connection to proper device.
 - c. Test all mixing console operations.
 - d. Test all control panels for all functions.
 - e. Test all functions of all remote devices and all control plug-in points.
 - f. Test all extension cables, adapters, etc.
 - g. Verify signal flow through the entire system.
 - h. Measure and record the impedance of each loudspeaker and loudspeaker line circuit terminating at the equipment rack. Use 100 Hz for low frequency loudspeakers, 1kHz for mid-range horns, 4kHz for high frequency horns. For full-range devices, use 1kHz.
 - i. Measure and record system electrical frequency response for each input channel through power amplifier output. Deviation shall not exceed ± 1 dB within the range 30Hz to 20kHz.
 - j. Check system to assure freedom from oscillation or stray RF pickup. Check each input without signal and detect unwanted signals on oscilloscope at loudspeaker termination in rack.

- k. Check polarity of loudspeakers with an electronic polarity checker and by applying music program or constant "pink noise" signal to system while walking through the transition areas of coverage from one loudspeaker to the next. Transition should be smooth with no apparent shift in source from one loudspeaker to the next.
 - l. Apply sine wave sweep signal to each loudspeaker system, sweeping from 50 Hz to 5 kHz and at t level of 10dB below full amplifier output, and listen for rattles or noise. Correct if apparent.
 - m. Establish the normal settings for systems level controls. Adjust level controls on rack-mounted equipment for optimum signal-to-noise ratio and signal balance; cap controls which are not intended for end-user operation.
 - n. Measure, adjust, align signal delay and equalize the response of all loudspeaker systems using calibrated measuring microphones and multi-channel testing equipment.
 - o. Further adjust equalization as necessary to the satisfaction of the Theatre Consultant and Owner.
 - p. Measure and record all fiber optic line End-to-End attenuations in accordance with TIA/EIA-526-14A using factory terminated test jumpers. Overall line attenuation, including all patch panel connections and mechanical or fusion splices shall be in accordance with TIA/EIA-568B. All fiber connectors shall be tested to assure insertion losses ≤ 0.3 dB (typical) and ≤ 0.75 dB (maximum).
 - q. Verify that all Cat5/5e/6 cable runs meet TIA/EIA-568B compliance, using an appropriate Level 2 testing instrument. The instrument must verify the integrity of all conductors, as well as correctness of termination sequence. Tests shall be performed between modular jacks at AV panels and modular jacks at patch panel.
 - r. Test RF video distribution system points for proper signal level and specified and OEM performance requirements utilizing a spectrum analyzer or signal level meter.
 - s. Following the Signal Level Test, a standard television color receiver shall be connected to the interface point test tap output with suitable pad(s). All TV channels shall be viewed to verify that there are not visible signal distortions such as intermodulation (windshield wiper effect), ghosting, beats, etc. on any channel.
 - t. The RF distribution system shall be checked at the first and last outlet in each leg to verify that the RF distribution system meets all performance requirements utilizing the spectrum analyzer or signal level meter and TV receiver.
5. Final Checkout
- a. Repair or replace any equipment that fails to conform to specification, and schedule second set of tests and adjustments.
 - b. Repeat testing and repair or replacement as required to make entire AV Systems conform to specification.
 - c. Upon completion of testing, furnish Owner and Theatre Consultant a complete report on all field-testing and adjustment, certifying that system is complete, conforms to specification and is ready for Demonstration.

3.4 ADJUSTING

- A. Contractor shall correct all cosmetic damage to equipment. Ensure that all equipment is clean and in perfect condition at time of Demonstration.
- B. Repair or replace any equipment that has suffered non-cosmetic damage prior to time of Demonstration. Claims arising from repair or replacement of such damage shall be considered only after final acceptance of system by Owner.

3.5 CLEANING

- A. Contractor shall clean all racks, panels and boxes of dirt, dust, and debris, re-assemble all equipment, and replace all panels, covers and screws prior to time of Demonstration.

- B. Contractor shall ensure that all control back boxes are free of dirt, dust and debris prior to installing control panels.

3.6 DEMONSTRATION

- A. Schedule Demonstration no earlier than upon Owner's receipt of above specified report.
- B. At request of Theatre Consultant, repeat any and all tests specified in "Field Testing and Adjustment" above in presence of Owner, Architect and Theatre Consultant.
- C. Adjustments and modifications shall be made as directed by the Owner, Architect and Theatre Consultant and demonstration repeated until successful.
- D. Following successful completion of demonstration, Contractor shall provide Owner's instruction as specified herein.
- E. All costs for re-inspection and additional testing by the Architect and Theatre Consultant, if required, due to incomplete work and/or errors and omissions shall be the responsibility of the Contractor. Re-inspection and testing will be conducted on a time and materials basis, including Architect's and Theatre Consultant's standard hourly rates. All re-inspection or testing shall be scheduled and approved in writing by the Theatre Consultant, Architect and Owner, in advance of the work. All expenses, including travel, shall be the responsibility of the Contractor.

3.7 PROTECTION

- A. Do not use any control equipment intended for installation for the purpose of checking out wiring or circuitry prior to proper conditions existing on site, as specified above. Equipment may be used for such testing only in specific areas where such proper conditions exist.
- B. Provide appropriate protection from damage for all equipment in this section during the period after installation and prior to demonstration.
- C. Remove all protection and clean all equipment immediately prior to demonstration.

3.8 APPENDIX A

- A. The following appendix details equipment types and requirements.

END OF SECTION 116183

SECTION 116183 - THEATRICAL AUDIO-VIDEO SYSTEMS
APPENDIX 116183-A: AV SYSTEMS EQUIPMENT LIST

Renovations to Miller Center					
Theatrical Audio / Video Systems					
APPENDIX "A" - AV SYSTEMS EQUIPMENT LIST					
NOTE: This equipment list specifies major systems components and equipment, and should not be interpreted as a "bill of materials".					
This list may not detail all equipment required for complete, working systems.					
It is the AV Systems Contractor's responsibility to provide complete, working systems regardless of the completeness of this list.					
REF. NO.	ITEM DESCRIPTION	MANUFACTURER	MODEL	QTY.	NOTES
IS1	Equipment Rack.	Middle Atlantic	ERK-4425	1	Do not install front door
IS2	Caster Base	Middle Atlantic	CBS-ERK-25	1	
IS3	Integrated fan top with Thermostatic Fan Control	Middle Atlantic	ERK-4QFT-FC	1	Confirm CFM's required per design
IS4	(1) 20A Circuit - (20) Receptacles thin power strip. Provide w/ L5-20P Plug	Middle Atlantic	PDT-2020TL-M-NS	2	
IS5	(1) 20A Circuit - Shallow power strip for inside rack mounting. Provide w/ L5-20P Plug	Middle Atlantic	PD-2015R-NS	2	
IS6	Rack blank panels	Middle Atlantic	HBL series	as required	
IS7	Rackmount receptacle strip	Hammond	1582T8A1BK	1	
IS8	3ru Lockable drawer	Middle Atlantic	TD3-LK	1	
IS9	Facility Panels Gang			-	See dwgs for details
IS10	Facility Panels			-	See dwgs for details
IS11	Custom Rack Mounted panels	Middle Atlantic	UNI Series	3	Connectors and labeling per specification See drawings for details. Provide
IS12	Custom Rack Mounted panels	Extron	AAP Series	1	Connectors and labeling per specification Provide Convection Cooled. Provide recessing mounting accessory as required
IS13	Ethernet managed Switch - 24 Port	Cisco	200 Series	1	
IS14	Brush Grommet Panel	Middle Atlantic		1	
IS15	IEEE 802.11n Wireless Access Point	Cisco	WAP4410N	1	Include PoE Injector
IS16	Short Rack on Casters w/ Wood top, plexiglass front door and optional LCD Mount	Middle Atlantic	PTRK-21MDK	1	
IS17	Rackmount power unit w/ Dry Contact Control and Front outlet	Middle Atlantic	PDC-915R-2	1	
IS18	Rackmount Panel w/ Dual Gooseneck lamps	Middle Atlantic	LT-GN-PNL	1	
IS19	Rack Panel Recess Accessory	Middle Atlantic	RR2-3RCN	2	For Ethernet switch and grommet
IS20	Articulated LCD Mount accessory	Middle Atlantic	MMB1x1	1	
IS21	Misc Rack Accessories (mounting screws, etc)	Middle Atlantic		AR	
IS22	Wire, cable	As required	A/R		
IS23	Misc hardware, etc.	As required	A/R		
IS24	Labor	As required	A/R		
Sound Reinforcement					
SR1	Digital Signal Processor	Biamp	Nexia PM	1	
SR2	Speaker Type 1	JBL	AM7212	2	Include Riggin Hardware (MTU-3 U bracket, Doughty Hook Clamp, pipe) See mounting details. Set-up as biamp
SR3	Rack Mounted Audio Monitor	Fostex	RM-1	1	
SR4	Amp Type 1	Yamaha	XP7000	2	Bridged - One per LF at speaker
SR5	Amp Type 2	Yamaha	XP3500	1	One channel per each HF driver
SR6	Amp Type 3	Yamaha	XM4180	1	For Floor monitors
SR7	Fira alarm Relay logic	FSR	IT-R4	1	See drawings for detail. Include power supply
SR8	Wireless Microphone	Line 6	XD-V55L	1	Includes Lavalier Microphone. Mount antennas on rear rack top knockouts
SR9	12 Mono Inputs/4 Stereo Channels/4 Aux Outputs	Presonus	StudioLive 16.0.2	1	
SR10	2 RU CD Player w/ Ipod Dock	Tascam	CD-200iB	1	
SR11	2 RU CD player/Recorder	Tascam	CD-RW901SL	1	
SR12	Wire, cable	As required	A/R		
SR13	Misc hardware, etc.	As required	A/R		
SR14	Labor	As required	A/R		

Intercom					
IC1	Power Supply 1 Channel	Telex	PS-1F	1	Provide Rack mount
IC2	Intercom plate	Custom	"H1"	4	See drawings
IC3	Wire, cable	As required	A/R		
IC4	Misc hardware, etc.	As required	A/R		
IC5	Labor	As required	A/R		
Assistive Listening Systems					
AL1	Wireless FM Transmitter	Listen Technologies	LT-800	1	provide rackmount & remote antenna (LA-122)
AL2	Single channel receiver	Listen Technologies	LR-300	12	4% of 291 occupants
AL3	Headphone	Listen Technologies	LA-164	12	
AL4	Telecoil neck loop	Listen Technologies	LA-166	12	
AL5	Charging System/Carry Case	Listen Technologies	LA-325	1	
AL6	NiMH Batteries	Listen Technologies	LA-362	24	2 per pack
AL7	2 Ch Mic preamplifier	FMR Audio	Really Nice Mic-pre	1	Provide rackmount
AL8	Microphone	Audio-Technica	AT8035	1	Include Clip Holder
AL9	C-Clamp for MM Microphone	Cardellini Products	Microphone mount (2M)	1	
AL10	6" Gooseneck extension, ebony	Atlas Sound	GN-6E	1	
AL11	Wire, cable	As required	A/R		
AL12	Misc hardware, etc.	As required	A/R		
AL13	Labor	As required	A/R		
Video Presentation and Control/Projection System					
VP1	9,600 Lumens Video Projector - 16:9 aspect ratio - 1366x768	Panasonic	PT-DW8300	1	Include lens. Provide Safety cable and confirm ventilation clearances
VP2	Motorized Rolling Projection Screen w/ low voltage controls. 9'x16' viewable area. Screen gain material =1	Dalite	Custom Tensioned Professional Electrol - Conf Number DC13_0053	1	Include Low Voltage controls, (1) switch and screen mounting hardware. See drawings for required backdrop length. Coordinate with mounting condition prior to ordering.
VP3	Extender receiver/Scaler	Crestron	DM-RMC-SCALER-C	1	Mounted by Video Projector
VP4	HDMI+Analog Converter on decora Plate 3G (Tx)	Crestron	DM-TX-200-C-2G	1	For Plate at Stage (LAP)
VP5	Digital Media Presentation Switcher w/ Control System	Crestron	DMPS-200-C	1	
VP6	48 poWER Pack for PoDM	Crestron	PW-4818	1	
VP7	Universal AV Player w/ RS-232 and streaming capabilities (3RU)	Denon	DBT-3313UDCI	1	
VP8	Bluray player rackmount	Middle Atlantic	RSH series	1	
VP9	23" Display w/ vesa mount	Samsung	S23B550V	1	Force setup to match projector EDID
VP10	Provide Ipad and integration with the control system	Crestron/Apple	AR	1	
VP11	8 Relay Out/4 Digital/Analog Input Module	Crestron	ST-IO	1	For screen low voltage interface
VP12	2 Channel serial port interface	Crestron	ST-COM	1	For lighting and Roll-down drapes control
VP13	PoE Injector	Crestron	PWE-4803RU	2	
VP14	4.3" Control Panel	Crestron	TPMC-4SM-B-S	1	
VP15	Tabletop Mount for touchpanel	Crestron	TTK-4SM	1	
VP16	Wire, cable	As required	A/R		
VP17	Misc hardware, etc.	As required	A/R		
VP18	Labor	As required	A/R		

SECTION 122413 - ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes, but is not limited to,
 - 1. Electrically operated room-darkening shades
 - 2. Local group and master control system for shade operation with addressable motor
- B. Roller shade motors and all related controls shall be integrated into a compatible control system as specified herein and included as work of this section.
- C. Related Sections include, but are not limited to:
 - 1. Division 06 Section "Rough Carpentry" for wood blocking and grounds for mounting roller shades and accessories
 - 2. Division 07 Section "Joint Sealants" for sealing the perimeters of installation accessories for light-blocking shades with a sealant.
 - 3. Division 26 for electrical service and connections for motors, controls, limit switches, and other powered devices and for system disconnect switches for motor-operated shades. Refer in particular to Section "Theatrical Systems Electrical Requirements."

1.3 REFERENCES

- A. ASTM G 21 – Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
- B. NFPA 70 – National Electrical Code.
- C. NFPA 701-99- Fire Tests for Flame-Resistant Textiles and Films.

1.4 SUBMITTALS

- A. Product Data: For each type of product. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades
- B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.
 - 1. Motor-Operated Shades: Include details of installation and diagrams for power, signal, and control wiring including integration with lighting control systems/ AV equipment as applicable.
 - 2. Include results of required field measurements.
- C. Samples for Initial Selection: For each type and color of shadeband material.
 - 1. Include samples of accessories involving color selection.
- D. Samples for Verification: For each type of roller shade.
 - 1. Shadeband Material: Not less than 10 inches square. Mark inside face of material if applicable

2. Roller Shade: Full-size operating unit, not less than 12 inches wide by 12 inches long for each type of roller shade indicated
3. Installation Accessories: Full-size unit, not less than 10 inches long

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Roller shade Fabric: Equal to five percent (5%) of quantity installed for each color, and shadeband material indicated.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Obtain roller shades through one source from a single manufacturer with a minimum of ten years experience in manufacturing products comparable to those specified in this section
- B. Installer Qualifications: Installer trained and certified by the manufacturer having at least five years experience installing products comparable to those specified in this section.
- C. Fire-Test-Response Characteristics: Passes NFPA 701-99 small and large-scale vertical burn. Materials tested shall be identical to products proposed for use.
- D. Electrical Components: NFPA Article 100 listed and labeled by either UL or ETL or other testing agency acceptable to authorities having jurisdiction, marked for intended use, and tested as a system. Individual testing of components will not be acceptable in lieu of system testing.
- E. Anti-Microbial Characteristics: 'No Growth' per ASTM G 21 results for fungi ATCC9642, ATCC 9644, ATCC9645

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roller shades in factory packages, marked with manufacturer, product name, fire-test-response characteristics, and location of installation using same designations indicated on Drawings and in the Window Treatment Schedule.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Field Measurements: Where roller shades are indicated to extend past other construction, verify dimensions of other construction by field measurements for each individual window opening before fabrication and indicate measurements on Shop Drawings. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.9 WARRANTY

- A. Roller Shade Hardware and Shadecloth: Manufacturer's standard non-depreciating twenty-five year limited warranty.
- B. Roller Shade Motors and Motor Control Systems: Manufacturer's standard non-depreciating five year warranty extended to eight years if turnkey wired.

- C. Roller Shade Installation: One year from date of Substantial Completion, not including scaffolding, lifts and other means of access.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide WhisperShade IQ motorized shades as manufactured by MechoShade Systems, Inc.
 - 1. Manufacturer's Representative: Caryl Mason.
 - 2. Address: 1645 Eton Way Crofton, MD 21114.
 - 3. Telephone: 202-580-5082.
 - 4. Email: Caryl.mason@mechoshade.com.
 - 5. Website: www.mechosystems.com.
- B. Requests for substitutions will be considered in accordance with provisions of Division 01 Section "Product Requirements".

2.2 MOTOR-OPERATED, SINGLE-ROLLER SHADES

- A. Motorized Roller Shade Operating System: Provide factory-assembled, shade-operator system of size and capacity and with features, characteristics, and accessories suitable for conditions indicated, complete with electric motor and factory-prewired motor controls, power disconnect switch, enclosures protecting controls and operating parts, and accessories required for reliable operation without malfunction. Include wiring from motor controls to motors. Coordinate operator wiring requirements and electrical characteristics with building electrical system.
 - 1. Electrical Components: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 2. Motor: Electric Motor Intelligent encoded, tubular, asynchronous (non-synchronous) motors, with built-in reversible capacitor, temperature Class A, thermally protected, totally enclosed, maintenance free with line voltage power supply equipped with locking disconnect plug assembly furnished with each motor. Max draw for each shade motor shall be 2.3 amps. Low voltage motors do not meet the intent of this specification.
 - a. Electrical Characteristics: Single phase, 110 V, 60 Hz.
 - b. Motor Noise Rating: Use motors rated as 44 – 46 dbA measured at three feet.
 - c. Motor Location: Conceal motors inside shade motor tube.
 - d. Utilizing five (5) motors for eight (8) panels of fabric.
 - 3. Limit Switches: Provide programming of upper and lower stopping points (operating limits) of shadebands into motors via a hand held removable program module /configurator.
 - 4. Operating Features:
 - a. Provide intermediate stopping positions for shades that allow for up to three (3) repeatable and precise aligned positions. All shades on the same switch circuit with the same opening height shall align at each intermediate stopping position
 - b. Provide two modes of operation, uniform and regular. Uniform mode shall allow for shades to only move to intermediate stop positions. Regular mode shall allow for shades to move to both intermediate stop positions, plus any position desired between the upper and lower limits as set by the installer
 - 5. Controls: Provide group switching at two (2) locations, as follows:
 - a. Integrated five button, single gang switch control near stage.
 - b. Interface with audio-visual system touch screen control panel at Control Booth in rear of Auditorium. Refer to Division 11 Section "Theatrical Audio Video Systems."
- B. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required for accommodating operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.

1. Roller Drive-End Location: Closest proximity to J Box.
 2. Direction of Shadeband Roll: Regular, from back of roller.
 3. Shadeband-to-Roller Attachment: Removable spline fitting integral channel in tube.
- C. Mounting Hardware: Provide shade hardware constructed of minimum 1/8-inch (3.18 mm) thick plated steel or heavier as required to support 150 percent of the full weight of each shade.
- D. Shadebands:
1. Shadeband Material: Light-blocking fabric.
 2. Each window to have its own shadecloth band, eight (8) total.
 3. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
- E. Installation Accessories:
1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners
 - a. Shape: L-shaped.
 - b. Height: Manufacturer's standard height required to conceal roller and shadeband when shade is fully open.
 - c. Endcap Covers: To cover exposed endcaps.
 - d. Installation Accessories Color and Finish: As selected by Architect from manufacturer's full range of available colors.
 2. Side Channels:
 - a. Extruded aluminum with polybond edge seals and SnapLoc-mounting brackets and with concealed fastening. Exposed fastening is not acceptable.
 - b. Nominal Size: 2-1/2 inches wide by 1-3/16 inches deep.
 - c. Color: As selected by Architect from manufacturer's full range of available colors.

2.3 SHADEBAND MATERIALS

- A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Identify products with appropriate markings of applicable testing agency.
- B. Light-Blocking Fabric: Opaque fabric, stain and fade resistant.
1. Basis of Design: Mechoshade Systems Equinox 0100 series.
 2. PVC-free, 66% acrylic (coating), 34% fiberglass (yarn).
 3. Openness factor: 0% (opaque).
 4. Color: As selected by Architect from manufacturer's full range of available colors.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, accurate locations of connections to building electrical system, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ROLLER-SHADE INSTALLATION

- A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.
1. Opaque Shadebands: Located so shadeband is beyond existing casing trim as indicated.

- B. Electrical Connections: Connect motor-operated roller shades to building electrical system.
- C. Turn-Key Single-Source Responsibility for Motorized Interior Roller Shades: To control the responsibility for performance of motorized roller shade systems, assign the design, engineering, and installation of motorized roller shade systems, motors, controls, and low voltage electrical control wiring specified in this Section to a single manufacturer and its authorized installer/dealer. The Architect will not produce a set of electrical drawings for the installation of control wiring for the motors, or motor controllers of the motorized roller shades. Power wiring (line voltage), shall be provided by the roller shade installer/dealer, in accordance with the requirements provided by the manufacturer. Coordinate the following with the roller shade installer/dealer:
 - 1. Main Contractor/Electrical Subcontractor shall provide power panels and circuits of sufficient size to accommodate roller shade manufacturer's requirements, as indicated on the mechanical and electrical drawings.
 - 2. Main Contractor shall coordinate with requirements of roller shade installer/dealer, before inaccessible areas are constructed.
 - 3. Roller shade installer/dealer shall run line voltage (of sufficient quantity, in sufficient capacity as required) terminating in junction boxes in locations designated by roller shade dealer.
 - 4. Roller shade installer/dealer shall provide and run all line voltage (from the terminating points) to the motor controllers, wire all roller shade motors to the motor controllers, and provide and run low voltage control wiring from motor controllers to switch/ control locations designated by the Architect. All above-ceiling and concealed wiring shall be plenum-rated, or installed in conduit, as required by the electrical code having jurisdiction.
 - 5. Main Contractor/Electrical Subcontractor shall provide conduit with pull wire in all areas, which might not be accessible to roller shade contractor due to building design, equipment location or schedule.

3.3 ADJUSTING

- A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

- A. Clean roller-shade surfaces after installation, according to manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer that ensure that roller shades are without damage or deterioration at time of Substantial Completion.
- C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain motor-operated roller shades.

END OF SECTION 122413

SECTION 124816 - ENTRANCE FLOOR GRILLES AND MATS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes, but is not limited to, recessed exterior floor grilles and interior floor mats and frames.
- B. Related Sections include, but are not limited to:
 - 1. Division 03 Section "Cast-In-Place Concrete" for recesses in concrete construction.

1.3 COORDINATION

- A. Coordinate size and location of recesses in concrete to receive floor grilles and frames.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for entrance floor grilles and foot grilles.
- B. Shop Drawings: Include the following:
 - 1. Items penetrating floor grilles and frames, including door control devices.
 - 2. Divisions between grille sections.
 - 3. Perimeter floor moldings.
- C. Samples: For the following products, in manufacturer's standard sizes:
 - 1. Floor Grille: Assembled section of floor grille.
 - 2. Frame Members: Sample of each type and color.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For floor grilles and frames to include in maintenance manuals.

1.6 FIELD CONDITIONS

- A. Field Measurements: Indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Arden Architectural Specialties, Inc.
 - 2. Balco, Inc.
 - 3. C/S Group - cited as design standard.
 - 4. J. L. Industries, Inc.

5. Kadee Industries, Inc.
6. Mats Inc.
7. Pawling Corporation; Architectural Products Division.
8. Reese Enterprises, Inc.

2.2 ENTRANCE FLOOR GRILLES AND MATS, GENERAL

- A. Structural Performance: Provide floor grilles and frames capable of withstanding the following loads and stresses:
 1. Uniform floor load of 300 lbf/sq. ft.
 2. Wheel load of 350 lb per wheel.
- B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1.

2.3 EXTERIOR FLOOR GRILLES

- A. General: Provide manufacturer's standard floor-grille assemblies consisting of treads of type and profile indicated, interlocked or joined together by cross members, and with support legs (if any) and other components needed to produce a complete installation.
- B. Stainless-Steel Floor Grille: Type 304.
 1. Basis of Design Product: C/S Group G6 Gridline™.
 2. Surface Treads: 0.090-by-0.150-inch wire with 0.145-inch- wide openings between wires.
 3. Pit Grating: 1-1/8 inches deep.
 4. Stainless-Steel Finish: No. 4.
 5. Grille Size: As indicated.
- C. Lockdown: Manufacturer's standard Hidden Lockdowns.

2.4 INTERIOR FLOOR MAT/GRID

- A. Basis of Design Product: C/S Group Floorometry® 301.
- B. Common Mud Plate and Bond Breaker: The aluminum mud plate shall attach to the floor substrate with the manufacturer's recommended adhesive. The bond breakers shall be integral to the mud plate, preventing the flooring adhesive from bonding to the top surface of the product. The bond breaker shall also provide the base of the collection reservoir that contains all contaminants removed and collected from foot traffic. Top surface sections shall be removable, interchangeable and capable of being quarter turned, utilizing common integral attachment clips allowing for periodic maintenance by vacuuming the reservoir or power washing the product. Each mud plate shall come equipped with four (4) alignment pins to ensure a proper and quick connection of the removable surface to the common base
- C. Adhesives: One of the following:
 1. Henry® 130 Thin Spread Floor Tile Adhesive.
 2. Laticrete Latapoxy® 300 Adhesive.
- D. Modular Floor Mat:
 1. Mud plate and bond breaker as described above.
 2. Top surface shall be manufactured from T-304 Stainless Steel (alternate 6061-T6 aluminum alloy).
 3. Inserts: 0.157" materials, colors and pattern as selected by Architect.

4. Product Free Area: 14.2% for fall through potential.
5. Each module size shall be 18" x 18" x 3/4".
6. All products shall include a sub-structure of 0.090" thick perimeter stainless steel banding and stainless steel intermediate supports with a horizontal drain feature.
7. All components tack welded.
8. Product surface removable and replaceable.

2.5 FRAMES

- A. Provide manufacturer's standard frames of size and style for grille or mat type, for permanent recessed installation in subfloor, complete with installation anchorages and accessories. Unless otherwise indicated, fabricate frame of same material and finish as grilles.

2.6 SUPPORT SYSTEM

- A. Level Bed Applications: Provide manufacturer's standard, vinyl cushion support system.

2.7 DRAIN PANS

- A. Provide manufacturer's standard, 0.060-inch- thick, aluminum or stainless-steel sheet drain pan with NPS 2 drain outlet for each exterior floor-grille unit. Coat bottom of pan with protective coating recommended by manufacturer.

2.8 MATERIALS

- A. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B, with A60 zinc-iron-alloy (galvannealed) coating or with G60 mill-phosphatized zinc coating; stretcher-leveled standard of flatness; with minimum thickness indicated representing specified thickness according to ASTM A 924/A 924M.
- B. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304.
- C. Aluminum Sheet: ASTM B 209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than strength and durability properties of Alloy 5005-H15.
- D. Extruded Aluminum: ASTM B 221, Alloy 6061-T6 or Alloy 6063-T5, T6, or T52 as standard with manufacturer. Coat surface of frame in contact with cementitious materials with manufacturer's standard protective coating.
- E. Stainless-Steel Angles: ASTM A 276 or ASTM A 479/A 479M, corrosion resistant, Type 304.

2.9 FABRICATION

- A. Shop fabricate floor grilles and mats to greatest extent possible in sizes as indicated. Unless otherwise indicated, provide each grille or mat as a single unit; do not exceed manufacturer's recommended maximum sizes for units that are removed for maintenance and cleaning. Where joints in grilles or mats are necessary, space symmetrically and away from normal traffic lanes.
- B. Fabricate frame members in single lengths or, where frame dimensions exceed maximum available lengths, provide minimum number of pieces possible, with hairline joints equally spaced and pieces spliced together by straight connecting pins.

2.10 STAINLESS-STEEL FINISHES

- A. Directional Satin Finish: No. 4.
 - 1. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and floor conditions for compliance with requirements for location, size, minimum recess depth, and other conditions affecting installation of floor grilles and frames.
- B. Examine roughing-in for drainage piping systems to verify actual locations of piping connections before floor grille and frame and drain pan installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install recessed floor grilles, frames, and drain pans to comply with manufacturer's written instructions at locations indicated and with top of floor grilles and frames in relationship to one another and to adjoining finished flooring as recommended by manufacturer.
 - 1. Set floor-grille tops at height for most effective cleaning action.
 - 2. Coordinate top of floor-grille surfaces with doors that swing across grilles to provide clearance under door.

3.3 PROTECTION

- A. After completing frame installations, provide temporary filler of plywood or fiberboard in floor-grille recesses and cover frames with plywood protective flooring. Maintain protection until construction traffic has ended and Project is near Substantial Completion.

END OF SECTION 124816

SECTION 126100 - FIXED SEATING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. The work in this section includes but is not limited to the following major elements and associated accessories: Provide all materials, components, and services necessary to provide the work indicated or implied in this section, as specified herein, in the Contract Documents and shown on related Drawings
 1. Ship existing seating components from the project site to seating contractor's factory
 2. Renovate and re-install seating to be fixed floor mounted on wood floor surface
 - a. Provide new seating materials as required
 3. Preparation and submission of complete shop drawings and samples for review by the Architect prior to fabrication
 4. Preparation and submission of quality control sample chairs as indicated herein for review by the Architect prior to fabrication
 5. Installation in accordance with these specifications, pertinent drawings, established trade criteria and applicable code requirements
 6. Inspection, demonstration and necessary adjustment of completed installations
 7. Submission of required record drawings, service data and certificates
 8. Coordination with other affected work and contractors
- B. Products Supplied But Not Installed Under This Section
 1. Extra materials as listed in Part 1 Article herein.
 2. Chair mounted aisle lights with mechanically protected low voltage wire whips. These shall be wired to junction boxes with low voltage wiring stub outs at floor construction.
- C. Related Sections: Coordinate with all related sections of the specifications including, but not limited to:
 1. Division 05- Metals.
 2. Division 09 – Finishes for Flooring of audience chamber
 3. Division 26- Electrical, including but not limited to:
 - a. Conduit, wire, pull boxes, junction boxes and miscellaneous hardware and components as required for a complete electrical installation
 - b. Terminations and testing of system continuity

1.3 REFERENCES

- A. References to code, standards, specifications and recommendations of technical societies, trade organizations and governmental agencies refer to the latest edition of such publications adopted and published prior to bid submittal. Applicable codes and standards will be considered a part of this specification as if they were fully included herein.
- B. If an applicable code or standard permits work of lesser quality or extent, this specification shall govern.
- C. Comply with Commonwealth of Virginia and City of Lynchburg Fire Regulations for places of assembly, and applicable Underwriters Laboratory standards.

- D. Comply with national, state and local labor regulations and requirements.
- E. Equipment to have pertinent testing labels.

1.4 DEFINITIONS

- A. "Architect": All references to the "Architect", H&A Architects & Engineers will refer to the process by which the indicated action or decision regarding the work in this section will be administered. All such actions shall be initiated with or by the Architect, who will disseminate all pertinent information and documents to, as well as coordinate all efforts and site visits with, the Theater Consultant and all other project consultants who may have design responsibility relating to the work in this section.
- B. "Theater Consultant": Auerbach + Associates, Inc. (d.b.a. Auerbach Pollock Friedlander) The Theater Consultant will be party to all actions and decisions regarding the work in this section.
- C. "Other Project Consultants": Acoustical Consultant, Electrical Engineer, Structural Engineer, or Mechanical Engineer as is applicable to a particular issue.
- D. "Contractor": Manufacturer / Installer responsible for the fabrication and installation for the work contained in this section.
 - 1. Contractors involved with other work shall be indicated with a specific trade preceding the word "Contractor" (i.e. General, Electrical, etc.).
- E. "Owner": Authorized personnel representing the Miller Center, Lynchburg, Virginia.
- F. "Furnish": Purchase and/or fabricate and deliver to project site.
- G. "Install": Physically install the items in their proper location (s) on the project site.
- H. "Provide": Furnish and install.
- I. In all cases where a device or a part of equipment is referred to in a singular manner within the contract documents, it is intended that such a reference shall include all devices required to complete the installation in accordance with the project documents.

1.5 SYSTEM DESCRIPTION

- A. Layout Requirements:
 - 1. Refer to 'TS' series drawings for seating layout plans and details.
 - 2. Refer to image at back of this specification section.
 - 3. Seats shall be as defined in Part 2 of this section.
 - 4. The layout of the fixed auditorium seating must respect all clear aisle dimensions.
 - 5. The chairs shall stagger from row to row along the centerline of the room. Ends of rows shall align.
 - 6. Seat widths shall typically be 1'-9" (center to center). Alternate wider seats may be used where additional width may be required to bring row to proper width. Where absolutely necessary, 1'-8" seats may be used.
 - 7. In rows that contain varying width chairs, the following general criteria shall be followed:
 - a. A narrower seat is to be mounted adjacent to an aisle.
 - b. A wider seat is to be mounted adjacent to side-walls or railing.
 - c. The remaining varying width seats shall be distributed throughout the row so that the narrower seats are not mounted adjacent to one another.

- B. Chair Design Criteria
1. Auditorium chairs shall be refurbished existing fixed seats, floor-mounted, with self-lifting seat that rises to a uniform fold position. Chairs shall be padded and upholstered on existing molded plywood seats and backs.
 2. Basis of Design: Refurbished seat sample provided by Country Roads, Inc. (Greenville, MI).
 3. Refer to existing and mock-up photos on last page of this specification.
 4. Seats:
 - a. Seats shall be tested and professionally certified through an independent testing laboratory to support and withstand an evenly distributed minimum of 600 lbs. static load located 3" back from the front of the seat without deflection.
 - b. Seats shall be tested and professionally certified through an independent testing laboratory to withstand 350,000 operating cycles without added lubrication, spring fatigue or measurable bearing wear.
 - c. Seats shall be tested and professionally certified through an independent testing laboratory to withstand, without failure, not less than 100,000 impacts of a 40 lb. sandbag dropped equally from heights of 6", 8", 10" and 12".
 - d. All up-stops and down-stops shall be completely concealed and damped to eliminate noise.
 5. Backs:
 - a. Backs shall withstand an evenly distributed front or rear load of 450 lbs.
 - b. Backs shall be tested and professionally certified through an independent testing laboratory to withstand, without failure, not less than 40,000 alternating swinging impact cycles by each of two (2) opposing 40 lb. sandbags. Sandbags shall be moved horizontally and equally through various distances of 6", 8", 10" and 12" at 35 cpm.

1.6 SUBSTITUTIONS

- A. All requests for variations from the specified materials and products will be reviewed by the Architect and Theatre Consultant according to the procedures outlined in Division 01.
- B. All requests for substitutions must be submitted in a timely manner, so as not to adversely impact the project schedule.
- C. Substitutions will only be accepted if, in the judgment of the Architect and Theatre Consultant, the product is an equal to the specified product. No substitutions may be made without written acceptance from the Architect and Theatre Consultant. All substitutions made prior to this acceptance are at the sole risk of the Contractor.
- D. A substitution must be a product of equal design, construction and performance. The Contractor must submit all pertinent information required to substantiate that the products equal. The Contractor must submit all additional information, including test data, which may be requested order for the Architect and Theatre Consultant to fully evaluate the substitution. The burden of proof is solely on the Contractor.

1.7 SUBMITTALS

- A. All submittals must be submitted in a timely manner, allowing sufficient time for adequate review and possible re-submittals without jeopardizing the project schedule.
- B. Submittals will be reviewed prior to proceeding with the fabrication of the work in this section. The Theatre Consultant will only mark one set of drawings per submittal with comments. Any additional sets of drawings or product data will be returned unmarked.

- C. All submittals shall leave minimum 4" x 4" space available for review stamps and comments.
- D. Product Data: Submit catalog or standard data sheets for component parts as part of the shop drawing submittal. The data shall include all information that demonstrates compliance with the specifications herein.
- E. Shop Drawings:
1. Submit shop drawings within thirty (30) business days of contract award. Drawings to include the following:
 - a. Include a cover sheet with a drawing index including the sheet number and title for each sheet in the set.
 - b. Provide a minimum 4" x 4" area near the title block for review stamps and comments. This area should be in relatively the same location on each sheet.
 - c. The shop drawings shall include a ¼" = 1'-0" complete layout indicating seating placement, aisle widths, chair size arrangement, seat numbering and aisle light locations. Provide seating schedules as required. Clearly note the width of each individual seat in rows with varying width seats.
 - d. Because seats are to be manufactured before the renovation of the physical space, provide dimensions confirming all seating areas and necessary clearances.
 - e. These plans shall clearly indicate critical field dimensions that must be maintained by the General Contractor.
 - f. Fully dimensioned, large scale detailed fabrication drawings of all major components.
 - g. Aisle light cut sheet, including physical and mechanical characteristics, photometric information, and diagrammatic information indicating the fixture's electrical connection requirements.
 - h. Indications by arrow and boxed caption of all variations from contract drawings and specifications, except where variation is indicated as acceptable.
 - i. Inventory of all equipment to be supplied, including quantities, reference to applicable drawings, etc.
 2. Provide all aisle light power requirements within thirty (30) business days of contract award. Provide duplicate copies of this information to Owner and Theatre Consultant.
 3. Responsibility to prevent or remedy conflicts with any floor element shall rest solely on the Contractor.
- F. Samples:
1. Submit samples of each of the following elements in each required color, finish, pattern and texture indicated within 30 days of request by Architect. If qualities of an element have not been specifically indicated herein, submit manufacturer's color charts or samples of actual materials indicating the full range of standard colors, finishes, patterns and textures available. The samples may include, but are not limited to:
 - a. Two 30" square "quality" samples of seating fabric.
 - b. Manufacturer's color charts or actual samples of electrostatically applied powder finishes to be used on exposed parts.
 - c. Wood and plywood materials with finish samples for color selection.
 - d. Seat and back cushion.
 2. Any additional samples as may be requested in writing during the shop drawing process to be submitted within 14 days of written request.
- G. Mock-Ups:
- a. Following approval of shop drawings and samples indicated above, fabricate a quality control mock-up for review by the Owner, Architect and Theatre Consultant.

- b. The mock-up for review shall be of two (2) chairs including selected fabric, finishes, aisle lights, etc. The mock-up shall include the extreme widths of chairs to be provided and at least one fixed chair shall have an end standard.
 - c. Owner, Architect and Theatre Consultant will approve the mock-up prior to the fabrication of the remainder of the seating. Architect will retain the mock-up until the installation is complete.
 - d. No component of the mock-up shall be used in the final installation. The seating installed in the project shall be compared with the mock-up. They shall be identical in all respects.
 - e. It shall be the Contractor's obligation to provide shipping of the mock-up to Architect's office. Following approval of the completed installation, the mock-up shall be turned over to the Owner.
- H. Quality Assurance Submittals: The Contractor shall provide quality assurance submittals including the following:
- 1. Certificates: Submit manufacturer's certificate stating materials have met fire performance requirements specified herein.
 - 2. Project Record Documents:
 - a. At the time of acceptance testing, submit three copies of parts lists and maintenance instruction sheets. In addition, submit certificates stating that materials provided for the fixed seating have met fire performance requirements.
 - b. Within 60 days of the acceptance testing, submit three (3) sets of "as built" drawings printed on bond paper and both CAD and PDF files of the complete set of "as built" drawings showing all seating as installed.
 - c. Above submissions are required as a condition for final approval of the work.
- I. Closeout Submittals:
- 1. Submit verification that all punch list items have been rectified will be required for project closeout and initiation of the warranty period.
 - 2. Operation and Maintenance Data:
 - a. Provide specific recommendations for cleaning upholstery including any precautions against materials and methods which could damage upholstery fabric.
 - b. Provide recommendations for maintaining and touch-up of all finished surfaces of chairs.
 - 3. Warranty: All warranty information and documentation shall be integrated into all materials provided at time of "as-built" submission.

1.8 QUALITY ASSURANCE

- A. Seat construction and installation to be the responsibility of the single theatre seating contractor/manufacturer, who shall own and operate its own shop for the manufacture of theatre and auditorium seating and shall be regularly engaged in the fabrication and installation of such equipment.
- B. Contractor shall have under his control all parts composing the complete chair including castings, steel, plywood, fabric, and accessories, as well as mounting and installation components. Contractor shall perform all fabrication and coordinate installation, and shall maintain thorough test and inspection procedures to assure uniform high quality of all raw materials used as well as the finished product.

1.9 DELIVERY, STORAGE AND HANDLING

- A. Pack all equipment appropriately and substantially for shipment.

- B. All equipment containers shall clearly indicate the equipment contained, "front", "top", "fragile", the project name, and theater site allocation. Include packing and shipping lists for each container.
- C. All shipping costs to the job site are the responsibility of the Contractor. The shipping method/company is at the total discretion of the Contractor in order to meet the published project schedules.
- D. Coordinate responsibility for acceptance of material and equipment at job site with the Owner and General Contractor.
- E. Upon delivery, store the materials under cover in a dry and clean location, off the ground. Remove delivered materials which are damaged or otherwise not suitable for installation from the job site and replace with acceptable materials.
- F. Replace, at no additional cost to the Owner, all equipment and materials that are damaged during storage or handling.

1.10 SITE CONDITIONS

- A. Environmental Requirements: Coordinate all environmental requirements for all materials provided and installed under this contract.
- B. Existing Conditions: Verify all conditions at jobsite. Any additions or corrections are to be requested prior to fabrication.
- C. Field Measurements:
 1. Verify and confirm field measurements as soon as practical after completion of the construction to verify conditions as compared to shop drawings.
 2. Inform General Contractor, Architect and Theatre Consultant of any conditions that are not in accordance with the dimensions provided in the shop drawings.

1.11 WARRANTY

- A. Contractor shall warrant materials and workmanship of all seats supplied as free of defects, and shall guarantee in writing the repair or replacement within 14 days of any item found defective during a period of 5 years following the date of final acceptance. Ordinary wear and defects due to improper usage are excepted.

1.12 MAINTENANCE

- A. Extra Materials: Deliver stock of maintenance material to the Owner. Furnish the following to match those installed and taken from the same production run, packaged with protective covering for storage and identified with appropriate labels.
 1. Seat and back covers in a quantity equal to five percent (5%) of each type of chairs provided, with covers prorated to sizes of chairs used.
 2. Fully upholstered replacement seat bottoms and seat backs in a quantity equal to one percent (1%) of each type of chairs provided.
 3. Spare LED lighting assemblies for aisle lights in a quantity equal to ten percent (10%) of the chairs installed with aisle lights.
 4. Mounting hardware for all mounting conditions equal to five percent (5%) of chairs installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. To establish comparative standards of quality, the equipment and installation indicated herein shall be by one of the following manufacturers:
 - 1. Irwin Seating
3251 Fruit Ridge NW
Grand Rapids, MI 49544
(616) 574-7400
 - 2. American Seating
401 American Seating Ctr NW
Grand Rapids, MI 49504
(616) 732-6600

2.2 GENERAL

- A. Provide and install all seating and seating components complete with all necessary accessories as described herein.

2.3 MATERIALS

- A. In all cases where a device or a part of equipment is referred to in a singular manner within the Contract Documents, it is intended that such a reference shall include all devices required to complete the installation in accordance with the Contract Documents.
- B. All variations from the specified materials and product must be approved by the Owner and Theatre Consultant.
- C. Fire Performance Characteristics:
 - 1. Flame retardant performance: Upholstery components and the assembly thereof shall be in conformance with flammability standards as set forth in California Technical Bulletin #117 and local fire codes.
 - 2. Padding: Provide new (prime manufacture) polyurethane foam with an average burn length not exceeding 8" and average flame time after removal of flame source not exceeding 15 seconds, with drippings from test specimen not continuing to flame for more than 5 seconds after falling, when tested vertically in compliance with Federal Test Method Standard 191, Method 5903.2.
 - 3. Fabric: Provide fabric complying with 16 CFR Part 1610 Class I.
 - 4. Certificates: Submit manufacturer's Certificates attesting that the materials provided for theatre seating meet the above fire performance requirements.
- D. Gray Iron Castings: American Society of Testing Materials A48, Class 25.
- E. Steel Plates, Shapes, and Bars: American Society of Testing Materials A36.
- F. Steel Sheets for Baked Enamel Finish: American Society of Testing Materials A591, commercial and drawing quality; Class C, galvanized-bonderized; 20 gauge minimum unless otherwise indicated.

- G. Expansion Bolts: FS FF-B-588; Type, Class, and Style as recommended by the chair manufacturer.
- H. Concealed Plywood: PS 1/ANSI A199.
- I. Cushions: Seat and back cushions made of open cell polyurethane foam, shaped and contoured, not carved.
- J. Fasteners: All fasteners shall be concealed. No exposed fasteners permitted.

2.4 REFURBISHED SEATS

- A. General: Refer to basis of design mock-up photos at the end of this specification.
- B. Seat Bottom:
 - 1. The seat bottom shall be fully upholstered, both top and underside.
 - 2. The seat cushion shall be minimum 2-1/2" to maximum 3" thick.
 - 3. The top of the seat cushion, when deployed, shall be 17-1/2" above the floor.
 - 4. When not occupied, seat bottoms shall automatically return to a full upright position. Seat return mechanisms and stops shall be virtually silent when returning to the upright position.
- C. Seat Back:
 - 1. The cushion shall be approximately 1-1/2" thick and shall be molded for comfort.
 - 2. The wood of the back shall be revealed on the front of the seat at the top and the sides.
- D. Intermediate Support Standards:
 - 1. The standards between seats shall be steel tube construction.
 - 2. The paint color of the intermediate support standards shall match the fabric color.
- E. Aisle End Panels: The existing historic aisle end panels shall be refurbished and painted in at least two (2) colors.
- F. Arms:
 - 1. Arms shall be solid maple stained to match seat backs.
 - 2. The seat arms shall have a gently curved top with rounded curves at the front edge for patron comfort.
 - 3. Row identification tags and aisle lights shall be incorporated into the aisle arm rests.
 - 4. Wood arm rests shall be stained.
 - a. Stain color to be chosen by Architect.
- G. Aisle Lights:
 - 1. Aisle lights shall be Integral to the arm rests in locations as shown on the drawings.
 - 2. Light shall be a 24v LED luminaire.
 - 3. The fixture shall be a strip of LEDs located in a routed recess on the under-side of the aisle arm rests.
 - 4. Provide dimmable transformer(s) and DMX driven LED driver(s) in type and quantity allowing the lights to be dimmed either directly from a standard theatrical 0-120v SCR dimmer or via drivers and DMX control.
- H. Wood:
 - 1. The back and arms shall utilize or be similar to the hardwood of the existing chairs.
 - 2. All exposed wood components will be stained:

- a. Stain color to be chosen by Architect.
- I. Fabric:
 - 1. The fabric shall be chosen by the Architect.
 - 2. The color shall chosen by the architect.
- J. Identification Tags:
 - 1. Round row letter tags shall be located in a routed recess at the rear of the aisle arm rests. The size shall be approximately 1-1/4" in diameter. The color shall be brass with black lettering.
 - 2. Oval seat letter tags shall be located at the center of the wood reveal at the top of the seat back. The size shall be approximately 1" in diameter. The color shall be brass with black lettering.
- K. Floor Fasteners: Each chair support standard shall be fastened to the floor in at least two (2) locations. Flooring material is strip hardwood.
 - 1. Typical wood connections shall utilize lag bolts.

2.5 FABRICATION

- A. Shop Assembly
 - 1. Fabricate all work in this section in accordance with the direction of the Owner and the Theatre Consultant, as well as all specifications, approved shop drawings, established trade practices, and applicable code requirements.
 - 2. Shop assembly shall not commence until written approval of all mock-ups has been received from the Owner and the Theatre Consultant.
 - 3. Perform shop welding in full accordance with the appropriate sections of "Specifications for the Design, Fabrication and Erection of Structural Steel Buildings" of the American Institute of Steel Construction (AISC).
- B. Shop/Factory Finishing: All factory finishes shall comply with manufacturer's recommendations. Color selection shall be as indicated in the seating color scheme schedule at the end of this section.
- C. Tolerances: Machine finish all operating parts to standard trade tolerances, fits and finishes.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Examine areas and conditions under which auditorium seating is to be installed, including condition of substrate to which seating standards are to be attached, and notify the General Contractor in writing of conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Contractor.

3.2 PREPARATION

- A. Surface Preparation: Prepare all surfaces as to manufacturers recommendations. Surface preparation shall comply with all industry standards regarding surfaces materials.

3.3 ERECTION / INSTALLATION / APPLICATION / CONSTRUCTION

- A. Comply with best standard industry practice for secure and proper installation. Install chairs in locations indicated on approved shop drawings, with required clearances, elevations, and sightlines.
- B. Install standards in locations necessitated by seating layout with each standard attached to the substrate by no less than two anchoring devices of recommended size.
- C. Install chairs by mounting components to standards or brackets mounted on standards using industry approved hardware and fasteners. Insure that chairs in angled rows are installed properly and verify that moving components operate properly.

3.4 FIELD QUALITY CONTROL

- A. The installation of the equipment indicated in this section shall be supervised by qualified personnel who are regularly employed by the Contractor for supervision of equipment installation similar to that indicated herein.
- B. Arrange for all test and inspections required by the General Conditions.

3.5 ADJUSTING

- A. Adjust seat uplift mechanisms as required to assure that seats in each row are aligned when in upright position.
- B. Replace any upholstery that has been damaged in installation.
- C. Remove all debris caused by this work from the premises.

3.6 CLEANING

- A. Touch-up minor abrasions and imperfections in painted finishes with coating to match factory-applied finish.
- B. Remove all debris caused by this work from the premises.

3.7 DEMONSTRATION

- A. Installed seating to be operated for approval, and inspected for quality by the Owner and the Theatre Consultant.
- B. Make necessary adjustments or modifications as required.
- C. Instruct Owner's designated staff or representatives in the care and maintenance of all items.
- D. Schedule tests and instruction in conformance with project construction schedules and the availability of the Owner and the Theatre Consultant.

- E. Cost of reinspection and additional testing by the Owner and Theatre Consultant, if required, due to lack of completion and/or errors and omissions shall be paid by the Contractor respective to the area of work concerned. This work will be conducted on a time and materials basis, including the Theatre Consultant's standard hourly rates, and shall be scheduled and approved in writing prior to the reinspection/testing session with the Owner and the Theatre Consultant.

3.8 INSTRUCTIONS AND COMMISSIONING

- A. Supply instruction to the Owner staff and personnel to convey details on the operation and care of system for not less than 2 hours total. Instruction shall include, but not be limited to, proper maintenance of all systems, and replacement procedures for user replaceable parts to obtain maximum usage of systems.
- B. Deliver all copies of approved Operations Manual to the Owner and the Theatre Consultant prior to first instruction session, and review it as part of that session.
- C. Timing of all sessions shall be scheduled by Owner and Theatre staff at their convenience.
- D. All instruction shall be by technical staff of the Seating Contractor.

3.9 PROTECTION

- A. Take suitable precautions to protect the equipment in this section from damage after installation and prior to acceptance by the Owner and the Theatre Consultant.
- B. Remove all equipment protection and clean all components thoroughly prior to the demonstration session.

END OF SECTION 126100



Existing Chair Front View



Existing Chair Side View



Refurbished Sample Front View



Refurbished Sample Side View

SECTION 142400 - HYDRAULIC ELEVATOR

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes one (1) hydraulic passenger elevator.
- B. No proprietary software, hardware, or equipment shall be used on this project.
 - 1. Elevator controller and system components installed, supplied, and/or provided shall be manufacturer's non-proprietary equipment such that any elevator company is allowed to purchase, install, and service the equipment.
 - 2. Equipment and component systems shall not employ any proprietary designs that could hamper and/or otherwise prohibit subsequent maintenance, repairs or adjustments by qualified contractors.
- C. Related Requirements include, but are not limited to:
 - 1. Division 01 Section "Temporary Facilities and Controls" for temporary use of elevators for construction purposes.
 - 2. Division 03 Section "Cast-in-Place Concrete" for setting sleeves, inserts, and anchoring devices in concrete.
 - 3. Division 04 Section "Unit Masonry" for setting sleeves, inserts, and anchoring devices in masonry and for grouting elevator entrance frames installed in masonry walls.
 - 4. Division 05 Section "Structural Steel Framing" for hoist beam.
 - 5. Division 05 Section "Metal Fabrications" for the following:
 - a. Attachment plates and angle brackets for supporting guide-rail brackets.
 - b. Structural-steel shapes for subsills.
 - c. Pit ladders.
 - 6. Division 09 for finish flooring in elevator cars.
 - 7. Division 22 for sump pumps, sumps, and sump covers in elevator pits.
 - 8. Division 28 for smoke detectors in elevator lobbies to initiate emergency recall operation and heat detectors in shafts and machine rooms to disconnect power from elevator equipment before sprinkler activation and for connection to elevator controllers.
 - 9. Division 31 for excavating well hole to accommodate cylinder assembly.

1.3 DEFINITIONS

- A. Definitions in the current edition of ASME A17.1/CSA B44 apply to work of this Section.
- B. Service Elevator: A passenger elevator that is also used to carry freight.

1.4 ACTION SUBMITTALS

- A. Product Data: Include capacities, sizes, performances, operations, safety features, finishes, and similar information. Include product data for car enclosures, hoistway entrances, and operation, control, and signal systems.
- B. Shop Drawings:

1. Include plans, elevations, sections, and large-scale details indicating service at each landing, machine room layout, coordination with building structure, relationships with other construction, and locations of equipment.
2. Include large-scale layout of car-control station.
3. Indicate maximum dynamic and static loads imposed on building structure at points of support, and maximum and average power demands.

C. Samples for Initial Selection: For finishes involving color selection.

D. Samples for Verification: For exposed car, hoistway door and frame, and signal equipment finishes; 3-inch- square Samples of sheet materials; and 4-inch lengths of running trim members.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Seismic Qualification Certificates: For elevator equipment, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Manufacturer Certificates: Signed by elevator manufacturer certifying that hoistway, pit, and machine room layout and dimensions, as shown on Drawings, and electrical service, as shown and specified, are adequate for elevator system being provided.

D. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For elevators to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Division 01, include diagnostic and repair information available to manufacturer's and Installer's maintenance personnel.

B. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted elevator use.

C. Continuing Maintenance Proposal: Submit a continuing maintenance proposal from Installer to Owner, in the form of a standard one-year maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Elevator manufacturer or an authorized representative who is trained and approved by manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle materials, components and equipment in manufacturer's protective packaging. Store materials, components, and equipment off of ground, under cover, and in a dry location.

1.9 COORDINATION

- A. Coordinate installation of sleeves, block outs, elevator equipment with integral anchors, and other items that are embedded in concrete or masonry for elevator equipment. Furnish templates, sleeves, elevator equipment with integral anchors, and installation instructions and deliver to Project site in time for installation.
- B. Furnish well casing and coordinate delivery with related excavation work.
- C. Coordinate locations and dimensions of other work relating to hydraulic elevators including pit ladders; sumps and floor drains in pits; entrance subsills; electrical service; and electrical outlets, lights, and switches in hoistways, pits, and machine rooms.

1.10 WARRANTY

- A. Manufacturer's Special Warranty: Manufacturer agrees to repair, restore, or replace elevator work that fails in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, operation or control system failure, including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.
 - 2. Warranty Period: Two year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Canton Elevator, Inc.
 - 2. Minnesota Elevator, Inc.
 - 3. Otis Elevator Co.
 - 4. Southern Elevator Co.

2.2 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with ASME A17.1/CSA B44.
- B. Accessibility Requirements: Comply with Section 407 in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and with ICC A117.1.
- C. Seismic Performance: Elevator system shall withstand the effects of earthquake motions determined according to the current edition of ASCE/SEI 7 and shall comply with elevator safety requirements for seismic risk Zone 2 or greater in the current edition of ASME A17.1/CSA B44.
 - 1. The term "withstand" means "the system will remain in place without separation of any parts when subjected to the seismic forces specified."
 - 2. Affected peak velocity acceleration (Av) for Project's location is greater than or equal to 0.10, but less than 0.20 (seismic risk Zone 2).
 - 3. Provide earthquake equipment required by ASME A17.1/CSA B44.
 - 4. Provide seismic switch required by ASCE/SEI 7.

5. Design earthquake spectral response acceleration short period (Sds) for Project is 0.234.
6. Project's Seismic Design Category: B.
7. Elevator Component Importance Factor: 1.25.

2.3 ELEVATOR

- A. Elevator System, General: Manufacturer's standard elevator systems. Unless otherwise indicated, manufacturers' standard components shall be used, as included in standard elevator systems and as required for complete system.
- B. Elevator Description:
1. Type: Under-the-car single cylinder.
 2. Rated Load: 4500 lb.
 3. Rated Speed: 100 fpm.
 4. Auxiliary Operations:
 - a. Battery-powered lowering.
 5. Car Enclosures:
 - a. Inside Width: 68 inches minimum from side wall to side wall.
 - b. Inside Depth: 93-1/2 inches minimum from back wall to front wall (return panels).
 - c. Inside Height: 112 inches minimum to underside of ceiling.
 - d. Front Walls (Return Panels): Satin bronze, lacquered with integral car door frames.
 - e. Car Fixtures: Satin bronze, lacquered.
 - f. Side and Rear Wall Panels: Plastic laminate.
 - g. Reveals: Satin bronze, lacquered.
 - h. Door Faces (Interior): Satin bronze, lacquered.
 - i. Door Sills: Bronze, polished.
 - j. Ceiling: Luminous ceiling.
 - k. Handrails: 1-1/2 inches round satin bronze, lacquered, at rear of car.
 - l. Floor prepared to receive resilient flooring (specified in Division 09).
 - m. Floor Thickness, Including Setting Materials: 3/16-inch above plywood subfloor.
 6. Hoistway Entrances:
 - a. Width: 48 inches.
 - b. Height: 96 inches.
 - c. Type: Two-speed side sliding.
 - d. Frames: Satin bronze, lacquered.
 - e. Doors: Satin bronze, lacquered.
 - f. Sills: Bronze, polished.
 7. Hall Fixtures: Satin bronze, lacquered.
 8. Additional Requirements:
 - a. Provide inspection certificate in each car, mounted under acrylic cover with frame made from satin bronze, lacquered.
 - b. Provide hooks for protective pads and one complete set(s) of full-height protective pads.

2.4 SYSTEMS AND COMPONENTS

- A. Pump Units: Positive-displacement type with a maximum of 10 percent variation between no load and full load and with minimum pulsations.
1. Pump shall be submersible type with submersible squirrel-cage induction motor, and shall be suspended inside oil tank from vibration isolation mounts or shall be tank-top-mounted type with fan-cooled, squirrel-cage induction motor, and shall be mounted on oil tank with vibration isolation mounts and enclosed in prime-painted steel enclosure lined with 1-inch-thick, glass-fiber insulation board.
 2. Motor shall have wye-delta or solid-state starting.
 3. Motor shall have variable-voltage, variable-frequency control.

- B. Hydraulic Silencers: System shall have hydraulic silencer containing pulsation-absorbing material in blowout-proof housing at pump unit.
- C. Piping: Size, type, and weight of piping as recommended by elevator manufacturer, with flexible connectors to minimize sound and vibration transmissions from power unit.
 - 1. Cylinder units shall be connected with dielectric couplings.
 - 2. Casing for Underground Piping: Schedule 40 PVC pipe complying with ASTM D 1785, joined with PVC fittings complying with ASTM D 2466 and solvent cement complying with ASTM D 2564.
- D. Hydraulic Fluid: Provide one of the following:
 - 1. Elevator manufacturer's standard fire-resistant fluid with additives as needed to prevent oxidation of fluid, corrosion of cylinder and other components, and other adverse effects.
 - 2. Nontoxic, biodegradable, fire-resistant fluid made from vegetable oil with antioxidant, anticorrosive, antifoaming, and metal-passivating additives and approved by elevator manufacturer for use with elevator equipment.
 - a. Product: Subject to compliance with requirements, provide "Hydro Safe" by Hydro Safe Oil Division, Inc.
- E. Inserts: Furnish required concrete and masonry inserts and similar anchorage devices for installing guide rails, machinery, and other components of elevator work. Device installation is specified in another Section.
- F. Protective Cylinder Casing: PVC or HDPE pipe casing complying with the current edition of ASME A17.1/CSA B44, of sufficient size to provide not less than 1-inch clearance from cylinder and extending above pit floor. Casing shall have means of monitoring effectiveness to comply with ASME A17.1/CSA B44.
- G. Corrosion-Protective Filler: A nontoxic, petroleum-based gel formulated for filling the space between hydraulic cylinder and protective casing. Filler shall be electrically nonconductive, displace or absorb water, and gel or solidify at temperatures below 60 deg F.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Hydro Safe Oil Division, Inc.; No-Ox-Id Liquid Elevator Casing Filler E-800.
 - b. Union-Gard, a division of Dome Services L.L.C.; Union-Gard 160.
- H. Car Frame and Platform: Welded or bolted steel units.
- I. Guides: Roller guides; polymer-coated, nonlubricated sliding guides; or sliding guides with guide-rail lubricators. Provide guides at top and bottom of car and counterweight frames.

2.5 OPERATION SYSTEMS

- A. General: Provide non-proprietary microprocessor operation system as required to provide type of operation indicated.
 - 1. Manufacturers: Subject to compliance with requirements, provide elevator control system manufactured by one of the following:
 - a. Motion Control Engineering
 - b. Virginia Controls, Inc.
 - 2. Controller manufacturer shall offer replacement parts on the open market to all maintenance/service providers for equipment and component systems for as long as said parts are available to ensure control systems remain maintainable regardless of who may be selected for future service.
 - 3. Provide with the controller all available diagnostic tool functionality, either onboard or in a separate device/interface for the sole purpose of periodic maintenance, adjustment, and

troubleshooting the system while permitting unrestricted access to all parameters, levels of adjustment, and flags necessary for maintenance, repair or adjustment of equipment.

- B. Auxiliary Operations: In addition to primary operation system features, provide the following operational features for elevators where indicated:
 - 1. Single-Car Battery-Powered Lowering: When power fails, car is lowered to the lowest floor, opens its doors, and shuts down. System includes rechargeable battery and automatic recharging system.

2.6 DOOR REOPENING DEVICES

- A. Infrared Array: Provide door reopening device with uniform array of 36 or more microprocessor-controlled, infrared light beams projecting across car entrance. Interruption of one or more light beams shall cause doors to stop and reopen.
- B. Nudging Feature: After car doors are prevented from closing for predetermined adjustable time, through activating door reopening device, a loud buzzer shall sound and doors shall begin to close at reduced kinetic energy.

2.7 CAR ENCLOSURES

- A. General: Provide enameled-steel car enclosures to receive removable wall panels, with removable car roof, access doors, power door operators, and ventilation.
 - 1. Provide standard railings complying with ASME A17.1/CSA B44 on car tops where required by ASME A17.1/CSA B44.
- B. Materials and Finishes: Manufacturer's standards, but not less than the following:
 - 1. Subfloor: Exterior, underlayment grade plywood, not less than 5/8-inch nominal thickness.
 - 2. Floor Finish: Specified in Division 09.
 - 3. Plastic-Laminate Wall Panels: Plastic laminate adhesively applied to 1/2-inch fire-retardant-treated particleboard or manufacturer's standard honeycomb core with manufacturer's standard protective edge trim. Panels have a flame-spread index of 25 or less, when tested according to ASTM E 84. Plastic-laminate color, texture, and pattern as selected by Architect from plastic-laminate manufacturer's full range of available colors and patterns.
 - 4. Fabricate car with recesses and cutouts for signal equipment.
 - 5. Fabricate car door frame integrally with front wall of car.
 - 6. Bronze Doors: Flush, hollow-metal construction; fabricated by laminating bronze sheet to exposed faces and edges of enameled cold-rolled steel doors using adhesive that fully bonds metal to metal without telegraphing or oil-canning.
 - 7. Sight Guards: Provide sight guards on car doors.
 - 8. Sills: Extruded metal, with grooved surface, 1/4 inch thick.
 - 9. Luminous Ceiling: Fluorescent light fixtures and ceiling panels of translucent acrylic or other permanent rigid plastic.
 - 10. Handrails: Manufacturer's standard handrails, of shape, metal, and finish indicated.

2.8 HOISTWAY ENTRANCES

- A. Hoistway Entrance Assemblies: Manufacturer's standard horizontal-sliding, door-and-frame hoistway entrances complete with track systems, hardware, sills, and accessories. Frame size and profile shall accommodate hoistway wall construction.
- B. Fire-Rated Hoistway Entrance Assemblies: Door and frame assemblies shall comply with NFPA 80 and be listed and labeled by a testing and inspecting agency acceptable to authorities

having jurisdiction based on testing at as close-to-neutral pressure as possible according to NFPA 252 or UL 10B.

1. Fire-Protection Rating: 1 hour with 30-minute temperature rise of 450 deg F.

- C. Materials and Fabrication: Manufacturer's standards, but not less than the following:
1. Bronze Frames: Formed from cold- or hot-rolled steel sheet, with enamel finish, and with formed-bronze sheet laminated to steel frames using adhesive that fully bonds metal to metal without telegraphing or oil-canning.
 2. Bronze Doors: Flush, hollow-metal construction; fabricated by laminating bronze sheet to exposed faces and edges of enameled cold-rolled steel doors using adhesive that fully bonds metal to metal without telegraphing or oil-canning.
 3. Sight Guards: Provide sight guards on doors matching door edges.
 4. Sills: Extruded metal, with grooved surface, 1/4 inch thick.
 5. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M.

2.9 SIGNAL EQUIPMENT

- A. General: Provide hall-call and car-call buttons that light when activated and remain lit until call has been fulfilled. Fabricate lighted elements with LEDs or long-life lamps and acrylic or other permanent, non-yellowing translucent plastic diffusers.
- B. Car-Control Stations: Provide manufacturer's standard recessed car-control stations. Mount in return panel adjacent to car door unless otherwise indicated.
1. Mark buttons and switches for required use or function. Use both tactile symbols and Braille.
 2. Provide "No Smoking" sign matching car-control station, either integral with car-control station or mounted adjacent to it, with text and graphics as required by authorities having jurisdiction.
- C. Emergency Communication System: Two-way voice communication system, with visible signal, which dials preprogrammed number of monitoring station and does not require handset use. System is contained in flush-mounted cabinet, with identification, instructions for use, and battery backup power supply.
- D. Car Position Indicator: Provide illuminated, digital-type car position indicator, located above car door or above car-control station. Also, provide audible signal to indicate to passengers that car is either stopping at or passing each of the floors served. Include travel direction arrows if not provided in car-control station.
- E. Hall Push-Button Stations: Provide one hall push-button station at each landing.
1. Provide units with flat faceplate for mounting with body of unit recessed in wall.
 2. Equip units with buttons for calling elevator and for indicating applicable direction of travel.
- F. Hall Lanterns: Units with illuminated arrows; but provide single arrow at terminal landings. Provide one of the following:
1. Units with flat faceplate for mounting with body of unit recessed in wall and with illuminated elements projecting from faceplate for ease of angular viewing.
 2. Units mounted in both jambs of entrance frame.
 3. Units mounted in both car door jambs.
- G. Hall Annunciator: With each hall lantern, provide audible signals indicating car arrival and direction of travel. Signals sound once for up and twice for down.
1. At manufacturer's option, audible signals may be placed on cars.

- H. Hall Position Indicators: Provide illuminated, digital-display-type position indicators, located above hoistway entrance at ground floor. Provide units with flat faceplate for mounting and with body of unit recessed in wall.
 - 1. Integrate ground-floor hall lanterns with hall position indicators.
- I. Emergency Pictorial Signs: Fabricate from materials matching hall push-button stations, with text and graphics as required by authorities having jurisdiction, indicating that in case of fire elevators are out of service and exits should be used instead. Provide one sign at each hall push-button station unless otherwise indicated.

2.10 FINISH MATERIALS

- A. General: Provide the following materials for exposed parts of elevator car enclosures, car doors, hoistway entrance doors and frames, and signal equipment as indicated.
- B. Bronze Plate and Sheet: ASTM B 36/B 36M, Alloy UNS No. C28000 (muntz metal).
- C. Bronze Extrusions: ASTM B 455, Alloy UNS No. C38500 (architectural bronze).
- D. Bronze Tubing: ASTM B 135, Alloy UNS No. C23000 (red brass, 85 percent copper).
- E. Plastic Laminate: High-pressure type complying with NEMA LD 3, Type HGS or HGL for flat applications.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine elevator areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work. Verify critical dimensions and examine supporting structure and other conditions under which elevator work is to be installed.
- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Excavation for Cylinder: Drill well hole in elevator pit to accommodate installation of cylinder; comply with applicable requirements in Division 31.
- B. Provide waterproof well casing as necessary to retain well-hole walls.
- C. Install cylinder in protective casing within well hole. Before installing protective casing, remove water and debris from well hole and provide permanent waterproof seal at bottom of well casing.
 - 1. Fill void space between protective casing and cylinder with corrosion-protective filler.
 - 2. Align cylinders and fill space around protective casing with fine sand.
- D. Install cylinder plumb and accurately centered for elevator car position and travel. Anchor securely in place, supported at pit floor. Seal between casing and pit floor with 4 inches of nonshrink, nonmetallic grout.

- E. Install cylinder plumb and accurately centered for elevator car position and travel. Anchor securely in place, supported at pit floor and braced at intervals as needed to maintain alignment. Anchor cylinder guides at spacing needed to maintain alignment and avoid overstressing guides.
- F. Welded Construction: Provide welded connections for installing elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS workmanship and welding operator qualification standards.
- G. Sound Isolation: Mount rotating and vibrating equipment on vibration-isolating mounts to minimize vibration transmission to structure and structure-borne noise due to elevator system.
- H. Install piping above the floor, where possible. Install underground piping in casing.
- I. Lubricate operating parts of systems as recommended by manufacturers.
- J. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with car. Where possible, delay installation of sills and frames until car is operable in shaft. Reduce clearances to minimum, safe, workable dimension at each landing.
- K. Leveling Tolerance: 1/4 inch, up or down, regardless of load and travel direction.
- L. Set sills flush with finished floor surface at landing. Fill space under sill solidly with nonshrink, nonmetallic grout.
- M. Locate hall signal equipment for elevators as follows, unless otherwise indicated:
 - 1. Place hall lanterns either above or beside each hoistway entrance.
 - 2. Mount hall lanterns at a minimum of 72 inches above finished floor.

3.3 FIELD QUALITY CONTROL

- A. Acceptance Testing: On completion of elevator installation and before permitting elevator use (either temporary or permanent), perform acceptance tests as required and recommended by ASME A17.1/CSA B44 and by governing regulations and agencies.
- B. Advise Owner, Architect, and authorities having jurisdiction in advance of dates and times that tests are to be performed on elevators.

3.4 PROTECTION

- A. Temporary Use: Comply with the following requirements for elevator used for construction purposes:
 - 1. Provide car with temporary enclosure, either within finished car or in place of finished car, to protect finishes from damage.
 - 2. Provide strippable protective film on entrance and car doors and frames.
 - 3. Provide padded wood bumpers on entrance door frames covering jambs and frame faces.
 - 4. Provide other protective coverings, barriers, devices, signs, and procedures as needed to protect elevator and elevator equipment.
 - 5. Do not load elevators beyond their rated weight capacity.
 - 6. Engage elevator Installer to provide full maintenance service. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleanup, and adjustment as necessary for proper elevator operation at rated speed and

capacity. Provide parts and supplies same as those used in the manufacture and installation of original equipment.

7. Engage elevator Installer to restore damaged work, if any, so no evidence remains of correction. Return items that cannot be refinished in the field to the shop, make required repairs and refinish entire unit, or provide new units as required.

3.5 DEMONSTRATION AND INSTRUCTIONS

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate, adjust, and maintain elevator(s).
- B. Check operation of elevator with Owner's personnel present before date of Substantial Completion and again not more than one month before end of warranty period. Determine that operation systems and devices are functioning properly.
- C. Deliver to the Owner printed or on-line "adjuster-level" help instructions for the proper use of any tool that may be necessary to perform diagnostic evaluations, adjustments and/or programmable software changes on any unit of microprocessor-based elevator control equipment installed by the Contractor.
 1. Include with these instructions any and all access codes, passwords, nomenclature or other information that is necessary to interface the tool with the microprocessor control equipment.

3.6 MAINTENANCE

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include twelve months' full maintenance by skilled employees of elevator Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper elevator operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
 1. Perform maintenance during normal working hours.
 2. Perform emergency callback service during normal working hours with response time of two hours or less.
 3. Include 24-hour-per-day, 7-day-per-week emergency callback service with response time of two hours or less.
- B. Original equipment manufacturer shall provide engineering and technical support to any maintaining contractor so designated by the building Owner or Management Company.

END OF SECTION 142400

SECTION 211300 - SPRINKLER EQUIPMENT

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to this Section.

1.2 SUMMARY

- A. Provide and install a complete sprinkler system with inside and outside piping, including sprinkler heads, valves, hangers and supports, sleeves, fire department connections and accessories as indicated on the contract drawings and as specified below.

1.3 QUALITY ASSURANCE

- A. Sprinkler equipment and installation shall be approved by local Fire Commissioner.
- B. Equipment and installation shall meet requirements of NFPA No. 13 - Standard for the Installation of Sprinklers Systems. NFPA No. 20 – Installation of Centrifugal Fire Pump and Virginia Uniform Statewide Building Code (VYSBC) and local codes.
- C. The system is to be installed by an accredited automatic sprinkler company regularly engaged in the business and familiar with this type of installation.

1.4 SUBMITTALS

- A. Submit shop drawings of entire sprinkler system for review by Architect/Engineer. Partial submittals will not be acceptable.
- B. Annotate descriptive data to show the specific model, type and size of each item the Contractor proposes to furnish. Prepare working drawings on sheets not smaller than 24 inches by 36 inches in accordance with the requirements for "Working Plans" as specified in NFPA 13 and all other pertinent NFPA requirements, and include data essential to the proper installation of each system. No work shall begin until the design of each system and the various components have been approved by the proper departments of the City Fire Inspection Division, Virginia State Fire Marshal, Mechanical Engineer and any other organization having jurisdiction over the sprinkler system. Before the work is commenced, submit sprinkler system hydraulic calculations to show the basis for the design, graphs or tables showing the pressure discharge relationship for the sprinkler heads, and full descriptive data for pipe, fittings, alarm valves, gate valves, check valves, sprinkler heads, hangers, devices, materials, and associated equipment for approval. Indicate clearly all piping that is to be exposed.
- C. Upon completion and before final acceptance of the work, submit record drawings and specifications showing the project as finally completed, including all changes specifically known to the Architect /Engineer.
- D. Make minor modifications to the sprinkler piping layout as required by the Architect /Engineer to accommodate the building's structural system.

1.4 WATER SOURCE FLOW TEST

- A. Obtain a flow test at the point at which the sprinkler system connects to the water source.

The responsibility of obtaining the flow test and any costs associated with obtaining the flow test shall be borne by the Contractor. Submit a copy of the test data along with the drawings and hydraulic calculations. Any flow test data provided in the Contract Documents is for the basis of obtaining a bid only and shall not be used for design purposes.

- B. The design shall accommodate minor modifications to the sprinkler piping layout as required by the Architect/Engineer to accommodate the building's structural system or coordination with other trades.

1.5 VERIFICATION OF EXISTING CONDITIONS

- A. The Contractor shall be responsible for verifying the size of all existing piping that shall be used for the sprinkler system water source between the building and the point at which the flow test data is obtained.

1.6 SYSTEM DESCRIPTION

- A. The system shall be a wet-pipe type designed for applicable hazard.
- B. Layout and design of the system shall be by the Sprinkler Contractor. Pipe sizing shall be based on a hydraulically calculated system per applicable NFPA-13 hazard, density and remote area square footage.
- C. The design, equipment, materials, installation, and workmanship shall be in strict accordance with the required and advisory provisions of NFPA 13 and all other pertinent NFPA requirements, except as modified herein. Each system shall include all materials, accessories and equipment inside and outside the building necessary to provide each system to give full consideration to built-in spaces, piping, electrical equipment, ductwork, and all other construction and equipment to afford complete coverage and be free from operating and maintenance difficulties, all in accordance with detailed drawings to be submitted for approval. Devices and equipment for fire protection service shall be of a make and type listed by the Underwriters' Laboratories, Inc., or approved by the Factory Mutual System. In the publications referred to herein, the advisory provisions shall be considered to be mandatory, as though the word "shall" had been substituted for "should" wherever it appears. Reference to the "authority having jurisdiction" shall be interpreted to mean all organizations having jurisdiction over the sprinkler system. The work shall begin at the point indicated.

PART 2 – PRODUCTS

2.1 SYSTEM COMPONENTS

- A. Sectional Control Valve: Provide valve with non-rising stem, mechanical joint one end and flanged joint opposite end, valve box and cover at grade.
- B. Post Indicator Valve: Valve shall be equal to Fairbanks Fig. 0435 gate valve with non-rising stem and mechanical joint ends. Provide complete with post indicator assembly equal to TCIW No. A-240. Seal opening with approved seals. Provide wrench for each post. See civil plans for location.
- C. Check Valve: Swing type check valve shall be provided with flanged connections, 175 psi wwp, brass-seat, elastomer "o"-ring seat. Valve shall be equal to Viking Model D, where allowed by the underwriter and permitted by local authorities.

- D. Detector Check Valve: Swing type valve with flanged connections, 175 psi wwp, bronze seat, neoprene seal, equal to Viking Model E-1 shall be provided. Meter isolation and check valves shall be furnished and installed by the Contractor. Meter will be installed by the Local Water Department.
- E. Water Motor Alarm: An 8 inch diameter gong, 3/4 inch pipe connections equal to Viking Model F-1 shall be provided.
- F. Flow Switch: Flow switch shall be furnished and installed by this Contractor. Wiring and
- G. Reduced Pressure Backflow Preventer: Reduced pressure backflow preventer shall be Ames "Silver Bullet" 4000SS. Route air gap drain to outside. Install at each main riser location.
- H. Valve Supervisory Switches: Switches shall be furnished and installed by this Contractor. All wiring and connection to building fire alarm panel shall be by Electrical Contractor.
- I. Sprinkler Heads: In areas with suspended ceilings, provide flush type, concealed sprinklers with cover plate factory-finished to match color and finish of ceiling. Bronze finish pendent heads may be used in Storage Rooms and Janitor's Closets. In areas without suspended ceilings, heads shall be bronze finish, up-right type. Temperature rating of fuses as dictated by authority having jurisdiction.
- J. Sprinkler Cabinet: Provide a wall-mounted sprinkler cabinet with a total of twelve (12) spare sprinkler heads, including all types and temperatures installed on project. Provide sprinkler wrench.

2.2 VERTICAL IN-LINE FIRE PUMP, CONTROLLER, TRANSFER SWITCH, JOCKEY PUMP & JOCKEY CONTROLLER

- A. Design: The vertical in-line pump shall have a rated capacity of 500 GPM when operating against at TDH as shown below. Motor and pump speed shall not exceed 3525 RPM. Unit provided under provision NFPA-20, 1993 paragraph # 1-5.

B. Design Points

<u>GPM</u>	<u>HEAD</u>	<u>REQUIREMENTS</u>
0	145' HD	MAX
500	127' HD	MIN (UL/FM)
750	94' HD	MIN (UL/FM)

- C. Pump: The pump shall be listed by Underwriters Laboratories (UL). The unit shall meet all the requirements outlined in National Fire Protection Association Pamphlet 20 and shall be a PATTERSON 5" X 3" Model VIP. The pump shall be constructed so that the rotating elements and motor can be removed without disturbing the piping fittings, and shall be of the back pull-out type and design. The suction and discharge flanges shall be on the same centerline plain, 180 degrees apart. Rotation shall be CW (clockwise) when viewed from the driver end. The casing shall be radially split with suitable connections supplied for gauges, priming, venting, and draining. The suction and discharge flanges shall be 125 lbs. ASA standard. The pump shall be hydrostatically tested to 1.5 times the maximum working pressure or 250 psi minimum. The stuffing box shall be designed for long packing life. A water seal (lantern) ring shall be located near the center of the

stuffing box. Sealing water injection shall be through a precision-drilled passage in the volute cover to the seal ring, eliminating external lines. The stuffing box gland shall exert uniform pressure on the packing. A replaceable shaft sleeve shall be furnished and is to be of a corrosion resistant material. The shaft sleeve shall be locked into position by the impeller key. The impeller shall be precision cast machined and balanced for optimum pump life. The pump casting shall be smooth, free of scale, lumps, cracks, sand holes and defects of any nature that may make it unfit for the use for which it is intended. The bolting of pressure-holding castings shall be such that the maximum stress on any bolt will not exceed one-fourth the elastic limit of the material as computed by using the stress area and on the basis of the water pressure equivalent to the shutoff pressure effective over the area out of the centerline of the bolts. The pump bearings shall have an L-10 rating of not less than 5000 hours based on load ratings and fatigue life.

- D. Motor: The driver shall be a JP Nema Hydraulic Institute, open drip-proof, ball bearing, squirrel cage, induction motor. The motor shall be designed for 25 HP, 3-phase, 60-cycle, 208 volts, operation with a 1.15 service factor. The motor shall be close coupled and is an integral part of the pump.
- E. Electric Fire Pump Controller With Transfer Switch: The controller shall be UL/FM labeled combined manual and automatic type designed for full voltage across the line start. The enclosure shall be NEMA Type 2. The fire pump controller and transfer switch shall be a single factory wired unit meeting the requirements of the most recently mandated edition of NFPA 20 and shall be listed by Underwriters Laboratories, Inc., and approved by Factory Mutual Research Corporation. Both shall bear the labels of UL, ULC, CSA, FM, and NYB of S and A. The minimum withstand rating of the controller shall not be less than 100,000 AMPS RMS Symmetrical at 208 volts. Fused type devices are not acceptable. The controller manufacturer shall provide a five-year warranty to include all parts and replacement labor covering the controller power circuit components, including isolating switch, circuit breaker, current sensing module, motor contactor, and PCL assembly. The isolating disconnect switch and circuit breaker shall be mechanically interlocked so that the enclosure door cannot be opened with the handle in the "ON" position except by a hidden tool operated defeater mechanism. The controller shall have a minimum running period timer set for ten minutes. Terminals shall be provided to field convert the controller from automatic to manual shutdown. The controller shall have externally mounted individual visible indicators for "POWER AVAILABLE, and PHASE REVERSAL". The power transfer switch shall include a motor rated disconnect/isolating switch capable of interrupting the motor locked rotor current. The disconnect/isolating switch shall be mechanically interlocked so that the enclosure door cannot be opened with the handle in the "ON" position except by a hidden tool operated defeater mechanism. The transfer switch circuitry shall be capable of sensing both the normal power source and the emergency source. The normal power source pickup shall be set to pickup at 90% nominal voltage and 95% nominal frequency. All voltage sensing, frequency sensing, and time delays shall be field adjustable. The transfer signal shall be delayed for one second, delaying the transfer and engine start signals so as to override momentary normal power outages. The transfer switch shall have "TRANSFER SWITCH NORMAL," "TRANSFER SWITCH EMERGENCY," "EMERGENCY ISOLATING SWITCH OFF," pilot lights, "TEST" and "TRANSFER BYPASS" switches, audible alarm and "SILENCE ALARM" pushbutton mounted on the flange of the enclosure. The transfer switch shall be electrically operated and mechanically held, and shall be capable of being operated by a manual transfer mechanism located on the switch.
- F. Pump Accessories:
1. 1/2" Automatic air release valve
 2. Suction and discharge gauges

3. 3/4" casing relief valve
 4. 6" X 5" Eccentric suction reducer
 5. 3" X 6" Concentric discharge increaser
 6. 4" Outside hose valve header
 7. 2 (qty.) 2 - 1/2" hose valves with caps and chains
- G. Jockey Pump and Jockey Pump Controller System: The Jockey Pump shall be a MTH Series T-41E, bronze fitted, close-coupled turbine pump. Designed for 5 GPM at 90 psi 3600 RPM complete with vertical open-drip proof motor rated for 1.0 HP, 3 Phase, 60 Cycle, 208 Volt operation. The Jockey Pump Controller shall be a wall mounted factory wired and tested controller to include a disconnect switch circuit breaker. The controller shall be rated for 1.0 HP, 3 Phase, 60 Cycle, 208 Volt and shall be of the automatic across the line type operation and shall be service entrance labeled. Unit shall be complete with pressure switch, 120 volt control transformer, magnetic motor starter, door interlock, Hand-Off-Automatic selector switch, pump running light, and NEMA 2 enclosure.
1. The jockey pump/controller system shall be arranged to start automatically at 10 psi above the fire pump start pressure and stop at 10 psi –15 psi above the fire pump shut-off pressure.
- H. Field Acceptance Test and Performance: The pump manufacturer or its designated representative shall be present for the field acceptance test. The pump, motor, and control shall meet the intent of the specifications and outlines set forth by NFPA Pamphlet 20.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Prior to installation of piping, coordinate all hanging methods of piping with Structural Engineer. Structural Engineer shall review methods of hanging pipe and provide letter of approval before Contractor commences work.
- B. Run piping concealed above furred ceilings and in joists to minimize obstructions. Expose only heads. Run piping as high as possible and closely coordinated with the structure and mechanical ductwork in order to allow maximum clearance above light fixtures. In no case shall piping be any closer than 9" above finished ceiling.
- C. Protect sprinkler heads against mechanical injury with standard guards.
- D. Locate outside alarms on wall of building as indicated.
- E. Slope piping to allow for drainage.
- F. Provide drains at base of risers, on valved sections and at other locations requiring same for complete drainage of system.
- G. Provide necessary inspector's test pipes as required by the National Fire Protection Association to discharge to a drain in accordance with the Virginia Uniform Statewide Building Code (VUSBC). All drain piping to be galvanized.
- H. All piping is to be tested to 200 psi pressure for two hours.
- I. Install underground piping in conformance with NFPA Pamphlet 24 and local governing

authority requirements. Block and strap all fittings as recommended by AWWA and NFPA. Flush underground pipe prior to connection to inside piping. If Class 53 pipe is used, 3 joints on each side of fittings shall be mechanical joint type.

- J. Run Sprinkler System Piping in the space between the bottom of the floor slab or roof deck and the bottom chord of the steel joists. Offset around beams as required.
- K. In areas with suspended acoustic tile ceiling construction, locate sprinkler heads in center of tile.
- L. Pipe material and fittings per NFPA 13. Threading and cut grooving of ASTM A135 and Schedule 5 piping will not be allowed.
- M. Fire rated penetrations shall be accomplished with materials as needed to maintain the integrity of the rating.
- N. Install sleeves where piping passes through masonry construction. Sleeves shall be Schedule 40 steel pipe sized to accommodate piping and shall be set in place as construction progresses. Set sleeves flush with finished surfaces. Seal outside surface of sleeve to maintain integrity of wall. Inside diameter of sleeves shall match outside diameter of covering. Seal fire wall penetrations with approved fire stop material.

3.2 TESTS

- A. The system shall be subjected to tests required by and in the presence of the representative agencies having jurisdiction. Details of tests not covered by agencies' requirements shall be in accordance with NFPA 13.
- B. Conduct tests required in the presence of the agencies having jurisdiction and in accordance with their instructions.
- C. Provide instruments, equipment and pay expenses incurred in performing the tests.

END OF SECTION 211300

SECTION 220100 – PLUMBING GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to this Section.

1.2 SUMMARY

- A. The work required for this Division includes labor, materials, equipment, services and supervision required to provide complete working Plumbing systems as shown on the drawings and specified in this section.

1.3 APPLICABLE SPECIFICATIONS, CODES AND STANDARDS

- A. Work shall comply with all applicable codes and ordinances. The latest effective publications of specifications, regulations, standards, codes, etc., as applicable, shall form a part of these specifications the same as if written fully herein and shall be followed as minimum requirements.

1. The codes and ordinances of local governing agencies
2. American National Standard Institute (ANSI)
3. Air Conditioning and Refrigeration Institute (ARI)
4. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)
5. American Society of Mechanical Engineers (ASME)
6. American Society for Testing and Materials (ASTM)
7. National Electric Code (NEC)
8. National Electrical Manufacturers Association (NEMA)
9. National Fire Protection Association (NFPA)
10. Occupational Safety and Health Administration (OSHA)
11. Uniform Federal Accessibility Standards (UFAS)
12. Underwriters Laboratories, Inc. (UL)
13. Virginia Fire Safety Regulation (VFSR)
14. Virginia Uniform Statewide Building Code (VUSBC)
15. American Gas Association (AGA)
16. Americans with Disabilities Act (ADA)
17. International Plumbing Code
18. International Mechanical Code

- B. Contractor shall obtain and pay for permits and required inspections.

1.4 CONTRACT DOCUMENTS

- A. The drawings and specifications are intended to cover all work enumerated under respective headings. The drawings are diagrammatical only. Due to the scale of the drawings all required offsets, fittings, and accessories may not be indicated. Where such details omitted provide all work complete to perform function intended at no additional cost to the Owner.
- B. This Contractor shall examine the architectural, structural, plumbing, mechanical and electrical drawings and specifications to avoid conflict with other trades. Minor variations in location of equipment may be made upon written approval of the Architect at no

additional cost to the Owner. No Contractor shall take advantage of conflict or error between the drawings and specifications or between general drawings and Plumbing, Mechanical and/or Electrical drawings but shall request a clarification of such from the Architect /Engineer should this condition exist. If there is insufficient time to issue an addendum for this clarification, the Contractor shall be required to assume the most expensive item in conflict.

- C. Cooperate and coordinate the work of this Division with other trades.

1.5 ELECTRICAL WORK

- A. All electrical power wiring required for equipment installed under Division 22 shall be provided under Division 26 with all necessary and approved wiring diagrams and guidance provided under Division 22.
- B. All motor controllers and starters connected to equipment installed under Division 22 shall be furnished under those sections and shall be turned over to the Electrical Contractor for installation by the Electrical Contractor. Controllers shall be equipped with all auxiliary contacts, poles, or devices necessary to permit interlocking and control required.
- C. Three-phase motors shall have magnetic across-the-line starters unless hereinafter indicated or required by the Power Company. Provide overload relay in each phase or motor lead. Operation of any overload relay shall simultaneously open all phases.
- D. Manual starters shall be manual, single, double or three pole type designed for flush or surface mounting with overload protection in each phase.
- E. Starters for motors under automatic control shall have a built-in, hand-off auto selector switch.
- F. Push-button stations shall have "start-stop" momentary contacts having one normally open and one normally closed set with indicating lights to display when motors are running. Stations shall be heavy-duty type designed for flush or surface mountings as required.
- G. All starters and controls shall be NEMA rated and NEMA 1 enclosed where mounted inside buildings. Starters and controls mounted outside or where specifically designated shall be NEMA IV enclosed.
- H. Auxiliary 120 volt contacts shall be provided to give control and interlocking as required or as indicated. Where control voltages are different from motor voltages, a control voltage transformer shall be provided as a part of the starter.
- I. Control wiring shall be in conduit, except low voltage wiring in concealed, accessible non-air plenum ceiling spaces may be run without conduits and adequately supported from the building's structure with cable ties. Electrical and/or other plumbing or mechanical items shall not be used for cable support.
- J. Low voltage control cable specifically listed for application in accessible ceiling air plenums may be utilized in lieu of wiring in conduit.
- K. When substituted motors and/or equipment require electrical modifications to support said motors and/or equipment, the cost of the electrical modifications, associated work and coordination shall be included under the Division providing the substituted equipment.

1.6 DIELECTRIC CONNECTIONS

- A. Provide dielectric connections at all connections between ferrous and nonferrous piping or metals, except drain piping connections at drain pans for cooling coils and valves may have cast-bronze adapters.

1.7 ACCESS PANELS

- A. This Contractor shall furnish and the General Contractor shall install access panels where required for access to valves, dampers, etc. Access panels shall match the integrity of the wall and/or ceiling in which they are being installed. Access panels shall be a minimum of 12" x 12".

1.8 PROTECTION OF EQUIPMENT AND MATERIALS

- A. Responsibility for care and protection of mechanical equipment rests with the Contractor providing the equipment until it has been tested and accepted.
- B. After delivery, before and after installation, protect the equipment and materials against theft, injury, the environment and damages from all causes.
- C. Protect equipment by temporarily plugging or capping pipe openings.
- D. Provide temporary filters bi-weekly for all equipment that is operated during construction. Install new filters after all construction dirt has been removed from the building just prior to final acceptance of the building.
- E. Do not deliver equipment not designated for exterior installation to the job site until a location protected from the environment is provided.
- F. Do not deliver equipment suitable for exterior installation to the job site until it is ready to be installed in its permanent location.

1.9 TESTING, CLEANING AND PAINTING

- A. After the installation is complete and before final acceptance of the work, clean and test each system for proper operation per latest edition of the International Plumbing Code and all local requirements.
- B. Thoroughly flush and clean water piping systems before being placed in operation.
- C. Prior to the connection of the plumbing fixtures and before connections to the sanitary system are made, cap the new sanitary piping system or plug and fill with water to the top. Where piping must be tested in sections to facilitate construction, it shall withstand 10 psi pressure per floor for 8 hours in lieu of above. Trenches shall remain open until pipe has been properly tested and approved. Contractor shall verify required testing procedure with the Local Authority Having Jurisdiction (LAHJ) prior to commencing any work.
- D. Clean equipment, piping, strainers, ductwork and filters thoroughly in accordance with the best practice or as specified herein.
- E. Test domestic water piping and prove tight under hydrostatic pressure of 100 psi (system working pressure) applied for two (2) hours without a 5 psi drop in pressure. All pumps, gauges, etc., for tests shall be furnished by the Contractor.
- F. Indicate piping service and flow direction with vinyl labels identifying the service by name and the flow direction by arrows. Use labels wherever piping is exposed and at all unit

connections. For concealed piping located above accessible ceilings, label piping at 25 foot intervals with painted stencil-type lettering.

- G. Identify all valves in equipment room(s) with 1-1/2" diameter, permanently stamped, brass tags. Secure tags to valve item or wheel with brass jack chain or copper meter seals. Provide framed and mounted, under clear plastic, valve chart (8-1/2" x 11" min.) identifying valve number by system served and function.
- H. Provide seals, signs and tags on fire protection equipment at designated locations per NFPA.
- I. Exposed piping and equipment in mechanical equipment room shall be completely color code painted under this Section. Color code shall be as follows:
 - 1. Natural Gas and Compressed Air Yellow
 - 2. Domestic Cold, Hot and Hot Return Water Green
 - 3. Fire Protection Red

1.10 EQUIPMENT MARKING

- A. Label all Plumbing equipment, including starters and control panels.
- B. Provide labels affixed to the ceiling grid for locations of all above ceiling Plumbing components.
- C. Labels shall be machine engraved, laminated, Bakelite nameplate type. Labels shall be black face with white letters.
- D. Labels shall have 1/4" high letters.
- E. Rigidly attach labels using rivets or screws. Adhesive backing is not acceptable.

1.11 OPERATING AND MAINTENANCE INSTRUCTIONS

- A. Furnish complete diagrams and instructions for operation and maintenance of the systems and component parts, including the automatic control system. These shall be included within a three ring binder with the record drawings and delivered to the General Contractor for the Architect.
- B. Include diagrams and instructions for the maintenance and operations of the following Plumbing systems:
 - 1. Plumbing Fixtures
 - 2. Water Heaters
 - 3. Kitchen Equipment
 - 4. Faucets
 - 5. Flush Valves
 - 6. Backflow Preventers
 - 7. Pumps

1.12 OWNER TRAINING

- A. Utilize form at the end of this Section to certify completion of Owner training. Submit a completed form for each sub-system as required.

1.13 WARRANTY AND SERVICE

- A. This Contractor shall service the installation for one year from date of final acceptance. This shall include emergency service, on all equipment. Maintain a log book on site for service entries (i.e. date, service performed, etc.).

1.14 RECORD DRAWINGS

- A. Upon completion of the work, the Contractor shall submit corrected reproducible drawings and specifications indicating deviations made in the actual installation to the contract plans.

1.15 VISIT TO THE SITE

- A. The Contractor shall visit the site of the work and familiarize himself with all conditions affecting his work. Submission of his proposal shall be construed as indicating such knowledge of existing conditions. No additional payment will be made on claims that arise from a lack of such knowledge of existing conditions.

1.16 COORDINATION

- A. Before installing any of this work, the Contractor shall verify that it does not interfere with clearances for the erection of beams, columns, ceilings, walls and other structural, electrical or architectural members as shown on the Contract Drawings. If any work is so installed and it later develops that the design cannot be followed, the Contractor shall, at his own expense, make such changes in his work as the Architect may direct to permit the completion of the work in accordance with the drawings and specifications.
- B. It shall be the duty of the Contractor to report any interferences between his work and that of any other Contractor to the Architect as soon as they are discovered. The Architect will determine which equipment shall be relocated regardless of which was first installed, and his decision shall be final.

1.17 CUTTING AND PATCHING

- A. Where cutting, channeling, chasing, or drilling of floors, walls, partitions, ceilings, ductwork or equipment surfaces is necessary for the proper installation, support or anchorage of the piping, it shall be carefully done in accordance with the current edition of the Building Code. Damage to the building, piping, ductwork or equipment shall be repaired by skilled mechanics of the trades involved at no additional cost to the Owner. This work shall be carefully laid out in advance. Cutting of masonry block shall be done with a masonry saw.

1.18 TRENCH EXCAVATION AND BACKFILL

- A. Excavate trenches to line and grades indicated or required. Excavate sufficient distance in advance of pipe laying but open trench shall not exceed 200 feet in advance of completed pipe work. Excavate trenches with 8" clearance on each side of barrel. Do not carry excavation below bottom of pipe. Before pipe is laid, fill space between bottom of pipe and existing surface with gravel. Excavation below required level shall be backfilled at the Contractor's expense and thoroughly tamped as directed. Tamp bottom of trenches hard and grade to secure required fall. Remove unstable soil to depth determined by Architect and replace with gravel or crushed stone. Do the last 2" of excavation by hand and make suitable channel for barrel of pipe. Excavate bell holes accurately by hand so pipe shall rest on solid ground the entire length. Lay sewer and water pipes in separate trenches. Banks of trenches shall be vertical and the Contractor shall be responsible for providing sheathing, bracing, and shoring necessary for safety to conform with governing laws and ordinances. Erect, maintain and safeguard temporary

bridges, walks, barricades, or crossings where necessary to maintain traffic. Protect the public from sunset to sunrise with sufficient lights or flares to prevent accidents.

- B. Perform necessary pumping and bailing as required to keep trench in satisfactory condition for pipe laying. All excavation and backfilling shall be in accordance with the applicable requirements of Division 02 - Site Work.
- C. Backfill after pipe lines have been tested, inspected, approved and the forms removed. Backfill shall be material from excavation, borrow of sand, gravel or other approved material free from large clods and undesirable matter. Place evenly and carefully in horizontal layers around and over pipe in 6" maximum layers. Compact and tamp each layer by hand or with suitable equipment to density that shall prevent excessive settlement or shrinkage and until pipe has 18" of cover. Continue backfill in 12" layers and tamp in an approved manner. Where excavation is made through permanent pavements, curbs, driveways, and sidewalks or where structures are undercut by excavations, make backfill of material selected by the Architect in 3" layers. Each layer shall be thoroughly compacted. Water tamping shall be permitted after compacted backfill has been placed to depth of 18" above the top of the pipe. Contractor shall compact fill so that subsidence of backfill shall not be detrimental to the structure or paved area for a period of six months. Dispose of the surplus material.

1.19 CONCRETE PADS

- A. Provide at least 24"x24"x6" concrete pad flush with grade around the storm and sanitary sewer cleanouts and other pipe projections above grade.
- B. Concrete shall conform to the requirements of Division 03 Section "Cast-in-place Concrete"

1.20 FLASHING

- A. Provide cap flashing for roof-mounted fans, goosenecks, air intakes, vents, etc.

1.21 SCHEDULE OF VALUES

- A. This Contractor shall furnish and the General Contractor shall include as a minimum the following list of items. This shall form the basis for determining the completed work as part of the Application for Payment process.

Plumbing:

Below Floor/Slab Waste and Drain(material)
Below Floor/Slab Waste and Drain (labor)
Above Floor/Slab Waste and Drain (material)
Above Floor/Slab Waste and Drain (labor)
Below Floor/Slab Water Piping (material)
Below Floor/Slab Water Piping (labor)
Above Floor/Slab Water Piping (material)
Above Floor/Slab Water Piping (labor)
Plumbing Fixtures (material)
Plumbing Fixtures (labor)
Miscellaneous Equipment, Drains, Carriers and Cleanouts (material)
Miscellaneous Equipment, Drains, Carriers and Cleanouts (labor)
Water Heaters (material)
Water Heaters (labor)
Pumping Systems (material)

Pumping Systems (labor)
Kitchen Equipment Connection (labor)
Demolition (Material and Labor)
Sprinkler System Design and Calculations
Sprinkler System (material)
Sprinkler System (labor)
Pipe Hangers (material)
Pipe Hangers (labor)
Pipe Insulation (material)
Pipe Insulation (labor)
Gas Piping (material)
Gas Piping (labor)
Grease Interceptor (material)
Grease Interceptor (labor)
Backflow Preventer (material)
Backflow Preventer (labor)

1.22 PROJECT CLOSEOUT

- A. Submit the following list of items in order to achieve final project acceptance. Final payment, including retainage, shall not be processed without the required documentation as follows:
1. Verification of completed punch list items.
 2. Start-up reports.
 3. Approved operations and maintenance manuals.
 4. Verification of Owner training.
 5. Warranty letters.
 6. Complete approval by Local Authority.
 7. Record drawings.
 8. Approved Pre-Commissioning and Final Commissioning Reports

PART 2 - PRODUCTS - Not Applicable

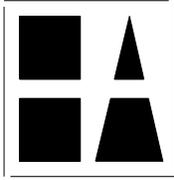
PART 3 – EXECUTION

3.1 FIELD QUALITY CONTROL AND TESTING

- A. After balancing and adjustment operations have been completed, Contractor shall conduct system check tests to prove to satisfaction of Architect that all systems are performing as specified.
- B. The Architect shall be given 48 hours notice before tests are made. The Contractor shall furnish the Architect a certificate of approval from the Local Authority Having Jurisdiction.
- C. At the time the tests are conducted, the following personnel shall be present:
1. Architect
 2. Mechanical Engineer
 3. Owner
 4. Mechanical Contractor including:
 - a. Plumbing sub-Contractor
 - b. Electrical sub-Contractor
 - c. Temperature Control sub-Contractor
 5. Other trades as may be required to successfully conduct tests.

- D. Test equipment for proper operation.
- E. Correct defects in the work and repeat tests at no additional cost to the Owner.
- F. Provide labor, material and instruments required for check tests at no additional cost to the Owner. Repair all cutting of ductwork or insulation required during test to the satisfaction of the Architect.

END OF SECTION 220100



HICKMAN • AMBROSE
INCORPORATED • CONSULTING ENGINEERS

Owner Training Certification

Project:

Equipment:

Contractor Certification

The undersigned as the Contractor's authorized training agent for the above noted equipment certifies that all required and applicable training has been provided to the Owner's representative(s) per the project Contract.

Contractor Representative: _____ **Date:** _____

Owner Certification

The undersigned as the Owner's authorized agent certifies that all required and applicable training has been provided to the Owner's satisfaction.

Owner Representative: _____ **Date:** _____

SECTION 220500 – PLUMBING MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to this Section.

1.2 SUMMARY

- A. Materials and equipment furnished under these specifications shall be new and free of scratches or any other imperfections and shall be the current product of the Manufacturer for the intended service.

1.3 REFERENCES

- A. Plumbing materials furnished under these specifications shall be new and listed, inspected and approved by the Underwriters' Laboratories (UL) and shall bear the UL label where labeling service is available. Where the UL labeling service is not available, submit a statement from a nationally recognized, adequately equipped testing agency indicating that the items have been tested in accordance with required procedures and that the materials and equipment comply with all contract requirements. Materials and equipment shall also comply with the requirements of all applicable Codes.

1.4 SUBMITTALS

- A. Submit complete schedules of material and equipment proposed for installation within 90 days after award of the contract, in quantities as indicated in Division 01. The schedules shall include catalogs, cuts, diagrams and such other descriptive data and/or samples as indicated in the SUBMITTALS paragraph of each Section in Division 22 – PLUMBING. Schedules of material which consist of facsimiles or copies of facsimiles shall be unacceptable. If after expiration of the 90 day period or any extension thereof as authorized by the Architect the Contractor fails to submit a schedule of acceptable material or equipment, the Engineer reserves the right to accept no substitutions, and the Contractor may be required to submit material and equipment as specified. In the event any items of material or equipment submitted within the 90 day period fail to comply with the specification requirements, such items will be rejected and approved items shall be submitted for the items rejected. If the resubmitted material or equipment fails to comply with the specification requirements, the Contractor shall then be required to submit material and equipment as specified without additional cost to the Owner.
- B. Submittals which do not adhere to the following format shall be rejected without review. Submittals shall be bound by staples, or in book form. The first page of the submittal shall be a Title page, which shall indicate the Project name and Project address, the General Contractor's name, address, phone number and contact and the Mechanical Contractor's name, address, phone number and contact. The second page of the submittal shall be a Table of Contents indicating the specification section number and name, and contain the General Contractor's and the Plumbing Contractor's stamps of approval. Blank page dividers shall separate each section and shall be tagged with the corresponding specification section number as listed in the Table of Contents. One of the submittals shall be hole-punched and placed in a 3-ring binder, which shall be retained by the Engineer. Partial submittals shall be allowed only when requested by the Contractor in writing and approved by the Engineer. The copies shall be clear and readable. Approved copies of all shop drawings shall be kept on the job site at all times accessible to the Architect/Engineer.

- C. Submittals that do not contain the General Contractor's and Plumbing Contractor's stamps of approval will be returned without review.
- D. Where Drawings are required, they must be submitted along with product data. Separate submittals will not be reviewed.

1.5 SUBSTITUTIONS

- A. The name of a certain brand, make, Manufacturer or definite specification is to denote the quality standard of article desired, but does not restrict bidders to the specified brand, make, Manufacturer or specification named. Substitution of any other brand, make, or Manufacturer, which in the opinion of the Architect or Engineer, and approved by the Owner, is recognized the equal of that specified, shall be accepted, but only if submitted within the requirements of Division 01. If substitute equipment is allowed, the Contractor shall be responsible for its use and for its ability to fulfill all intended functions in the completed system with no additional or extra cost to the Owner.
- B. When substituted equipment is dissimilar from that specified, the Contractor may be requested by the Engineer to submit layout drawings (drawn to scale) indicating the proposed method of installation. Modifications required to duct, piping, access, etc. shall be clearly indicated. All cost associated with such modification shall be the responsibility of the Contractor providing the substitute equipment.
- C. When three or more Manufacturers are specified, there will be no substitution.

PART 2 - PRODUCTS - Not Applicable

PART 3 – EXECUTION

3.1 INSTALLATION- GENERAL

- A. Properly store and protect materials and equipment at the project site until installation by the Contractor and acceptance by the Owner. Materials intended for indoor use must be stored inside or adequately protected from the weather.
- B. Workmanship shall be of highest quality and shall conform to standard practice for trade involved.
- C. Do not support equipment and/or piping from the roof deck, the ceiling or the support wires.

3.2 CLEANING

- A. Remove all dirt trash and oil from the exterior and interior of all equipment and duct prior to installation.

3.3 REPAIR OF EXISTING WORK

- A. Repair of existing work, demolition, and modification of existing plumbing systems shall be performed as follows:
 - 1. Workmanship: Lay out work in advance. Exercise care when cutting, channeling, chasing, or drilling of floors, walls, partitions, ceilings, or other surfaces as necessary for proper installation, support, or anchorage of other work. Repair damage to buildings, piping, and equipment using skilled craftsmen of trades

- involved.
2. Existing Concealed Piping to be Removed: Disconnect from its source. Cut piping flush with floor, underside of floor, and through walls; and seal openings.
 3. Maintain access and operation of existing installations and devices which are to remain active. Modify installation or provide access panel as required.
 4. Repair surfaces damaged by demolition and unfinished surfaces exposed by demolition and paint to match surrounding surfaces.

END OF SECTION 220500

SECTION 220523 - PLUMBING VALVES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to this Section.

1.2 SUMMARY

- A. Install valves where indicated or required. When miscellaneous valves are not shown, provide all valves necessary for the control and operation of equipment and fixtures.

PART 2 - PRODUCTS

2.1 VALVES

- A. Manufacturer Catalog numbers used are Nibco/Scott. Valves with equal characteristics by Jenkins Brothers or Lunkenheimer are acceptable.
 - 1. Ball valves 2" and smaller: Figure S-585-70.
 - 2. Gate valves 3" and smaller: Figure S113.
 - 3. Check valves 2" and smaller: Figure S-413.
 - 4. Balancing valves: Sarco type 1BW series, brass body.
 - 5. Temperature and Pressure Relief Valves: Watts AGA listed and ASME rate.
- B. HOSE BIBBS
 - 1. Hose bibbs in unfinished spaces shall be rough brass with a wheel handle and equipped with a vacuum breaker.
 - 2. Hose bibbs in finished spaces shall be polished chrome with removable "T" handle and equipped with a vacuum breaker.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Install gate valves in service requiring the valve to be fully opened or tightly closed.
- B. Use balancing valves on hot water recirculating lines.

END OF SECTION 220523

SECTION 220630 - PLUMBING EQUIPMENT

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to this Section.

1.2 SUMMARY

- A. Provide Plumbing equipment and materials as indicated.
- B. Trenching and backfill for piping shall be the responsibility of this Contractor.
- C. Coordinate all piping below slab with foundation construction.
- D. Sleeve all piping that passes through the footings.

PART 2 - PRODUCTS

2.1 WATER PIPING

- A. Interior water piping buried under floor slabs on grade to 5'-0" exterior to the building shall be Type "K" or "L" copper tubing.
- B. Interior water piping above first floor slab shall be Type "L" hard copper tubing.
- C. Copper tubing shall be assembled with cast or wrought copper solder joint fittings.
- D. Joints shall be made with a non-corrosive flux and solder composed of 95% tin, 5% antimony.

2.2 SOIL, WASTE, VENT AND DRAIN PIPING

- A. Drain and waste piping buried up to a point 5'-0" outside the building shall be no-hub cast iron or Schedule 40 plastic pipe and fittings that meet the requirements of ASTM D-2665. Cell-core piping will not be allowed for any portion of drain waste and vent system. Fernco fittings are not allowed on any buried piping.
- B. Drain, waste and vent piping above grade shall be no-hub cast iron or Schedule 40 PVC piping and fittings that meet the requirements of ASTM D-2665. PVC pipe shall not be permitted for soil, waste, roof drain and overflow drain stacks or in ceiling return air plenums. Cell-core piping will not be allowed for any portion of drain waste and vent system.
- C. Assemble no-hub cast iron pipe and fittings using neoprene gaskets and stainless steel retaining sleeve. Assemble all stacks with huskey heavy couplers. MG type couplers are allowed, however installation must be in strict accordance with the manufacturers instructions. Installation shall be in accordance with CISPI Pamphlet No 100.
- D. This Contractor shall furnish vent collars to Roofing Contractor for installation.

2.3 CLEANOUTS

- A. Provide cleanouts as indicated.
- B. Cleanouts shall be same size as pipe except that cleanout plugs shall not be larger than 4". Cleanouts installed in connection with cast-iron, pipe shall consist of long-sweep 1/4 bend or one or two 1/8 bends extended where indicated.
- C. Cleanout shall be cast-iron drainage T-pattern 90 degree branch, fittings with a brass screw plug at the foot of soil, waste, and drain stacks and on each building drain outside the building. Access covers to cleanouts on pipe concealed in partitions and wall shall be provided with a chromium-plated cast-brass plate secured to the plug. Exterior cleanouts shall be installed with concrete collar. Exterior wall access covers shall be chrome-plated brass or stainless steel.

2.4 TRAPS

- A. Provide a trap for each fixture and piece of equipment requiring connections to drainage system. Supply traps with fixtures. Place each trap as near to the fixture as possible. No fixture shall be double trapped. Traps installed on threaded pipe shall be recess drainage pattern. Traps on all floor drains shall be deep-seal type.
- B. Provide trap primers on floor drains as indicated on plans. Traps primers shall be by Precision or approved equal.
- C. Exposed traps and drain piping shall be chromium plated.
- D. Rough-ins for plaster trap shall ensure the device will fit in the intended location and trap can be cleaned without removal.

2.5 WATER HAMMER ARRESTERS

- A. Locate water hammer arresters as indicated
- B. Method of installation shall be in accordance with the Manufacturer's specifications.
- C. Coordinate access panel in walls with grab bars.

2.6 HANGERS

- A. Hangers shall be Grinnel and Automatic Sprinkler, or approved equal, of the following catalog numbers:
 - 1. Insulated piping - Insul-Speed
 - 2. Uninsulated piping - Auto-Grip.
- B. Hanger spacing shall be as follows:
 - 1. ½" to 1" - maximum span 7'.
 - 2. 1-1/2" to 2" - maximum span 10'.
 - 3. 2-1/2" to 3" - maximum span 12'.
- C. Drain, waste and vent piping - maximum span 5', and located at each joint.
- D. Secure hangers to the structure by means of approved beam clamps and/or concrete inserts. Expansion and toggle bolts shall not be permitted. Provide intermediate supports between structural members where required to obtain proper hanger spacing.

- E. Support all piping below first floor and basement slab by hangers. Attach hangers to bottom side of floor slab, and maintain proper slope of drainage piping.

2.7 WATER HEATERS

- A. Water heaters shall be complete with factory installed safety equipment.
- B. Provide thermal expansion tank on cold water inlet of water heater equal to Amtrol ST. All thermal expansion tanks for water heaters above 199,000 BTU shall be ASME rated.
- C. Gas-fired water heaters above 199,000 BTU must be ASME rated.

2.8 HOT WATER CIRCULATING PUMPS

- A. In-line pumps shall be close-coupled all bronze construction with Mechanical seals. Motor shall be open drip-proof.

2.9 THERMOMETERS

- A. Provide thermometers for water heater as indicated and as manufactured by Weksler Instrument.
- B. Thermometers in pipelines shall be separable socket 9" red reading mercury insertion type with scale suitable for required temperature range. Locate thermometers to facilitate reading from the floor. Use angle type where necessary to facilitate reading.

PART 3 - EXECUTION

3.1 PIPE INSTALLATION

- A. Piping shall be concealed throughout the building except piping may be exposed in Mechanical equipment rooms, utility spaces, at immediate connections to Plumbing fixtures and where indicated.
- B. Accomplish fire rated penetrations with materials as needed to maintain the integrity of the rating. See Drawings for Details.
- C. Install sleeves where piping passes through masonry construction. Sleeves shall be Schedule 40 steel pipe sized to accommodate piping and insulation. Set sleeves in place as construction progresses. Set sleeves flush with finished surfaces. Seal outside surface of sleeve to maintain integrity of wall. Inside diameter of sleeves shall match outside diameter of covering as detailed on the Contract Documents.
- D. Install escutcheons where pipes pass through any exposed surfaces. Escutcheons shall be split-ring hinged and sized as required. Escutcheons in the equipment rooms shall be suitable for painting. Other escutcheons shall be nickel or chromium finish.
- E. Stencil directional flow arrows and pipe identification on all piping.
- F. Grade horizontal soil, waste, and drain pipes as follows, except as approved and as indicated on the drawings.
 - 1. 2" 1/4" per foot, minimum
 - 2. 3" and larger 1/8" per foot, minimum

- G. Install vertical soil and waste piping with provisions for expansion and extend full size to and above roof lines as vents, except as otherwise indicated. Where practicable, connect two or more vent pipes together and extend as one pipe through roof in approved locations. Run concealed vent pipes in overhead spaces with horizontal waste or soil piping pitched down to stacks without forming traps in pipes using the required fittings. Where an end or circuit vent pipe from fixture is connected to vent line serving other fixtures, make the connect at least 4'-0" above the floor on which the fixtures are located. Vent lines shall not be used as waste, except as approved. Extend cast-iron hub-and-spigot pipe inside of building 6" above the floor.
- H. Make changes in the pipe sizes on soil, waste, and drain lines with reducing fittings or recessed reducers. Make changes in direction by appropriate use of 45° wyes, longsweep 1/6, 1/8 or 1/16 bends except sanitary tees may be used where permitted by Code in soil and waste lines where changes in direction of flow is from horizontal to vertical and on discharge from water closets. Short-radius fittings shall not be permitted, except in approved location.
- I. Slip joints shall be permitted only in trap seals or on inlet side of traps. Use hub fittings for making union connections wherever practicable in connection with dry vents. The use of long screws and bushings is prohibited.
- J. Do not install PVC piping in the return-air plenums, through fire walls or any location not allowed by the Building Code.
- K. Coordinate the locations of all cleanouts to ensure they do not occur under built-ins or equipment.

END OF SECTION 220630

SECTION 220700 - PIPING AND EQUIPMENT INSULATION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to this Section.

1.2. SUMMARY

- A. Insulate piping as specified below, unless otherwise indicated on the contract drawings.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Insulation for domestic hot water, cold water, hot water recirculation, horizontal roof drainage and overflow piping up to and including roof drain sump and Mezzanine floor drain waste piping and p-traps: 1" thick preformed fire retardant fiberglass pipe insulation with vapor barrier jacket or 3/8" thick flexible closed cell type for piping up to 3" diameter.
- B. Insulation for heating water converter and storage water heaters: 2-1/2" thick rigid fiberglass insulation held in place with bands and studs as recommended by the Manufacturer and finished with insulating and finishing cement over 2" hexagonal mesh wire.
- C. Insulation for fittings, valves, flanges, strainers and piping accessories: Similar to piping systems in which they occur and finished with cement and jackets as specified for piping system. Interior exposed elbows, tees, and valves shall have one piece PVC insulated fitting covers. Piping specified with vapor barriers shall have all seam edges of fitting covers sealed with vapor barrier adhesive mastic prior to taping.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Apply insulation on clean, dry surfaces and, after inspection, released for insulation application. Run insulation continuously through wall and ceiling openings and sleeves. Apply insulation on cold surfaces where vapor barrier jackets are used, with a continuous, unbroken vapor seal. Hangers, supports, anchors, etc., that are secured directly to cold surfaces must be adequately insulated and vapor-sealed to prevent condensation.
- B. Apply insulation in accordance with the Manufacturer's recommendations unless specified otherwise. No insulation will be required at immediate fixture connections or on buried pipe.
- C. Provide insulation protection shields or saddles at pipe supports for insulated pipes 1/2" in size and larger.
- D. Do not run piping above the Electrical equipment rooms.

END OF SECTION 220700

SECTION 221100 - PLUMBING SYSTEM

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to this Section.

1.2 SUMMARY

- A. Rough-in for and make final plumbing connections to plumbing equipment and fixtures, unless otherwise indicated.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Products shall be as specified elsewhere in this division, and shall be furnished complete.

PART 3 – EXECUTION

3.1 INSTALLATION, GENERAL

- A. Connections to equipment and fixtures shall be in accordance with approved shop drawings and Manufacturer's written instructions.
- B. Rough-in connections shall be one size larger than actual fixture connections and shall be reduced at supply fittings.
- C. Make all connections between dissimilar metals with dielectric union.

END OF SECTION 221100

SECTION 221116 - DOMESTIC WATER SUPPLY AND TREATMENT

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to this Section.

1.1 SUMMARY

- A. The domestic water service piping shall be from the city system.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. New (and affected existing) domestic water piping shall be thoroughly sterilized with a solution containing not less than 50 parts per million of available chlorine.
- B. Chlorinating materials shall be liquid chlorine gas-water mixture, calcium hypochlorite, sodium hypochlorite or chlorinated lime and water mixture conforming to the requirements of the American Water Works Association.

PART 3 – EXECUTION

3.1 STERILIZATION

- A. After introducing the solution into the system, it shall remain in the system for a minimum period of 24 hours or until pronounced by the local Health Authority as safe and fit for human consumption. During the sterilization period, open and close valves and outlets shall be opened and closed several times. After sterilization, flush the solution shall be flushed from the system with clean water until residue content is not greater than 0.2 parts per million unless otherwise directed. Submit statement of certification per Materials and Methods Section 220500 requirements.

END OF SECTION 221116

SECTION 224200 - PLUMBING FIXTURES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to this Section.

1.2 SUMMARY

- A. Plumbing fixtures shall be as indicated.

PART 2 - PRODUCTS

2.1 PLUMBING FIXTURES

- A. Fixtures shall be as listed by Manufacturer in the fixture connection schedule on the drawings.
- B. Fixtures shall be complete with appurtenances, including faucet set, supplies, drain, trap, etc. Fixtures shall be by one Manufacturer insofar as possible. All faucets shall meet ANSI/NSF 61, Section 9 certification.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Install fixtures in accordance with Manufacturer's detailed instructions, unless otherwise indicated.
- B. Provide wall hung fixtures not specified to be furnished with chair carriers with a hanger bracket secured to the face of the wall.
- C. Install floor fixtures on firm and even bearing. Seal fixture mounting surface at wall and/or floor with a high quality white silicone caulk and sealant.

END OF SECTION 224200

SECTION 230100 – MECHANICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to this Section.

1.2 SUMMARY

- A. The work required for this Division includes labor, materials, equipment, services and supervision required to provide complete working Mechanical systems as shown on the drawings and specified in this specification.

1.3 APPLICABLE SPECIFICATIONS, CODES AND STANDARDS

- A. Work shall comply with all applicable codes and ordinances. The latest effective publications of specifications, regulations, standards, codes, etc., as applicable, shall form a part of these specifications the same as if written fully herein and shall be followed as minimum requirements.

1. The codes and ordinances of local governing agencies
2. Air Moving and Conditioning Association (AMCA)
3. American National Standard Institute (ANSI)
4. Air Conditioning and Refrigeration Institute (ARI)
5. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)
6. American Society of Mechanical Engineers (ASME)
7. American Society for Testing and Materials (ASTM)
8. National Association of Fan Manufacturers (NAFM)
9. National Electric Code (NEC)
10. National Electrical Manufacturers Association (NEMA)
11. National Fire Protection Association (NFPA)
12. Occupational Safety and Health Administration (OSHA)
13. Sheet Metal and Air Conditioning Contractors National Association (SMACNA)
14. Uniform Federal Accessibility Standards (UFAS)
15. Underwriters Laboratories, Inc. (UL)
16. Virginia Fire Safety Regulation (VFSR)
17. Virginia Uniform Statewide Building Code (VUSBC)
18. American Gas Association (AGA)
19. Americans with Disabilities Act (ADA)
20. International Plumbing Code
21. International Mechanical Code

- B. Contractor shall obtain and pay for permits and required inspections.

1.4 CONTRACT DOCUMENTS

- A. The drawings and specifications are intended to cover all work enumerated under respective headings. The drawings are diagrammatical only. Due to the scale of the drawings all required offsets, fittings, and accessories may not be indicated. Where miscellaneous details are omitted provide work complete to perform function intended at no additional cost to the Owner.

- B. Examine the architectural, structural, plumbing, mechanical and electrical drawings and specifications to avoid conflict with other trades. Make minor variations in location of equipment upon written approval of the Architect at no additional cost to the Owner. No Contractor shall take advantage of conflict or error between the drawings and specifications or between general drawings and Plumbing, Mechanical and/or Electrical drawings but shall request a clarification of such from the Architect /Engineer should this condition exist. If there is insufficient time to issue an addendum for this clarification, the Contractor shall be required to assume the most expensive item in conflict.
- C. Cooperate and coordinate the work of this Division with other trades.

1.5 ELECTRICAL WORK

- A. All electrical power wiring required for equipment installed under Division 23 shall be provided under Division 16 with all necessary and approved wiring diagrams and guidance provided under Division 23.
- B. All motor controllers and starters connected to equipment installed under Division 23 shall be furnished under those sections and shall be turned over to the Electrical Contractor for installation by the Electrical Contractor. Controllers shall be equipped with all auxiliary contacts, poles, or devices necessary to permit interlocking and control required.
- C. Three-phase motors shall have magnetic across-the-line starters unless hereinafter indicated or required by the Power Company. Provide overload relay in each phase or motor lead. Operation of any overload relay shall simultaneously open all phases.
- D. Manual starters shall be manual, single, double or three pole type designed for flush or surface mounting with overload protection in each phase.
- E. Starters for motors under automatic control shall have a built-in, hand-off auto selector switch.
- F. Push-button stations shall have "start-stop" momentary contacts having one normally open and one normally closed set with indicating lights to display when motors are running. Stations shall be heavy-duty type designed for flush or surface mountings as required.
- G. All starters and controls shall be NEMA rated and NEMA 1 enclosed where mounted inside buildings. Starters and controls mounted outside or where specifically designated shall be NEMA IV enclosed.
- H. Auxiliary 120 volt contacts shall be provided to give control and interlocking as required or as indicated. Where control voltages are different from motor voltages, a control voltage transformer shall be provided as a part of the starter.
- I. Control wiring shall be in conduit, except low voltage wiring in concealed, accessible non-air plenum ceiling spaces may be run without conduits and adequately supported from the building's structure with cable ties. Electrical and/or other plumbing or mechanical items shall not be used for cable support.
- J. Low voltage control cable specifically listed for application in accessible ceiling air plenums may be utilized in lieu of wiring in conduit.
- K. When substituted motors and/or equipment require electrical modifications to support said motors and/or equipment, the cost of the electrical modifications, associated work and coordination shall be included under the Division providing the substituted equipment.

1.6 DIELECTRIC CONNECTIONS

- A. Provide dielectric connections at all connections between ferrous and nonferrous piping or metals, except drain piping connections at drain pans for cooling coils and valves may have cast-bronze adapters.

1.7 NOISE AND VIBRATION

- A. Isolate all mechanical equipment from the building structure by means of noise and vibration isolators. Equipment to be isolated includes, but is not limited to, the following:
 - 1. Roof Top Air Conditioning and Ventilation Units
 - 2. Suspended Air Handling Equipment
- B. Mount all curb mounted roof air conditioning and ventilation equipment on vibration isolation rails and install sound barrier material throughout the area of the roof curb.
- C. Submit written documentation that the Isolation System Manufacturer has observed the isolation installation and finds that it meets its requirements.

1.8 ACCESS PANELS

- A. This Contractor shall furnish and the General Contractor shall install access panels where required for access to valves, dampers, etc. Access panels shall match the integrity of the wall and/or ceiling in which they are being installed. Access panels shall be a minimum of 12" x 12".

1.9 PROTECTION OF EQUIPMENT AND MATERIALS

- A. Responsibility for care and protection of mechanical equipment rests with the Contractor providing the equipment until it has been tested and accepted.
- B. After delivery, before and after installation, protect the equipment and materials against theft, injury, the environment and damages from all causes.
- C. Protect equipment and ductwork outlets by temporarily plugging or capping pipe openings.
- D. Provide temporary filters bi-weekly for all equipment that is operated during construction. Install new filters after all construction dirt has been removed from the building just prior to final acceptance of the building.
- E. Do not deliver equipment not designated for exterior installation to the job site until a location protected from the environment is provided. Location must be approved by the Engineer prior to the delivery.
- F. Do not deliver equipment suitable for exterior installation to the job site until it is ready to be installed in its permanent location.

1.10 TESTING, CLEANING AND PAINTING

- A. After the installation is complete and before final acceptance of the work, clean and test each system for proper operation per latest edition of the International Mechanical Code and all local requirements.

- B. Thoroughly flush and clean water piping systems before being placed in operation.
- C. Clean equipment, piping, strainers, ductwork and filters thoroughly in accordance with the best practice or as specified herein.
- E. Indicate piping service and flow direction with vinyl labels identifying the service by name and the flow direction by arrows. Use labels wherever piping is exposed and at all unit connections. For concealed piping located above accessible ceilings, label piping at 25 foot intervals with painted stencil-type lettering.
- F. Identify all valves in equipment room(s) with 1-1/2" diameter, permanently stamped, brass tags. Secure tags to valve item or wheel with brass jack chain or copper meter seals. Provide framed and mounted, under clear plastic, valve chart (8-1/2" x 11" min.) identifying valve number by system served and function.
- G. Exposed piping and equipment in mechanical equipment room shall be completely color code painted under this Section. Color code shall be as follows:

1.	Natural Gas and Compressed Air	Yellow
2.	Condenser Water Supply and Return	Blue
3.	Heating Hot Water Supply and Return	Orange

1.11 EQUIPMENT MARKING

- A. Label all mechanical equipment, including starters, control panels, and air conditioning units.
- B. Provide labels affixed to the ceiling grid for locations of all above ceiling HVAC components.
- C. Labels shall be machine engraved, laminated, Bakelite nameplate type. Labels shall be black face with white letters.
- D. Labels shall have 1/4" high letters.
- E. Labels shall be rigidly attached using rivets or screws. Adhesive backing is not acceptable.

1.12 OPERATING AND MAINTENANCE INSTRUCTIONS

- A. Furnish complete diagrams and instructions for operation and maintenance of the systems and component parts, including the automatic control system. These shall be included within a three ring binder with the record drawings and delivered to the General Contractor for the Architect.
- B. Diagrams and instructions for the maintenance and operations of the following Mechanical Systems shall be included:
 - 1. Mechanical:
 - 1. Air Handling Units
 - 2. Air Conditioning Units
 - 3. Heat Pump Units
 - 4. Rooftop Units
 - 5. Make-up Air Units
 - 6. Unit/Duct Heaters
 - 7. Exhaust Fans

- 8. Cooking Hood System
- 9. Temperature Controls

- C. Provide a minimum of two 4-hour maintenance training sessions for the Owner's Representative. These training sessions shall focus on preventative maintenance, regularly scheduled maintenance and trouble-shooting malfunctions on all equipment and systems furnished as a part of this Contract.
- D. Provide a minimum of 8 hours additional training on the operation and maintenance of the temperature control system. This training shall provide a functional demonstration of the control systems, a review of the control and monitoring functions, as well as preventative and regular systems maintenance training.
- E. Utilize form at the end of this Section to certify completion of Owner training. Submit a completed form for each sub-system as required.

1.13 WARRANTY AND SERVICE

- A. This Contractor shall service the installation for one year from date of final acceptance. This shall include emergency service, on all equipment. Maintain a log book on site for service entries (i.e. date, service performed, etc.).

1.14 RECORD DRAWINGS

- A. Upon completion of the work, submit corrected reproducible drawings and specifications indicating deviations made in the actual installation to the contract plans.

1.15 VISIT TO THE SITE

- A. The Contractor shall visit the site of the work and familiarize himself with all conditions affecting his work. Submission of his proposal shall be construed as indicating such knowledge of existing conditions. No additional payment will be made on claims that arise from a lack of such knowledge of existing conditions.

1.16 COORDINATION

- A. Before installing any of this work, verify that it does not interfere with clearances for the erection of beams, columns, ceilings, walls and other structural, electrical or architectural members as shown on the Contract Drawings. If any work is so installed and it later develops that the design cannot be followed, the Contractor shall, at his own expense, make such changes in his work as the Architect may direct to permit the completion of the work in accordance with the drawings and specifications.
- B. It shall be the duty of the Contractor to report any interferences between his work and that of any other Contractor to the Architect as soon as they are discovered. The Architect will determine which equipment shall be relocated regardless of which was first installed, and his decision shall be final.

1.17 CUTTING AND PATCHING

- A. Where cutting, channeling, chasing, or drilling of floors, walls, partitions, ceilings, ductwork or equipment surfaces is necessary for the proper installation, support or anchorage of the piping, it shall be carefully done in accordance with the current edition of the Building Code. Damage to the building, piping, ductwork or equipment shall be repaired by skilled mechanics of the trades involved at no additional cost to the Owner.

This work shall be carefully laid out in advance. Cutting of masonry block shall be done with a masonry saw.

1.18 FLASHING

- A. Provide cap flashing for roof-mounted fans, goosenecks, air intakes, vents, etc.

1.19 SCHEDULE OF VALUES

- A. This Contractor shall furnish and the General Contractor shall include as a minimum the following list of items. This shall form the basis for determining the completed work as part of the Application for Payment process.

Mechanical

Demolition
Hydronic Piping (material)
Hydronic Piping (labor)
Pipe Hangers (material)
Pipe Hangers (labor)
Hydronic Valves and Fittings (material)
Hydronic Valves and Fittings (labor)
Hydronic Pipe Insulation (material)
Hydronic Pipe Insulation (labor)
Gas Piping (material)
Gas Piping (labor)
Refrigerant Piping and Accessories (material)
Refrigerant Piping and Accessories (labor)
Air Separators (material)
Air Separators (labor)
Thermometers and Gauges (material)
Thermometers and Gauges (labor)
HVAC Pumps and Accessories (material)
HVAC Pumps and Accessories (labor)
Expansion Tank (material)
Expansion Tank (labor)
Boiler (material)
Boiler (labor)
Cooling Tower (material)
Cooling Tower (labor)
Air Handling Units (material)
Air Handling Units (labor)
Condensing Units (material)
Condensing Units (labor)
Heat Pump Units (material)
Heat Pump Units (labor)
Rooftop Units (material)
Rooftop Units (labor)
Make Up Air Unit (material)
Make Up Air Unit (labor)
Unit Heater/Duct Heater (material)
Unit Heater/Duct Heater (labor)
Ductwork and Accessories (material)
Ductwork and Accessories (labor)
Ductwork Insulation (material)
Ductwork Insulation (labor)

Fans and Vents (material)
Fans and Vents (labor)
Grilles and Registers (material)
Grilles and Registers (labor)
Fire Dampers (material)
Fire Dampers (labor)
Cooking Hood System (material)
Cooking Hood System (labor)
Condensate Drain Piping (material)
Condensate Drain Piping (labor)
Temperature Control Engineering
Temperature Control (material)
Temperature Control (labor)
Factory Start Up
Testing, Adjusting and Balancing
System Commissioning
Monthly Filter Changes
Annual Belt Replacement

1.20 PROJECT CLOSEOUT

- A. Submit the following list of items in order to achieve final project acceptance. Final payment, including retainage, shall not be processed without the required documentation as follows:
1. Verification of completed punch list items.
 2. Start-up reports.
 3. Approved operations and maintenance manuals.
 4. Verification of Owner training.
 5. Warranty letters.
 6. Approved Testing and Balancing reports.
 7. Complete approval by Local Authority.
 8. Development and posting of service log.
 9. Record drawings.
 10. Approved Pre-Commissioning and Final Commissioning Reports

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Vibration isolation shall be Model KSR-2 Isolation Rail System manufactured by Kinetics Noise Control or approved equal. System shall consist of two parallel aluminum rails with continuous neoprene air and water seal, incorporating steel spring isolators designed for 2" static deflection, all designed to be installed over the roof curb system furnished with each unit. Provide with curb adaptor flashing for the weatherproofing of field altered curb rails. Make up air ventilation units designed with heat pipe energy recovery components are excluded from this requirement.
- B. Sound barrier material shall be RT-4S4 Composite System manufactured by Kinetics Noise Control, or approved equal. System shall consist of two layers of one-half inch (1/2") 2 PSF sound board sandwiched between 2" thick RIM isolation material and two inch (2") 3 PCF Kinetics fiberglass. Joints shall be staggered per Manufacturer's recommendations.
- C. Suspend all horizontally suspended equipment from structure with combination spring and fiberglass hangers designed for static deflection of 1.0". Springs shall be Model SFH.

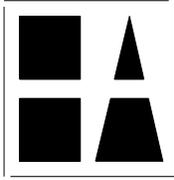
- D. Install in-line exhaust/supply fans with Kinetics Noise Control Model RD neoprene isolators.

PART 3 – EXECUTION

3.1 FIELD QUALITY CONTROL AND TESTING

- A. After balancing and adjustment operations have been completed, conduct system check tests to prove to satisfaction of Architect that all systems are performing as specified.
- B. The Architect shall be given 48 hours notice before tests are made. The Contractor shall furnish the Architect a certificate of approval from the Local Authority Having Jurisdiction.
- C. At the time the tests are conducted, the following personnel shall be present:
 - 1. Architect
 - 2. Mechanical Engineer
 - 3. Owner
 - 4. Mechanical Contractor including:
 - a. Sheetmetal sub-Contractor
 - b. Electrical sub-Contractor
 - c. Temperature Control sub-Contractor
 - 5. Other trades as may be required to successfully conduct tests.
- D. Test equipment in operation for a continuous period of not less than 48 hours.
- E. Adjust and test automatic control systems to assure satisfactory operation through every cycle of operation. Test safety controls shall be tested to assure performance of their required function.
- F. Correct defects in the work provided and repeat tests at no additional cost to the Owner.
- G. Provide labor, material and instruments required for check tests at no additional cost to the Owner. Cutting of ductwork or insulation required during test shall be repaired to the satisfaction of the Architect.

END OF SECTION 230100



HICKMAN • AMBROSE
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Owner Training Certification

Project:

Equipment:

Contractor Certification

The undersigned as the Contractor's authorized training agent for the above noted equipment certifies that all required and applicable training has been provided to the Owner's representative(s) per the project Contract.

Contractor Representative: _____ **Date:** _____

Owner Certification

The undersigned as the Owner's authorized agent certifies that all required and applicable training has been provided to the Owner's satisfaction.

Owner Representative: _____ **Date:** _____

SECTION 230500 – MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to this Section.

1.2 SUMMARY

- A. Materials and equipment furnished under these specifications shall be new and free of scratches or any other imperfections and shall be the current product of the Manufacturer for the intended service.

1.3 REFERENCES

- A. Mechanical materials furnished under these specifications shall be new and listed, inspected and approved by the Underwriters' Laboratories (UL) and shall bear the UL label where labeling service is available. Where the UL labeling service is not available, the Contractor shall submit a statement from a nationally recognized, adequately equipped testing agency indicating that the items have been tested in accordance with required procedures and that the materials and equipment comply with all contract requirements. Materials and equipment shall also comply with the requirements of all applicable Codes.

1.4 SUBMITTALS

- A. Submit complete schedules of material and equipment proposed for installation to the Architect within 90 days after award of the contract, in quantities as indicated in Division 01. The schedules shall include catalogs, cuts, diagrams and such other descriptive data and/or samples as indicated in the SUBMITTALS paragraph of each Section in Division 23 - MECHANICAL. Schedules of material which consist of facsimiles or copies of facsimiles shall be unacceptable. If after expiration of the 90 day period or any extension thereof as authorized by the Architect the Contractor fails to submit a schedule of acceptable material or equipment, the Engineer reserves the right to accept no substitutions, and the Contractor may be required to submit material and equipment as specified. In the event any items of material or equipment submitted within the 90 day period fail to comply with the specification requirements, such items will be rejected and approved items shall be submitted for the items rejected. If the resubmitted material or equipment fails to comply with the specification requirements, the Contractor shall then be required to submit material and equipment as specified without additional cost to the Owner.
- B. Submittals that do not adhere to the following format may be rejected without review. Submittals shall be bound by staples, or in book form. The first page of the submittal shall be a Title page, which shall indicate the Project name and Project address, the General Contractor's name, address, phone number and contact and the Mechanical Contractor's name, address, phone number and contact. The second page of the submittal shall be a Table of Contents indicating the specification section number and name, and contain the General Contractor's and the Mechanical Contractor's stamps of approval. One of the submittals shall be hole-punched and placed in a 3-ring binder, which shall be retained by the Engineer. Partial submittals shall be allowed only when requested by the Contractor in writing and approved by the Engineer. The copies shall be clear and readable. Approved copies of all shop drawings shall be kept on the job site at all times accessible to the Architect/Engineer.

- C. Submittals that do not contain the General Contractor's and Mechanical Contractor's stamps of approval shall be returned without review.
- D. Where Drawings are required, they must be submitted along with product data. Separate submittals will not be reviewed.

1.5 SUBSTITUTIONS

- A. The name of a certain brand, make, Manufacturer or definite specification is to denote the quality standard of article desired, but does not restrict bidders to the specified brand, make, Manufacturer or specification named. Substitution of any other brand, make, or Manufacturer, which in the opinion of the Architect or Engineer, and approved by the Owner, is recognized the equal of that specified, shall be accepted, but only if submitted within the requirements of Division 01. If substitute equipment is allowed, the Contractor shall be responsible for its use and for its ability to fulfill all intended functions in the completed system with no additional or extra cost to the Owner.
- B. When substituted equipment is dissimilar from that specified, the Contractor may be requested by the Engineer to submit layout drawings (drawn to scale) indicating the proposed method of installation. Modifications required to duct, piping, access, etc. shall be clearly indicated. All cost associated with such modification shall be the responsibility of the Contractor providing the substitute equipment.
- C. When three or more Manufacturers are specified, there will be no substitution.

PART 2 - PRODUCTS - Not Applicable

PART 3 – EXECUTION

3.1 INSTALLATION, GENERAL

- A. Properly store and protect materials and equipment at the project site until installation by the Contractor and acceptance by the Owner. Materials intended for indoor use must be stored inside or adequately protected from the weather.
- B. Workmanship shall be of highest quality and shall conform to standard practice for trade involved.
- C. Do not support equipment and/or ducts from the roof deck, the ceiling or the support wires.

3.2 CLEANING

- A. Remove all dirt trash and oil from the exterior and interior or all equipment and duct prior to installation.

3.3 REPAIR OF EXISTING WORK

- A. Repair of existing work, demolition, and modification of existing HVAC systems shall be performed as follows:
 - 1. Workmanship: Lay out work in advance. Exercise care when cutting, channeling, chasing, or drilling of floors, walls, partitions, ceilings, or other surfaces as necessary for proper installation, support, or anchorage of other work. Repair damage to buildings, piping, and equipment using skilled craftsmen of trades

- involved.
2. Existing Concealed Piping to be Removed: Disconnect piping from its source. Cut piping flush with floor, underside of floor, and through walls; and seal openings.
 3. Maintain access and operation of existing installations and devices which are to remain active. Modify installation or provide access panel as required.
 4. Repair surfaces damaged by demolition and unfinished surfaces exposed by demolition and paint to match surrounding surfaces.

END OF SECTION 230500

SECTION 230593 - STARTING, TESTING, ADJUSTING AND BALANCING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to this Section.

1.2 SUMMARY

- A. The work under this Section shall include the adjustment of each air and water system to design quantities, the balance of all air and water systems, verification of the performance of equipment and automatic controls, electrical measurements, and all labor, materials, equipment and services required to perform the work specified in this Section.
- B. Testing, adjusting and balancing shall be performed and conducted in strict accordance with the methods and requirements of the NEBB or AABC. The Contractor shall secure the services of an independent Testing and Balancing Contractor, certified by the NEBB or AABC, to perform the work outlined herein. The TAB Agency shall have been in the TAB business for a minimum of 5 years.
- C. The TAB Contractor shall be a direct Subcontractor to the General Contractor and shall not be associated with the Mechanical Contractor.

1.3 QUALITY ASSURANCE

- A. Adhere to all standards, codes, rules and regulations listed in Division 23 Section: "MECHANICAL GENERAL PROVISIONS"
- B. All test and balance procedures shall be in accordance with Standards published by the NEBB or the AABC.

1.4 SUBMITTALS

- A. Submit four (4) copies of a complete testing and balancing report for evaluation and approval prior to final acceptance of the project.
- B. The report shall list all test, adjust and balance work reported on NEBB approved forms. It shall also include a letter of certification listing all instruments and the last date of calibration of each. This report shall be submitted at least two (2) weeks prior to final inspection.

PART 2 - PRODUCTS

2.1 INSTRUMENTS

- A. Provide all instruments required to properly perform the test and balance work. All instruments shall be of first quality and accurately calibrated at the time of use.
- B. Whenever possible, the same instrument shall be used for the entire job to avoid possible errors in calibration. If more than one instrument of a similar type is used, check to verify the variation in instrument readings does not exceed plus or minus five percent (5%).

2.2 ACCESSORY DEVICES

- A. The Mechanical Contractor shall provide, as required by the TAB Contractor, all necessary dampers, thermometer wells and other appurtenances as required. He shall coordinate the location of these devices as construction progresses to avoid disturbing the finished systems. He shall also provide new belts and sheaves for air moving equipment as required to attain desired air quantities. These items shall be provided at no additional cost to the Owner.

PART 3 – EXECUTION

3.1 SITE VISITS

- A. TAB work will be required to adhere to phasing requirements of the project. This will require repeated visits to the Site.

3.2 PREPARATION

- A. Notify the Engineer in writing of the date and time of all tests a minimum of one (1) week prior to start of air and water systems tests.
- B. Do not begin test, adjust and balance work until the system installation is complete, the system is thoroughly cleaned prior to start-up, and the system is in full working order.
- C. The Temperature Control/Energy Management Contractor shall provide a mechanic familiar with the building control systems for the purpose of making modifications and adjustments to the control system to complete the balancing work.
- D. After completion of the installation of the air conditioning, heating, ventilating, and exhaust systems, and prior to acceptance by the Owner, adjust and balance all systems and appurtenances applicable to the above systems to deliver the air and water quantities as specified and indicated on the Drawings.

3.3 WATER BALANCE PROCEDURE

- A. Use calibrated orifices and portable flow meters to balance water flow at all points. Purge all air from system after start up and before balancing.
- B. Determine pump capacities by differential pressure measurements. Adjust water circuits by balancing cocks previously specified. Permanently mark all balancing cocks after balance is complete so that they may be restored to their correct position if disturbed.
- C. Install circuit setters permanently where indicated on the Drawings and as recommended by the Manufacturer.

3.4 AIR SYSTEMS TESTING

- A. Perform the following for each system:
 - 1. Adjust fan RPM, tighten and align fan belts.
 - 2. Adjust volume dampers to obtain desired air flow.
 - 3. Adjust grilles, diffusers and registers to obtain desired air flow and air pattern.
 - 4. Adjust dampers to obtain desired outdoor air quantities.
 - 5. Operation of automatically operated dampers shall be verified.
- B. Determine total system air values by traversing supply, return and/or outside air intake ductwork. Where this methodology is not possible, a summation of values obtained at

individual outlets and inlets is acceptable. Where the summation method is used, it shall be clearly noted for each instance in the final report.

- C. Submit a set of neatly marked plans identifying the location of all recorded data with the report.

3.5 REPORTING

- A. The test and balance technicians shall record the following data for each system and include it in the report. All data shall be neatly typed.
 1. Location, Manufacturer, serial number, model number, size, design air flow and design static pressure of each air handling unit, exhaust fan, or air moving device.
 2. Discharge and suction static pressure of each air handling unit, exhaust fan, or air moving device.
 3. Air pressure drop across each air handling unit coil, heating coil or fan.
 4. Supply air and mixed air temperature for each air handling unit.
 5. Fan CFM and RPM.
 6. Location, Manufacturer, serial number, model number, size, HP, RPM, frame size, amp draw, operating BHP and motor controller heater size, for each pump.
 7. Tabulated flow setting of each balancing device and circuit setter valve.
 8. Manufacturer, location, size, design and actual CFM air quantities, of each supply, return, or exhaust grille or diffuser.

3.6 FIELD QUALITY CONTROL

- A. Air side balancing tolerance shall be +10% of design values unless otherwise noted. Direct drive fans associated with systems having a design of 800 cubic feet per minute or less shall have a tolerance of +15% of design values.
- B. Waterside balancing shall be +10%, - 0% of design values.
- C. Use duct mounted dampers for rough air balance. Trim with register or diffuser mounted dampers to avoid excessive room air noise.
- D. Any work showing faults during the testing or any work not in accordance with the Contract Documents shall be corrected by the Mechanical Contractor at his own expense prior to preparation of the final report. Failure to correct faults shall result in the final report being rejected without review.

3.7 FINAL INSPECTION

- A. Upon submittal and review of TAB Reports, the Contractor shall conduct a building walk-through at which time a selection of up to 10% of the air side and water side systems may be spot-checked. If the total air flow or fluid flow as reported within the TAB Report differs from the verified flows then, at the discretion of the Project Engineer, that system shall be re-balanced at no additional cost to the Owner, and additional systems shall be spot checked.

END OF SECTION 230593

SECTION 230713 - DUCT INSULATION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to this Section.

1.2 SUMMARY

- A. Insulate supply, return and outside air ductwork as specified herein unless otherwise indicated on the contract drawings.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Insulation for interior supply, return and outside air intake ductwork and plenums, including metal on the back of diffusers and registers: 2" thick, 1.0 PCF, fiberglass flexible blanket type or rigid board type insulation with fire retardant, reinforced foil-backed vapor barrier.
- B. Insulate for exterior supply and exterior return air ductwork: 3" thick, 3.0 PCF, rigid fiberglass type insulation with fire retardant, reinforced foil-backed vapor barrier.

PART 3 – EXECUTION

3.1 INSULATION

- A. Apply insulation with 100 percent coverage of fire retardant adhesive.
- B. Seal joints with minimum 3" wide strips same as vapor barrier jackets.
- C. Rigid insulation shall have pins on maximum 12" centers. Self adhesive pins are not allowed.
- D. Seal insulation that terminates at AHU's, VAV's, coils, etc. to the equipment with 3" wide strips same as vapor barrier jackets.
- E. Seal all transitions to and from flexible duct with 3" wide strips same as vapor barrier jackets.
- F. At exterior insulation apply one coat of bitumastic, then wrap completely with Fab-Cloth, and then apply two more complete coats of bitumastic sealer.
- G. Apply insulation and accessories in accordance with the Manufacturer's recommendations unless indicated otherwise.
- H. Apply insulation on clean, dry surfaces after inspection. Run insulation continuous through wall, floor, roof and ceiling openings. Apply insulation on cold surfaces where vapor barrier jackets are used with a continuous unbroken vapor seal. At hangers, supports, anchors, etc., that are secured directly to cold surfaces provide adequate insulation and vapor seals to prevent condensation.

END OF SECTION 230713

SECTION 230716 - PIPING AND EQUIPMENT INSULATION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to this Section.

1.2 SUMMARY

- A. Insulate piping as specified below, unless otherwise indicated on the contract drawings.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Insulation for hot water supply and return piping: Preformed fire retardant fiberglass pipe insulation with factory applied all purpose jacket. Insulation shall be 1" thick for pipe sizes up through 3" and 1-1/2" thick for pipe sizes 4" and larger.
- B. Insulation for interior refrigerant suction piping: 1" thick preformed fire retardant fiberglass pipe insulation with factory applied vapor barrier jacket or 3/4" thick closed cell foam insulation. Exterior refrigerant suction piping shall be insulated with 3/4" thick closed cell foam insulation.
- C. Insulation for interior condensate drain piping: 1" thick preformed fire retardant fiberglass pipe insulation with vapor barrier jacket or 3/8" thick closed cell foam insulation.
- D. Insulation for domestic hot water, cold water, hot water recirculation, horizontal roof drainage and overflow piping up to and including roof drain sump and Mezzanine floor drain waste piping and p-traps: 1" thick preformed fire retardant fiberglass pipe insulation with vapor barrier jacket or 3/8" thick flexible closed cell type for piping up to 3" diameter.
- E. Insulation for water piping and electrically traced piping exposed above grade: 2" thick preformed fire retardant fiberglass insulation with aluminum jacket, completely weatherproofed per Manufacturer's recommendations.
- F. Insulation for fittings, valves, flanges, strainers and piping accessories: Similar to piping systems in which they occur and finished with cement and jackets as specified for piping system. Interior exposed elbows, tees, and valves shall have one piece PVC insulated fitting covers. Piping specified with vapor barriers shall have all seam edges of fitting covers sealed with vapor barrier adhesive mastic prior to taping.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Apply insulation on clean, dry surfaces and, after inspection, released for insulation application. Run insulation continuously through wall and ceiling openings and sleeves. Apply insulation on cold surfaces where vapor barrier jackets are used with a continuous, unbroken vapor seal. At hangers, supports, anchors, etc., that are secured directly to cold surfaces promote adequate insulation and vapor-seals to prevent condensation.
- B. Apply insulation in accordance with the Manufacturer's recommendations unless specified

otherwise. No insulation will be required at immediate fixture connections or on buried pipe.

- C. Provide insulation protection shields or saddles at pipe supports for insulated pipes 1/2" in size and larger.
- D. Do not run piping above the Electrical equipment rooms.

END OF SECTION 230716

SECTION 230900 – BUILDING MANAGEMENT SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Scope: Furnish all labor, materials and equipment necessary for a complete and operating Building Management System (BMS), utilizing Direct Digital Controls as shown on the drawings and as described herein. Drawings are diagrammatic only. All controllers furnished in this section shall communicate on a peer-to-peer bus over a single LonTalk open protocol bus.
 1. The intent of this specification is to provide a system that is consistent with BMS systems throughout the owner's facilities running the Niagara AX™ Framework.
 2. System architecture shall fully support a multi-vendor environment and be able to integrate third party systems via existing vendor protocols including, as a minimum, LonTalk, BACnet, and Modbus. Non LonTalk communication protocol for specific pieces of equipment must be approved on a case by case basis.
 3. System architecture shall provide secure Web access using MS Internet Explorer from any computer on the owner's LAN.
 4. All control devices furnished with this Section shall be programmable directly from the Niagara-AX™ Workbench upon completion of this project. The use of configurable or programmable controllers that require additional software tools for post-installation maintenance shall not be acceptable.
 5. Any control vendor that must provide additional BMS server software shall be unacceptable. Only systems that utilize the WEBS Niagara AX™ Framework shall satisfy the requirements of this section.
 6. The BMS server shall host all graphic files for the control system. All graphics and navigation schemes for this project shall match those that are on the existing Niagara-AX framework server.
 7. All open NIC statements shall follow Niagara Open NIC specifications
 8. All JACE hardware products used on this project must be Made in the USA or come through the Tridium Richmond, VA shipping facility. JACE hardware products not meeting these requirements will not be allowed.

1.3 RELATED WORK SPECIFIED ELSEWHERE

- A. Products Supplied But Not Installed Under This Section:
 1. Control valves.
 2. Flow switches.
 3. Wells, sockets and other inline hardware for water sensors (temperature, pressure, flow).
 4. Automatic control dampers, where not supplied with equipment.
 5. Airflow measuring stations.
 6. Terminal unit controllers and actuators, when installed by terminal unit manufacturer.
- B. Products Not Furnished or Installed But Integrated with the Work of This Section:
 1. Water Source Heat Pump Systems.
 2. Boiler Control Systems.
 3. Pump Control Packages.
 4. Smoke Detectors (through alarm relay contacts).
- C. Work Required Under Division 26 Related to This Section:

1. Power wiring to line side of motor starters, disconnects or variable frequency drives.
2. Provision and wiring of smoke detectors and other devices relating to fire alarm system.
3. Campus LAN (Ethernet) connection adjacent to JACE network management controller.

1.4 SUBMITTALS:

- A. Contractor Qualifications: Documentation of contractor qualifications, including those indicated in paragraph "Quality Assurance" article if requested by the A-E.
- B. Shop Drawings: Shop Drawings of the entire control system shall consist of a complete list of equipment and materials, including manufacturers' catalog data sheets and installation instructions.
 1. Include samples of written Controller Checkout Sheets and Performance Verification Procedures for applications similar in scope.
 2. Shop drawings shall also contain complete wiring and schematic diagrams, sequences of operation, control system bus layout and any other details required to demonstrate that the system has been coordinated and will properly function as a system. Terminal identification for all control wiring shall be shown on the shop drawings.
- C. Upon completion of the work, provide complete „as-built“ drawings and other project-specific documentation in 3-ring hard-backed binders and on compact disc.
- D. Any deviations from these specifications or the work indicated on the drawings shall be clearly identified in the Submittals.

1.5 AGENCY AND CODE APPROVALS

- A. All products of the BMS shall be provided with the following agency approvals. Verification that the approvals exist for all submitted products shall be provided on request, with the submittal package. Systems or products not currently offering the following approvals are not acceptable.
 1. Federal Communications Commission (FCC), Rules and Regulations, Volume II -July 1986 Part 15 Class A Radio Frequency Devices
 2. FCC, Part 15, Subpart J, Class A Computing Devices
 3. UL 504 - Industrial Control Equipment
 4. UL 506 - Specialty Transformers
 5. UL 910 - Test Method for Fire and Smoke Characteristics of Electrical and Optical-Fiber Cables Used in Air-Handling Spaces
 6. UL 916 - Energy Management Systems All
 7. UL 1449 – Transient Voltage Suppression
 8. Standard Test for Flame Propagation Height of Electrical and Optical - Fiber Cables Installed Vertically in Shafts
 9. EIA/ANSI 232-E - Interface Between Data Technical Equipment and Data Circuit Terminal Equipment Employing Serial Binary Data Interchange
 10. EIA 455 - Standard Test Procedures for Fiber Optic Fibers, Cables, Transducers, Connecting and Terminating Devices
 11. IEEE C62.41- Surge Voltages in Low-Voltage AC Power Circuits
 12. IEEE 142 - Recommended Practice for Grounding of Industrial and Commercial Power Systems
 13. NEMA 250 - Enclosures for Electrical Equipment
 14. NEMA ICS 1 - Industrial Controls and Systems
 15. NEMA ST 1 - Specialty Transformers

16. NCSBC Compliance, Energy: Performance of control system shall meet or surpass the requirements of ASHRAE/IESNA 90.1-1999.

1.6 SOFTWARE OWNERSHIP

- A. The Owner shall have full ownership and full access rights for all network management, operating system server, engineering and programming software required for the ongoing maintenance and operation of the BMS.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Maintain integrity of shipping cartons for each piece of equipment and control device through shipping, storage, and handling as required to prevent equipment damage. Store equipment and materials inside and protected from weather.

1.8 JOB CONDITIONS

- A. Cooperation with Other Trades: Coordinate the Work of this section with that of other sections to insure that the Work will be carried out in an orderly fashion. It shall be this Contractor's responsibility to check the Contract Documents for possible conflicts between his Work and that of other crafts in equipment location, pipe, duct and conduit runs, electrical outlets and fixtures, air diffusers, and structural and architectural features.

1.9 QUALITY ASSURANCE

- A. The manufacturer of the BMS digital controllers shall, if requested, provide documentation supporting compliance with ISO-9001 (Model for Quality Assurance in Design/Development, Production, Installation and Servicing).
 1. The Control System Contractor shall have a full service DDC office within 50 miles of the job site. This office shall be staffed with applications engineers and field technicians.
 2. Single Source Responsibility of Supplier: The Control System Contractor shall be responsible for the complete installation and proper operation of the control system. The Control System Contractor shall exclusively be in the regular and customary business of design, installation and service of computerized building management systems similar in size and complexity to the system specified.
 3. The Control System Contractor shall be the manufacturer of the primary DDC system components or shall have been the authorized representative for the primary DDC components manufacturer for at least 5 years.
- B. Equipment and Materials: Equipment and materials shall be cataloged products of manufacturers regularly engaged in the production and installation of HVAC control systems. Products shall be manufacturer's latest standard design and have been tested and proven in actual use.

1.10 SPECIFICATION NOMENCLATURE

- A. Acronyms and definitions used in this specification are as follows:
 1. Actuator: Control device that opens or closes valve or damper in response to control signal.
 2. AI Analog Input
 3. AO Analog Output
 4. Analog Continuously variable state over stated range of values
 5. BMS Building Management System
 6. DDC Direct Digital Control
 7. Discrete Binary or digital state

8.	DI	Discrete Input
9.	DO	Discrete Output
10.	FC	Fail Closed position of control device or actuator. Device moves to closed position on loss of control signal or energy source.
11.	FO	Fail open (position of control device or actuator). Device moves to open position on loss of control signal or energy source.
12.	GUI	Graphical User Interface
13.	HVAC	Heating, Ventilating and Air Conditioning
14.	IDC	Interoperable Digital Controller
15.	ILC	Interoperable Lon Controller
16.	LAN	Local Area Network
17.	Modulating	Movement of a control device through an entire range of values, proportional to an infinitely variable input value.
18.	Motorized	Control device with actuator
19.	NAC	Network Area Controller
20.	NC	Normally closed position of switch after control signal is removed or normally closed position of manually operated valves or dampers.
21.	NO	Normally open position of switch after control signal is removed; or the open position of a controlled valve or damper after the control signal is removed; or the usual position of a manually operated valve.
22.	OSS	Operating System Server, host for system graphics, alarms, trends, etc.
23.	Operator	Same as actuator
24.	PC	Personal Computer
25.	Peer-to-Peer	Mode of communication between controllers in which each device connected to network has equal status and each shares its database values with all other devices connected to network
26.	P	Proportional control; control mode with continuous linear relationship between observed input signal and final controlled output element.
27.	PI	Proportional-Integral control, control mode with continuous proportional output plus additional change in output based on both amount and duration of change in controller variable (reset control).
28.	PICS	BACnet Product Interoperability Compliance Statement
29.	PID	Proportional-Integral-Derivative control, control mode with continuous correction of final controller output element versus input signal based on proportional error, its time history (reset) and rate at which it's changing (derivative).
30.	Point	Analog or discrete instrument with addressable database value
31.	WAN	Wide Area Network

PART 2 - MATERIALS

2.1 GENERAL

- A. The Building Management System (BMS) shall be comprised of a network of interoperable, stand-alone digital controllers, a network area controller, graphics and programming, and other control devices for a complete system as specified herein.
- B. The installed system shall provide secure password access to all features, functions and data contained in the overall BMS.
- C. Manufacturer: Subject to compliance with requirements, provide building management system by one of the following approved manufacturers only; no substitutions permitted.
 1. Honeywell AX – cited as design standard
 2. Vykon
 3. Trane Tracer SC

2.2 OPEN, INTEROPERABLE, INTEGRATED ARCHITECTURE

- A. The intent of this specification is to provide a peer-to-peer networked, stand-alone, distributed control system utilizing the LonWorks technology communication protocol in one open, interoperable system.
- B. The supplied computer software shall employ object-oriented technology (OOT) for representation of all data and control devices within the system. Physical connection of any BACnet control equipment, such as chillers, shall be via Ethernet.
- C. All components and controllers supplied under this contract shall be true "peer-to-peer" communicating devices. Components or controllers requiring "polling" by a host to pass data shall not be acceptable.
- D. All components and controllers supplied under this contract shall be true "peer-to-peer" communicating devices. Components or controllers requiring "polling" by a host to pass data shall not be acceptable.
- E. The supplied system must incorporate the ability to access all data using Java enabled browsers without requiring proprietary operator interface and configuration programs. An Open Database Connectivity (ODBC) or Structured Query Language (SQL) compliant server database is required for all system database parameter storage. This data shall reside on the existing Operating System Server currently located in the Facilities Office on the LAN. Systems requiring proprietary database and user interface programs shall not be acceptable.
- F. A hierarchical topology is required to assure reasonable system response times and to manage the flow and sharing of data without unduly burdening the customer's internal Intranet network. Systems employing a "flat" single tiered architecture shall not be acceptable.
 - 1. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 5 seconds for network connected user interfaces.
 - 2. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 60 seconds for remote or dial-up connected user interfaces.

2.3 SYSTEM NETWORK CONTROLLER (SNC)

- A. These controllers are designed to manage communications between the programmable equipment controllers (PEC), application specific controllers (ASC), and advanced unitary controllers (AUC) which are connected to its communications trunks, manage communications between itself and other system network controllers (SNC) and with any operator workstations (OWS) that are part of the BAS, and perform control and operating strategies for the system based on information from any controller connected to the BAS.
- B. The controllers must be fully programmable to meet the unique requirements of the facility it must control.
- C. The controllers must be capable of peer-to-peer communications with other SNC's and with any OWS connected to the BAS, whether the OWS is directly connected, connected via modem or connected via the Internet.
- D. The communication protocols utilized for peer-to-peer communications between SNC's will be Niagara AX, BACnet TCP/IP and SNMP. Use of a proprietary communication protocol for peer-to-peer communications between SNC's is not allowed.

- E. The SNC shall be capable of executing application control programs to provide:
 1. Calendar functions
 2. Scheduling
 3. Trending
 4. Alarm monitoring and routing
 5. Time synchronization
 6. Integration of LonWorks, BACnet, and ModBus controller data
 7. Network management functions for all SNC, PEC and ASC based devices

- F. The SNC must provide the following hardware features as a minimum:
 1. One Ethernet Port-10/100 Mdps
 2. One RS-232/485 port
 3. One LonWorks Interface Port – 78KB FTT-10A
 4. Battery Backup
 5. Flash memory for long term data backup (If battery backup or flash memory is not supplied, the controller must contain a hard disk with at least 1 gigabyte storage capacity)

- G. The SNC shall support standard Web browser access via the Intranet/Internet. It shall support a minimum of 16 simultaneous users.

- H. The SNC shall provide alarm recognition, storage, routing, management and analysis to supplement distributed capabilities of equipment or application specific controllers.

- I. The SNC shall be able to route any alarm condition to any defined user location
 1. Alarm generation shall be selectable for annunciation type and acknowledgement requirements including but not limited to:
 - a. Alarm,
 - b. Return to normal,
 - c. To default.
 2. Alarms shall be annunciated via Email of complete alarm message to multiple recipients.
 3. The following shall be recorded by the SNC for each alarm (at a minimum):
 - a. Time and date
 - b. Equipment (air handler #, accessway, etc.)
 - c. Acknowledge time, date, and user who issued acknowledgement.

- J. Programming software and all controller “Setup Wizards” shall be embedded into the SNC.

2.4 PROGRAMMABLE EQUIPMENT CONTROLLER (PEC)

- A. HVAC control shall be accomplished using LonMark□ based devices where the application has a LonMark profile defined. Where LonMark devices are not available for a particular application, devices based on LonWorks shall be acceptable. For each LonWorks device that does not have LonMark certification, the device supplier must provide an XIF file for the device. The controller platform shall provide options and advanced system functions, programmable and configurable using Niagara AX Framework™, that allow standard and customizable control solutions required in executing the “Sequence of Operation”.

- B. All PECs shall be application programmable and shall at all times maintain their LonMark certification. All control sequences within or programmed into the ILC shall be stored in non-volatile memory, which is not dependent upon the presence of a battery to be retained.

- C. The PECs shall communicate with the SNC at a baud rate of not less than 78.8K baud. The PEC shall provide LED indication of communication and controller performance to the technician, without cover removal.

- D. The following integral and remote Inputs/Outputs shall be supported per each PEC:
1. Eight integral dry contact digital inputs.
 2. Any two digital inputs may be configured as pulse counters with a maximum pulse read rate of 15 Hz.
 3. Eight integral analog inputs (configurable as 0-10V, 0-10,000 ohm or, 20K NTC).
 4. Six integral 4-20 ma analog outputs.
 5. Eight integral 24 Vac Triac digital outputs, configurable as maintained or floating motor control outputs.
 6. One integral 20 Vdc, 65-mA power supply for auxiliary devices.
 7. If a 20 Vdc 65-mA power supply terminal is not integral to the ILC, provide at each PEC a separate, fully isolated, enclosed, current limited and regulated UL listed auxiliary power supply for power to auxiliary devices
- E. Each PEC shall have expansion ability to support additional I/O requirements through the use of remote input/output modules
- F. PEC Controllers shall support the following control techniques:
1. Ten configurable general-purpose control loops that can incorporate Demand Limit Control strategies, Setpoint reset, adaptive intelligent recovery, and time of day bypass.
 2. Ten general-purpose, non-linear control loops.
 3. Eight start/stop Loops.
 4. Thirty-two If/Then/Else logic loops.
 5. Thirty six Math Function loops (MIN, MAX, AVG, SUM, SUB,SQRT, MUL, DIV, ENTHALPY).

2.5 ADVANCED UNITARY CONTROLLER

- A. The advanced unitary controller (AUC) platform shall be designed specifically to control HVAC – ventilation, filtration, heating, cooling, humidification, and distribution. Equipment includes: constant volume air handlers, VAV air handlers, packaged RTU, heat pumps, unit vents, fan coils, natural convection units, and radiant panels. The controller platform shall provide options and advanced system functions, programmable and configurable using Niagara AX Framework™, that allow standard and customizable control solutions required in executing the “Sequence of Operation.”
- B. Minimum Requirements:
1. The controller shall be fully programmable with full functionality on any Niagara AX brand platform.
 - a. Support downloads to the controller from any brand of Niagara AX platform.
 - b. Support uploads from the controller to any brand of Niagara AX platform.
 - c. Support simulation/debug mode of the controller.
 - d. Maintain native GUI.
 - e. Native function-block programming within the Niagara AX environment.
 2. The controller shall be capable of either integrating with other devices or stand-alone operation.
 3. The controller shall have two microprocessors. The Host processor contains on-chip FLASH program memory, FLASH information memory, and RAM to run the main HVAC application. The second processor for network communications. Controller memory minimum requirements include:
 - a. FLASH Memory Capacity: 60 Kilobytes with 8 Kilobytes for application program.
 - b. FLASH Memory settings retained for ten years.
 - c. RAM: 2 Kilobytes
 4. The controller shall have an FTT transformer-coupled communications port interface for common mode-noise rejection and DC isolation.
 5. The controller shall have an internal time clock with the ability to automatically revert from a master time clock on failure.

- a. Operating Range: 24 hour, 365 day, multi-year calendar including day of week and configuration for automatic day-light savings time adjustment to occur on configured start and stop dates.
- b. Accuracy: ± 1 minute per month at 77° F (25° C).
- c. Power Failure Backup: 24 hours at 32° to 122° F (0° to 50° C).
6. The controller shall have Significant Event Notification, Periodic Update capability, and Failure Detect when network inputs fail to be detected within their configurable time frame.
7. The controller shall have an internal DC power supply to power external sensors.
 - a. Power Output: 20 VDC $\pm 10\%$ at 75 mA.
8. The controller shall have a visual indication (LED) of the status of the device:
 - a. Controller operating normally.
 - b. Controller in process of download.
 - c. Controller in manual mode under control of software tool.
 - d. Controller lost its configuration.
 - e. No power to controller, low voltage, or controller damage.
 - f. Processor and/or controller are not operating.
9. The minimum controller Environmental ratings
 - a. Operating Temperature Ambient Rating: -40° to 150° F (-40° to 65.5° C).
 - b. Storage Temperature Ambient Rating: -40° to 150° F (-40° to 65.5° C).
 - c. Relative Humidity: 5% to 95% non-condensing.
10. The controller shall have the additional approval requirements, listings, and approvals:
 - a. UL/cUL (E87741) listed under UL916 (Standard for Open Energy Management Equipment) with plenum rating.
 - b. CSA (LR95329-3) Listed
 - c. Meets FCC Part 15, Subpart B, Class B (radiated emissions) requirements.
 - d. Meets Canadian standard C108.8 (radiated emissions).
 - e. Conforms requirements European Consortium standard EN 61000-6-1; 2001 (EU Immunity)
 - f. Conforms requirements European Consortium standard EN 61000-6-3; 2001 (EU Emission)
11. The controller housing shall be UL plenum rated mounting to either a panel or DIN rail (standard EN50022; 7.5mm x 35mm).
12. The controller shall have a mix of digital inputs (DI), digital Triac outputs (DO), analog outputs (AO), and universal inputs (UI).
 - a. Analog outputs (AO) shall be capable of being configured as digital outputs (DO)
 - b. Input and Output wiring terminal strips shall be removable from the controller without disconnecting wiring.
 - c. Input and Output wiring terminals shall be designated with color coded labels.
 - d. Universal inputs shall be capable of being configured as binary inputs, resistive inputs, voltage inputs (0-10 VDC), or current inputs (4-20 mA)
13. The controller shall provide for "user defined" Network Variables (NV) for customized configurations and naming using Niagara AX Framework™.
 - a. The controller shall support 62 Network Variables with a byte count of 31 per variable.
 - b. The controller shall support 1,922 separate data values.
14. The controller shall provide "continuous" automated loop tuning with an Adaptive Integral Algorithm Control Loop.
15. The controller platform shall have standard HVAC application programs that are modifiable to support both the traditional and specialized "sequence of operations" as outlined in Section 4.
 - a. Discharge air control and low limit
 - b. Pressure-dependent dual duct without flow mixing.
 - c. Variable air volume with return flow tracking.
 - d. Economizer with differential enthalpy.
 - e. Minimum airflow coordinated with CO2.

- f. Unit ventilator cycle (1,2,3) 2-pipe.
- g. Unit ventilator cycle (1,2,3) 2-pipe with face/bypass.
- h. Unit ventilator cycle (1,2,3) 4-pipe.
- i. Unit ventilator cycle (1,2,3) 4-pipe with EOC valve.

2.6 ADVANCED VARIABLE AIR VOLUME CONTROLLER

- A. The advanced VAV controller platform shall be designed specifically for room-level VAV control – pressure-independent air flow control, pressure dependent damper control, supply and exhaust pressurization/de-pressurization control; temperature, humidity, complex CO₂, occupancy, and emergency control. Equipment includes: VAV terminal unit, VAV terminal unit with reheat, Series fan powered terminal unit, Parallel fan powered terminal unit, Supply and Exhaust air volume terminals, and Constant volume dual-duct terminal unit. The controller platform shall provide options and advanced system functions, programmable and configurable using Niagara AX Framework™, that allow standard and customizable control solutions required in executing the “Sequence of Operation”.
- B. Minimum Requirements:
 - 1. The controller shall be fully programmable with full functionality on any Niagara AX brand platform.
 - a. Support downloads to the controller from any brand of Niagara AX platform.
 - b. Support uploads from the controller to any brand of Niagara AX platform.
 - c. Support simulation/debug mode of the controller.
 - d. Maintain native GUI.
 - e. Native function-block programming within the Niagara AX environment.
 - 2. The controller shall be capable of either integrating with other devices or stand-alone room-level control operation.
 - 3. The controller shall have an internal velocity pressure sensor.
 - a. Sensor Type: Microbridge air flow sensor with dual integral restrictors.
 - b. Operating Range: 0 to 1.5 in. H₂O (0 to 374 Pa).
 - c. Accuracy: ±2% of full scale at 32° to 122° F (0° to 50° C); ±1% of full scale at null pressure.
 - 4. The controller shall have two microprocessors. The Host processor contains on-chip FLASH program memory, FLASH information memory, and RAM to run the main HVAC application. The second processor for network communications.
 - a. FLASH Memory Capacity: 60 Kilobytes with 8 Kilobytes for application program.
 - b. FLASH Memory settings retained for ten years.
 - c. RAM: 2 Kilobytes
 - 5. The controller shall have an FTT transformer-coupled communications port interface for common mode-noise rejection and DC isolation.
 - 6. The controller shall have an internal time clock with the ability to automatically revert from a master time clock on failure.
 - a. Operating Range: 24 hour, 365 day, multi-year calendar including day of week and configuration for automatic day-light savings time adjustment to occur on configured start and stop dates.
 - b. Accuracy: ±1 minute per month at 77° F (25° C).
 - c. Power Failure Backup: 24 hours at 32° to 122° F (0° to 50° C).
 - 7. The controller shall have Significant Event Notification, Periodic Update capability, and Failure Detect when network inputs fail to be detected within their configurable time frame.
 - 8. The controller shall have an internal DC power supply to power external sensors.
 - a. Power Output: 20 VDC ±10% at 75 mA.
 - 9. The controller shall have a visual indication (LED) of the status of the device:
 - a. Controller operating normally.
 - b. Controller in process of download.
 - c. Controller in manual mode under control of software tool.

- d. Controller lost its configuration.
 - e. No power to controller, low voltage, or controller damage.
 - f. Processor and/or controller are not operating.
10. The minimum controller Environmental ratings:
- a. Operating Temperature Ambient Rating: 32° to 122° F (0° to 50° C).
 - b. Storage Temperature Ambient Rating: 32° to 122° F (0° to 50° C).
 - c. Relative Humidity: 5% to 95% non-condensing.
11. The controller shall have the additional approval requirements, listings, and approvals:
- a. UL/cUL (E87741) listed under UL916 (Standard for Open Energy Management Equipment) with plenum rating.
 - b. CSA (LR95329-3) Listed
 - c. Meets FCC Part 15, Subpart B, Class B (radiated emissions) requirements.
 - d. Meets Canadian standard C108.8 (radiated emissions).
 - e. Conforms requirements European Consortium standard EN 61000-6-1; 2001 (EU Immunity)
 - f. Conforms requirements European Consortium standard EN 61000-6-3; 2001 (EU Emission)
12. The controller housing shall be UL plenum rated mounting to either a panel or DIN rail (standard EN50022; 7.5mm x 35mm).
13. The controller shall provide an integrated actuator option.
- a. Actuator type: Series 60 Floating.
 - b. Rotation stroke: 95° ±3° for CW or CCW opening dampers.
 - c. Torque rating: 44 lb-in. (5 Nm).
 - d. Run time for 90° rotation: 90 seconds at 60 Hz.
14. The controller shall have four digital inputs (DI), eight digital Triac outputs (DO) or six digital Triac outputs (DO) with Integrated Actuator, three analog outputs (AO), and six universal inputs (UI).
- a. Analog outputs (AO) shall be capable of being configured as digital outputs (DO).
 - b. Input and Output wiring terminal strips shall be removable from the controller without disconnecting wiring.
 - c. Input and Output wiring terminals shall be designated with color coded labels.
15. The controller shall provide for “user defined” Network Variables (NV) for customized configurations and naming using Niagara AX Framework™.
- a. The controller shall support a range of Network Variables to 62 with a byte count of 31 per variable.
 - b. The controller shall support 1,922 separate data values.
16. The controller shall provide “continuous” automated loop tuning with an Adaptive Integral Algorithm Control Loop.
17. The controller shall have a loop execution response time of 1 second.
18. The controller platform shall have standard HVAC application programs that are modifiable to support both the traditional and specialized “sequence of operations” as outlined in Section 4.
- a. VAV terminal unit.
 - b. VAV terminal unit fan speed control.
 - c. Series fan.
 - d. Parallel fan.
 - e. Regulated air volume (room pressurization/de-pressurization).
 - f. CV dual-duct
 - g. Room CO2 control
 - h. Room Humidity
 - i. TOD occupancy sensor stand-by setpoints

2.7 OTHER CONTROL SYSTEM HARDWARE

- A. Motorized control dampers that will not be integral to the equipment shall be furnished by the Control System Contractor. Control damper frames shall be constructed of galvanized steel,

formed into changes and welded or riveted. Dampers shall be galvanized, with nylon bearings. Blade edge seals shall be vinyl. Blade edge and tip seals shall be included for all dampers. Blades shall be 16-gauge minimum and 6 inches wide maximum and frame shall be of welded channel iron. Damper leakage shall not exceed 10 CFM per square foot, at 1.5-inches water gauge static pressure.

- B. Control damper actuators shall be furnished by the Control System Contractor. Two-position or proportional electric actuators shall be direct-mount type sized to provide a minimum of 5 in-lb torque per square foot of damper area. Damper actuators shall be spring return type. Operators shall be heavy-duty electronic type for positioning automatic dampers in response to a control signal. Motor shall be of sufficient size to operate damper positively and smoothly to obtain correct sequence as indicated. All applications requiring proportional operation shall utilize truly proportional electric actuators.
- C. Control Valves: Control valves shall be 2-way or 3-way pattern as shown and constructed for tight shutoff at the pump shut-off head or steam relief valve pressure. Control valves shall operate satisfactorily against system pressures and differentials. Two-position valves shall be „line“ size. Proportional control valves shall be sized for a maximum pressure drop of 5.0 psi at rated flow (unless otherwise noted or scheduled on the drawings). Valves with sizes up to and including 2 inches shall be “screwed” configuration and 2-1/2 inch and larger valves shall be “flanged” configuration. All control valves, including terminal unit valves, less than 2 inch shall be globe valves. Electrically-actuated control valves shall include spring return type actuators sized for tight shut-off against system pressures (as specified above) and, when specified, shall be furnished with integral switches for indication of valve position (open-closed). Pneumatic actuators for valves, when utilized, shall be sized for tight shut-off against system pressures (as specified above).
- D. Control Valve Actuators: Actuators for VAV terminal unit heating coils shall be “drive-open; drive-closed” type. All actuators shall have inherent current limiting motor protection. Valve actuators shall be 24-volt, electronic type, modulating or two-position as required for the correct operating sequence. Actuators on valves needing „fail-safe“ operation shall have spring return to Normal position. Modulating valves shall be positive positioning in response to the signal. All valve actuators shall be UL listed.
- E. All control valves 2 ½” or larger shall have position indication. All hot water control valves shall be Normally-Open arrangement; all chilled water control valves shall be Normally-Closed arrangement.
- F. Wall Mount Room Temperature sensors: Each room temperature sensor shall provide temperature indication to the digital controller, provide the capability for a software-limited occupant set point adjustment (warmer-cooler slider bar or switch) and limited operation override capability. Room Temperature Sensors shall be 20,000-ohm thermistor type with a temperature range of -40 to 140 degrees F. The sensor shall be complete with a decorative cover and suitable for mounting over a standard electrical utility box. These devices shall have an accuracy of 0.5 degrees, F., over the entire range.
- G. Duct-mounted and Outside Air Temperature Sensors: 20,000-ohm thermistor temperature sensors with an accuracy of ± 0.2°C. Outside air sensors shall include an integral sun shield. Duct-mounted sensors shall have an insertion measuring probe of a length appropriate for the duct size, with a temperature range of -40 to 160 degrees F. The sensor shall include a utility box and a gasket to prevent air leakage and vibration noise. For all mixed air and preheat air applications, install bendable averaging duct sensors with a minimum 8 - foot long sensor element. These devices shall have accuracy of 0.5 degrees, F., over the entire range.
- H. Humidity sensors shall be thin-film capacitive type sensor with on-board nonvolatile memory, accuracy to plus or minus two percent (2%) at 0 to 90% RH, 12 - 30 VDC input voltage, analog

output (0 - 10 VDC or 4 - 20mA output). Operating range shall be 0 to 100% RH and 32 to 140 degree F. Sensors shall be selected for wall, duct or outdoor type installation as appropriate.

- I. Carbon Dioxide Sensors (CO₂): Sensors shall utilize Non-dispersive infrared technology (N.D.I.R.), repeatable to plus or minus 20 PPM. Sensor range shall be 0 - 2000 PPM. Accuracy shall be plus or minus five percent (5%) or 75 PPM, whichever is greater. Response shall be less than one minute. Input voltage shall be 20 to 30 VAC or DC. Output shall be 0 - 10 VDC. Sensor shall be wall or duct mounted type, as appropriate for the application, housed in a high impact plastic enclosure.
- J. Current Sensitive Switches: Solid state, split core current switch that operates when the current level (sensed by the internal current transformer) exceeds the adjustable trip point. Current switch to include an integral LED for indication of trip condition and a current level below trip set point.
- K. Differential Analog (duct) Static Pressure Transmitters Provide a pressure transmitter with integral capacitance type sensing and solid-state circuitry. Accuracy shall be plus or minus one percent (1%) of full range; range shall be selected for the specific application. Provide zero and span adjustment capability. Device shall have integral static pickup tube.
- L. Differential Air Pressure Switches: Provide SPDT type, UL-approved, and selected for the appropriate operating range where applied. Switches shall have adjustable setpoints and barbed pressure tips.
- M. Water Flow Switches: Provide a SPST type contact switch with bronze paddle blade, sized for the actual pipe size at the location. If installed outdoors, provide a NEMA-4 enclosure. Flow switch shall be UL listed.
- N. Temperature Control Panels: Furnish temperature control panels of code gauge steel with locking doors for mounting all devices as shown. All electrical devices within a control panel shall be factory wired. Control panel shall be assembled by the BMS in a UL-Certified 508A panel shop. A complete set of „as-built“ control drawings (relating to the controls within that panel) shall be furnished within each control panel.
- O. Pipe and Duct Temperature sensing elements: 20,000-ohm thermister temperature sensors with and accuracy of $\pm 1\%$ accuracy. Their range shall be -5- to 250 deg. F. Limited range sensors shall be acceptable provided they are capable of sensing the range expected for the point at the specified accuracy. Thermal wells with heat conductive gel shall be included.
- P. Low Air Temperature Sensors: Provide SPST type switch, with 15 to 55 degrees F., range, vapor-charged temperature sensor. Honeywell model L482A, or approved equivalent.
- Q. Relays: Start/stop relay model shall provide either momentary or maintained switching action as appropriate for the motor being started. All relays shall be plugged in, interchangeable, mounted on a subbase and wired to numbered terminals strips. Relays installed in panels shall all be DPDT with indicating lamp. Relays installed outside of controlled devices shall be enclosed in a NEMA enclosure suitable for the location. Relays shall be labeled with UR symbol. RIB-style relays are acceptable for remote enable/disable.
- R. Emergency Stop Switches: Provide toggle-type switch with normally-closed contact. Switch shall be labeled “AIR HANDLER EMERGENCY SHUTOFF, NORMAL - OFF.”.
- S. Transducers: Differential pressure transducers shall be electronic with a 4-20 mA. output signal compatible to the Direct Digital Controller. Wetted parts shall be stainless steel. Unit shall be designed to operate in the pressure ranges involved.

- T. Control Power Transformers: Provide step-down transformers for all DDC controllers and devices as required. Transformers shall be sized for the load, but shall be sized for 50 watts, minimum. Transformers shall be UL listed Class 2 type, for 120VAC/24VAC operation.
- U. Line voltage protection: All DDC system control panels that are powered by 120 VAC circuits shall be provided with surge protection. This protection is in addition to any internal protection provided by the manufacturer. The protection shall meet UL, ULC 1449, IEEE C62.41B. A grounding conductor, (minimum 12 AWG), shall be brought to each control panel.

2.8 BAS SERVER AND WEB BROWSER GUI SYSTEM OVERVIEW

- A. The BAS Contractor shall provide system software based on server/thin-client architecture, designed around the open standards of web technology. The BAS server shall communicate using Ethernet and TCP/IP. Server shall be accessed using a web browser over Owner intranet and remotely over the Internet.
- B. The intent of the thin-client architecture is to provide the operator(s) complete access to the BAS system via a web browser. The thin-client web browser Graphical User Interface (GUI) shall be browser and operating system agnostic, meaning it will support Microsoft and Netscape Navigator browsers (6.0 or later versions), and Windows as well as non-Window operating systems. No special software, other than free public domain programs such as "JAVA VIRTUAL MACHINE" shall be required to be installed on PC's used to access the BAS via a web browser.
- C. The BAS server software must support at least the following server platforms (Windows, and/or Linux). The BAS server software shall be developed and tested by the manufacturer of the system stand-alone controllers and network controllers/routers.
- D. The web browser GUI shall provide a completely interactive user interface and must offer and be configured with the following features as a minimum:
 - 1. Trending
 - 2. Scheduling
 - 3. Downloading Memory to field devices
 - 4. Real time "live" Graphic Programs
 - 5. Tree Navigation
 - 6. Parameter change of properties
 - 7. Setpoint Adjustments
 - 8. Alarm / Event information
 - 9. Configuration of operators
 - 10. Execution of global commands
 - 11. Add, delete, and modify graphics and displayed data
- E. Software Components: All software shall be the most current version. All software components of the BAS system software shall be provided and installed as part of this project .BAS software components shall include:
 - 1. Server Software, Database and Web Browser Graphical User Interface
 - 2. System Configuration Utilities for future modifications to the system, and controllers.
 - 3. Graphical Programming Tools
 - 4. Direct Digital Control software
 - 5. Application Software
 - 6. Any required third party software
 - 7. If licensing credits are required provide a minimum of 10% additional to as built control system requires.
- F. BAS Server Database: The BAS server software shall utilize a Java DataBase Connectivity (JDBC) compatible database such as: MS SQL 8.0, Oracle 8i or IBM DB2. BAS systems written to Non -Standard and/or Proprietary databases are NOT acceptable.

- G. Database Open Connectivity: The BAS server database shall allow real time access of data via the following standard mechanisms:
 1. Open protocol standard like SOAP
 2. OLE/OPC (for Microsoft Client's/Server platform only)
 3. Import/Export of the database from or to XML (eXtensible Mark-up Language)
- H. Communication Protocol(s): The native protocol for the BAS server software shall be TCPIP over Ethernet. Proprietary protocols over TCP/IP are NOT acceptable.
- I. Thin Client – Web Browser Based: The GUI shall be thin client or browser based and shall meet the following criteria:
 1. Web Browser's for PC's: Only a 5.5 or later browser (Explorer/Navigator) will be required as the GUI, and a valid connection to the server network. No installation of any custom software shall be required on the operator's GUI workstation/client. Connection shall be over an intranet or the Internet.
 2. Secure Socket Layers: Communication between the Web Browser GUI and BAS server shall offer encryption using 128-bit encryption technology within Secure Socket Layers (SSL). Communication protocol shall be Hyper-Text Transfer Protocol (HTTP)

2.9 WEB BROWSER GRAPHICAL USER INTERFACE

- A. Web Browser Navigation: The Thin Client web browser GUI shall provide a comprehensive user interface. Using a collection of web pages, it shall be constructed to "feel" like a single application, and provide a complete and intuitive mouse/menu driven operator interface. It shall be possible to navigate through the system using a web browser to accomplish requirements of this specification. The Web Browser GUI shall (as a minimum) provide for navigation, and for display of animated graphics, schedules, alarms/events, live graphic programs, active graphic setpoint controls, configuration menus for operator access, reports, and reporting actions for events.
- B. Login: On launching the web browser and selecting the appropriate domain name or IP address, the operator shall be presented with a login page that will require a login name and password. Navigation in the system shall be dependent on the operator's role privileges, and geographic area of responsibility.
- C. Navigation: Navigation through the GUI shall be accomplished by clicking on appropriate level of a navigation tree (consisting of expandable and collapsible tree control like Microsoft's Explorer program), and/or by selecting dynamic links to other system graphics. Both the navigation tree and action pane shall be displayed simultaneously, enabling the operator to select a specific system or equipment, and view the corresponding graphic. The navigation tree shall as a minimum provide the following views: Geographic, Network, Groups and Configuration.
 1. Geographic View shall display a logical geographic hierarchy of the system including: cities, sites, buildings, building systems, floors, equipment and objects.
 2. Groups View shall display Scheduled Groups and custom reports.
 3. Configuration View shall display all the configuration categories (Operators, Schedule, Event, Reporting and Roles).
- D. Action Pane: The Action Pane shall provide several functional views for each HVAC or mechanical/electrical subsystem specified. A functional view shall be accessed by clicking on the corresponding button:
 1. Graphics: Using graphical format suitable for display in a web browser, graphics shall include aerial building/campus views, color building floor-plans, equipment drawings, active graphic setpoint controls, web content, and other valid HTML elements. The data on each graphic page shall automatically refresh.
 2. Properties: Shall include graphic controls and text for the following: Locking or overriding

- objects, demand strategies, and any other valid data required for setup. Changes made to the properties pages shall require the operator to depress an „accept/cancel“ button.
3. Schedules: Shall be used to create, modify/edit and view schedules based on the systems geographical hierarchy (using the navigation tree).
 4. Alarms: Shall be used to view alarm information geographically (using the navigation tree), acknowledge alarms, sort alarms by category, actions and verify reporting actions.
 5. Trends: Shall be used to display associated trend and historical data, modify colors, date range, axis and scaling
 6. Logic - Live Graphic Programs: Shall be used to display“ live“ graphic programs of the control algorithm, (micro block programming) for the mechanical/electrical system selected in the navigation tree.
 7. Other actions such as Print, Help, Command, and Logout shall be available via a drop-down window.
- E. Color Graphics: The Web Browser GUI shall make extensive use of color in the graphic pane to communicate information related to setpoints and comfort. Animated .gifs or .jpg, vector scalable, active setpoint graphic controls shall be used to enhance usability. Graphics tools used to create Web Browser graphics shall be non-proprietary and conform to the following basic criteria:
1. Display Size: The GUI workstation software shall graphically display in 1024 by 768 pixels 24 bit True Color.
 2. General Graphic: General area maps shall show locations of controlled buildings in relation to local landmarks.
 3. Color Floor Plans: Floor plan graphics shall. Provide a visual display of temperature relative to their respective setpoints.
 4. Mechanical Components: Mechanical system graphics shall show the type of mechanical system components serving any zone through the use of a pictorial representation of components. Selected I/O points being controlled or monitored for each piece of equipment shall be displayed with the appropriate engineering units. Animation shall be used for rotation or moving mechanical components to enhance usability.
 5. Minimum System Color Graphics: Color graphics shall be selected and displayed via a web browser for the following:
 - a. Each piece of equipment monitored or controlled including each terminal unit
 - b. Each building
 - c. Each floor and zone controlled
- F. Hierarchical Schedules: Utilizing the Navigation Tree displayed in the web browser GUI, an operator (with password access) shall be able to define a Normal, Holiday or Override schedule for an individual piece of equipment or room, or choose to apply a hierarchical schedule to the entire system, site or floor area. For example, Independence Day „Holiday“ for every level in the system would be created by clicking at the top of the geographic hierarchy defined in the Navigation Tree. No further operator intervention would be required and every control module in the system with would be automatically downloaded with the „Independence Day“ Holiday. All schedules that affect the system/area/equipment highlighted in the Navigation Tree shall be shown in a summary schedule table and graph.
1. Schedules: Schedules shall comply with the LonWorks standards, (Schedule Object, Calendar Object, Weekly Schedule property and Exception Schedule property) and shall allow events to be scheduled based on:
 - a. Types of schedule shall be Normal, Holiday or Override
 - b. A specific date,
 - c. A range of dates,
 - d. Any combination of Month of Year (1-12, any), Week of Month (1-5, last, any), Day of Week (M-Sun, Any)
 - e. Wildcard (example, allow combinations like second Tuesday of every month).
 2. Schedule Categories: The system shall allow operators to define and edit scheduling categories (different types of “things” to be scheduled; for example, lighting, HVAC

- occupancy, etc.). The categories shall include: name, description, icon (to display in the hierarchy tree when icon option is selected) and type of value to be scheduled.
3. Partial Day Exceptions: Schedule events shall be able to accommodate a time range specified by the operator (ex: board meeting from 6 pm to 9 pm overrides Normal schedule for conference room).
 4. Schedule Summary Graph: The schedule summary graph shall clearly show Normal versus Holiday versus Override Schedules, and the net operating schedule that results from all contributing schedules. Note: In case of priority conflict between schedules at the different geographic hierarchy, the schedule for the more detailed geographic level shall apply.
- G. Alarms: Alarms associated with a specific system, area, or equipment selected in the Navigation Tree, shall be displayed in the Action Pane by selecting an „Alarms“ view. Alarms, and reporting actions shall have the following capabilities:
1. Alarms View: Each Alarm shall display an Alarms Category (using a different icon for each alarm category), date/time of occurrence, current status, alarm report, and a bold URL link to the associated graphic for the selected system, area or equipment. The URL link shall indicate the system location, address and other pertinent information. An operator shall easily be able to sort events, edit event templates and categories, acknowledge or force a return to normal in the Events View as specified in this section.
 2. Alarm Categories: The operator shall be able to create, edit or delete alarm categories such as HVAC, Maintenance, Fire, or Generator. An icon shall be associated with each alarm category, enabling the operator to easily sort through multiple events displayed.
 3. Alarm Time/Date Stamp: All events shall be generated at the DDC control module level and comprise the Time/Date Stamp using the standalone control module time and date.
 4. Alarm Summary Counter: The view of Alarm in the Graphic Pane shall provide a numeric counter, indicating how many Alarms are active (in alarm), require acknowledgement, and total number of Alarms in the BAS Server database.
 5. Alarm Auto-Deletion: Alarms that are acknowledged and closed shall be auto-deleted from the database and archived to a text file after an operator defined period.
 6. Alarm Reporting Actions: Alarm Reporting Actions specified shall be automatically launched (under certain conditions) after an Alarm is received by the BAS server software. Operators shall be able to easily define these Reporting Actions using the Navigation Tree and Graphic Pane through the web browser GUI. Reporting Actions shall be as follows:
 - a. Email: Email shall be sent via any POP3-compatible e-mail server (most Internet Service Providers use POP3). Email messages may be copied to several email accounts. Note: Email reporting action shall also be used to support alphanumeric paging services, where email servers support pagers.
- H. Trends: Trends shall both be displayed and user configurable through the Web Browser GUI. Trends shall comprise analog, digital or calculated points simultaneously. A trend log's properties shall be editable using the Navigation Tree and Graphic Pane.
1. Viewing Trends: The operator shall have the ability to view trends by using the Navigation Tree and selecting a Trends button in the Graphic Pane. The system shall allow y- and x-axis maximum ranges to be specified and shall be able to simultaneously graphically display multiple trends per graph.
 2. Local Trends: Trend data shall be collected locally by Multi-Equipment/Single Equipment general-purpose controllers, and periodically uploaded to the BAS server if historical trending is enabled for the object. Trend data, including run time hours and start time date shall be retained in non-volatile module memory. Systems that rely on a gateway/router to run trends are NOT acceptable.
 3. Resolution. Sample intervals shall be as small as one second. Each trended point will have the ability to be trended at a different trend interval. When multiple points are selected for displays that have different trend intervals, the system will automatically scale the axis.

4. Dynamic Update. Trends shall be able to dynamically update at operator-defined intervals.
 5. Zoom/Pan. It shall be possible to zoom-in on a particular section of a trend for more detailed examination and „pan through“ historical data by simply scrolling the mouse.
 6. Numeric Value Display. It shall be possible to pick any sample on a trend and have the numerical value displayed.
 7. Copy/Paste. The operator must have the ability to pan through a historical trend and copy the data viewed to the clipboard using standard keystrokes (i.e. CTRL+C, CTRL+V).
- I. Security Access: Systems that Security access from the web browser GUI to BAS server shall require a Login Name and Password. Access to different areas of the BAS system shall be defined in terms of Roles, Privileges and geographic area of responsibility as specified:
1. Roles: Roles shall reflect the actual roles of different types of operators. Each role shall comprise a set of „easily understood English language“ privileges. Roles shall be defined in terms of View, Edit and Function Privileges.
 - a. View Privileges shall comprise: Navigation, Network, and Configuration Trees, Operators, Roles and Privileges, Alarm/Event Template and Reporting Action.
 - b. Edit Privileges shall comprise: Setpoint, Tuning and Logic, Manual Override, and Point Assignment Parameters.
 - c. Function Privileges shall comprise: Alarm/Event Acknowledgement, Control Module Memory Download, Upload, Schedules, Schedule Groups, Manual Commands, Print, and Alarm/Event Maintenance.
 2. Geographic Assignment of Roles: Roles shall be geographically assigned using a similar expandable/collapsible navigation tree. For example, it shall be possible to assign two HVAC Technicians with similar competencies (and the same operator defined HVAC Role) to different areas of the system.

2.10 GRAPHICAL PROGRAMMING

- A. The system software shall include a Graphic Programming Language (GPL) for all DDC control algorithms resident in all control modules. Any system that does not use a drag and drop method of graphical icon programming shall not be accepted. All systems shall use a GPL is a method used to create a sequence of operations by assembling graphic microblocks that represent each of the commands or functions necessary to complete a control sequence. Microblocks represent common logical control devices used in conventional control systems, such as relays, switches, high signal selectors, etc., in addition to the more complex DDC and energy management strategies such as PID loops and optimum start. Each microblock shall be interactive and contain the programming necessary to execute the function of the device it represents.
- B. Graphic programming shall be performed while on screen and using a mouse; each microblock shall be selected from a microblock library and assembled with other microblocks necessary to complete the specified sequence. Microblocks are then interconnected on screen using graphic "wires," each forming a logical connection. Once assembled, each logical grouping of microblocks and their interconnecting wires then forms a graphic function block which may be used to control any piece of equipment with a similar point configuration and sequence of operation.
- C. Graphic Sequence: The clarity of the graphic sequence must be such that the operator has the ability to verify that system programming meets the specifications, without having to learn or interpret a manufacturer's unique programming language. The graphic programming must be self-documenting and provide the operator with an understandable and exact representation of each sequence of operation.
- D. GPL Capabilities: The following is a minimum definition of the capabilities of the Graphic Programming software:

1. Function Block (FB): Shall be a collection of points, microblocks and wires which have been connected together for the specific purpose of controlling a piece of HVAC equipment or a single mechanical system.
2. Logical I/O: Input/Output points shall interface with the control modules in order to read various signals and/or values or to transmit signal or values to controlled devices.
3. Microblocks: Shall be software devices that are represented graphically and may be connected together to perform a specified sequence. A library of microblocks shall be submitted with the control contractors bid.
4. Wires: Shall be Graphical elements used to form logical connections between microblocks and between logical I/O.
5. Reference Labels: Labels shall be similar to wires in that they are used to form logical connections between two points. Labels shall form a connection by reference instead of a visual connection, i.e. two points labeled 'A' on a drawing are logically connected even though there is no wire between them.
6. Parameter: A parameter shall be a value that may be tied to the input of a microblock.
7. Properties: Dialog boxes shall appear after a microblock has been inserted which has editable parameters associated with it. Default parameter dialog boxes shall contain various editable and non-editable fields, and shall contain "push buttons" for the purpose of selecting default parameter settings.
8. Icon: An icon shall be graphic representation of a software program. Each graphic microblock has an icon associated with it that graphically describes its function.
9. Menu-bar Icon: Shall be an icon that is displayed on the menu bar on the GPL screen, which represents its associated graphic microblock.
10. Live Graphical Programs: The Graphic Programming software must support a „live“ mode, where all input/output data, calculated data, and setpoints shall be displayed in a „live“ real-time mode.

2.11 LONWORKS NETWORK MANAGEMENT

- A. Systems requiring the use of third party LonWorks network management tools shall not be accepted.
- B. Network management shall include the following services: device identification, device installation, device configuration, device diagnostics, device maintenance and network variable binding.
- C. The Network configuration tool shall also provide diagnostics to identify devices on the network, to reset devices, and to view health and status counters within devices.
- D. These tools shall provide the ability to “learn” an existing LonWorks network, regardless of what network management tool(s) were used to install the existing network, so that existing LonWorks devices and newly added devices are part of a single network management database.
- E. The network management database shall be resident in the Network Area Controller (NAC), ensuring that anyone with proper authorization has access to the network management database at all times. Systems employing network management databases that are not resident, at all times, within the control system shall not be accepted.

PART 3 - INSTALLATION

3.1 GENERAL

- A. Install system and materials in accordance with manufacturer’s instructions, and as detailed on the project drawing set.

- B. Line and low voltage electrical connections to control equipment shown specified or shown on the control diagrams shall be furnished and installed by the Control System Contractor in accordance with these specifications.
- C. Equipment furnished by the Mechanical Contractor that is normally wired before installation shall be furnished completely wired. Control wiring normally performed in the field will be furnished and installed by the Control System Contractor.
- D. All control devices mounted on the face of control panels shall be clearly identified as to function and system served with permanently engraved phenolic labels.

3.2 WIRING

- A. All electrical control wiring = to the control panels shall be the responsibility of the Control System Contractor.
- B. All wiring shall be in accordance with the Project Electrical Specifications (Division 16), the National Electrical Code and any applicable local codes. All control wiring shall be installed in raceways.

3.3 PROJECT CLOSEOUT ACCEPTANCE TESTING

- A. Upon completion of the installation, the Control System Contractor shall load all system software and start-up the system. The Control System Contractor shall perform all necessary calibration, testing and de-bugging and perform all required operational checks to insure that the system is functioning in full accordance with these specifications.
- B. The Control System Contractor shall perform tests to verify proper performance of components, routines, and points. Repeat tests until proper performance results. This testing shall include a point-by-point log to validate 100% of the input and output points of the DDC system operation.
- C. System Acceptance: Satisfactory completion is when the Control System Contractor has performed successfully all the required testing to show performance compliance with the requirements of the Contract Documents to the satisfaction of the Owner's Representative. System acceptance shall be contingent upon completion and review of all corrected deficiencies.

3.4 OPERATOR TRAINING

- A. During system commissioning and at such time acceptable performance of the Control System hardware and software has been established, the Control System Contractor shall provide on-site operator instruction to the owner's operating personnel. Operator instruction shall be done during normal working hours and shall be performed by a competent representative familiar with the system hardware, software and accessories.
- B. The Control System Contractor shall provide 16 hours (total) of instruction to the owner's designated personnel on the operation of the BMS and describe its intended use with respect to the programmed functions specified. Operator orientation of the BMS shall include, but not be limited to; the overall operation program, equipment functions (both individually and as part of the total integrated system), commands, systems generation, advisories, and appropriate operator intervention required in responding to the System's operation

3.5 WARRANTY PERIOD SERVICES

- A. Equipment, materials and workmanship incorporated into the work shall be warranted for a period of one year from the time of system acceptance.
- B. Within this period, upon notice by the Owner, any defects in the BMS due to faulty materials, methods of installation or workmanship shall be promptly repaired or replaced by the Control System Contractor at no expense to the Owner
- C. Maintenance of Computer Software Programs: The Control System Contractor shall maintain all software during the warranty period. In addition, all factory or sub-vendor upgrades to software shall be added to the systems, when they become available, at no additional cost. New products are not considered upgrades in this context.
- D. Maintenance of Control Hardware: The Control System Contractor shall inspect, repair, replace, adjust, and calibrate, as required, the controllers, control devices and associated peripheral units during the warranty period. The Control System Contractor shall then furnish a report describing the status of the equipment, problem areas (if any) noticed during service work, and description of the corrective actions taken. The report shall clearly certify that all software is functioning correctly.
- E. Service Period: Calls for service by the Owner shall be honored within 24 hours and are not to be considered as part of routine maintenance.
- F. Service Documentation: A copy of the service report associated with each owner-initiated service call shall be provided to the owner.

3.6 WARRANTY ACCESS

- A. The Owner shall grant to the Control System Contractor reasonable access to the BMS during the warranty period. Remote access to the BMS (for the purpose of diagnostics and troubleshooting, via the Internet, during the warranty period) will be allowed.

3.7 OPERATION AND MAINTENANCE MANUALS

- A. See Division 01 for requirements. O&M manuals shall include the following elements, as a minimum:
 - 1. As-built control drawings for all equipment.
 - 2. As-built Network Communications Diagram.
 - 3. General description and specifications for all components.
 - 4. Completed Performance Verification sheets.
 - 5. Completed Controller Checkout/Calibration Sheets.

PART 4 - SEQUENCE OF OPERATION

4.1 WSHP HEAT PUMP CONTROL

- A. The DDC Controller shall energize the unit through its Optimization Program for morning warmup and cool down. During morning warmup, the compressor shall be energized to full heat and full cool for morning cool down.
- B. On a fall in space temperature to the heating setpoint of the DDC Controller, the DDC Controller shall energize the Heat Pump in the heating cycle. On a rise in space temperature to the cooling setpoint, the DDC Controller shall stage on mechanical cooling.

- C. Whenever the setting of the condensate overflow switch is reached, the condensate switch shall de-energize the supply air fan.
- D. During the unoccupied mode, the Heat Pump shall be cycled at a reduced heating setpoint and a raised cooling setpoint.

4.2 HEAT PUMP LOOP CONTROL

- A. The DDC Controller shall select a different loop pump weekly to act as the main, indexing the other loop pump as a standby. Whenever the DDC Controller senses that the main loop pump has lost flow, the DDC Controller, after a time delay (adjustable), shall start the standby pump and de-energize the failed pump.
- B. Whenever the DDC Controller senses that any heat pump has a demand for heating or cooling or the building is occupied, the DDC Controller shall energize the system pumps. Once the system pumps have proven flow, after a time delay, the heat pumps will be allowed to start.
- C. On a fall in loop supply temperature below the setpoint of the DDC Controller, the DDC Controller shall enable the boiler control panel to maintain setpoint. The DDC system shall communicate via BACnet to the boiler control panel.
- D. On a rise in rise in supply water temperature above the setpoint of the DDC Controller, the DDC Controller shall energize the spray pump. On a continued rise in supply water temperature, the DDC Controller shall enable the Closed Circuit Cooler fan on low speed, on a continued rise, the DDC controller shall index fan to high speed to maintain supply water temperature to the setpoint of the DDC Controller. On a fall in supply water temperature the reverse sequence shall occur.
- E. All heat pumps shall be organized in zones so that initial morning startup, all heat pumps will not energize at the same time. The DDC Controller shall be programmed to stagger the start of each zone.
- F. Whenever the loop temperature falls below an adjustable setpoint or rises above an adjustable setpoint (high and low temp alarms) the DDC Controller shall de-energize all water source heat pumps.

4.3 DEDICATED OUTDOOR AIR UNIT CONTROL

- A. Please see unit specifications for "Sequence of Operations". Controls contractor shall communicate via BACnet with the factory mounted controls and create a graphic depicting the unit.

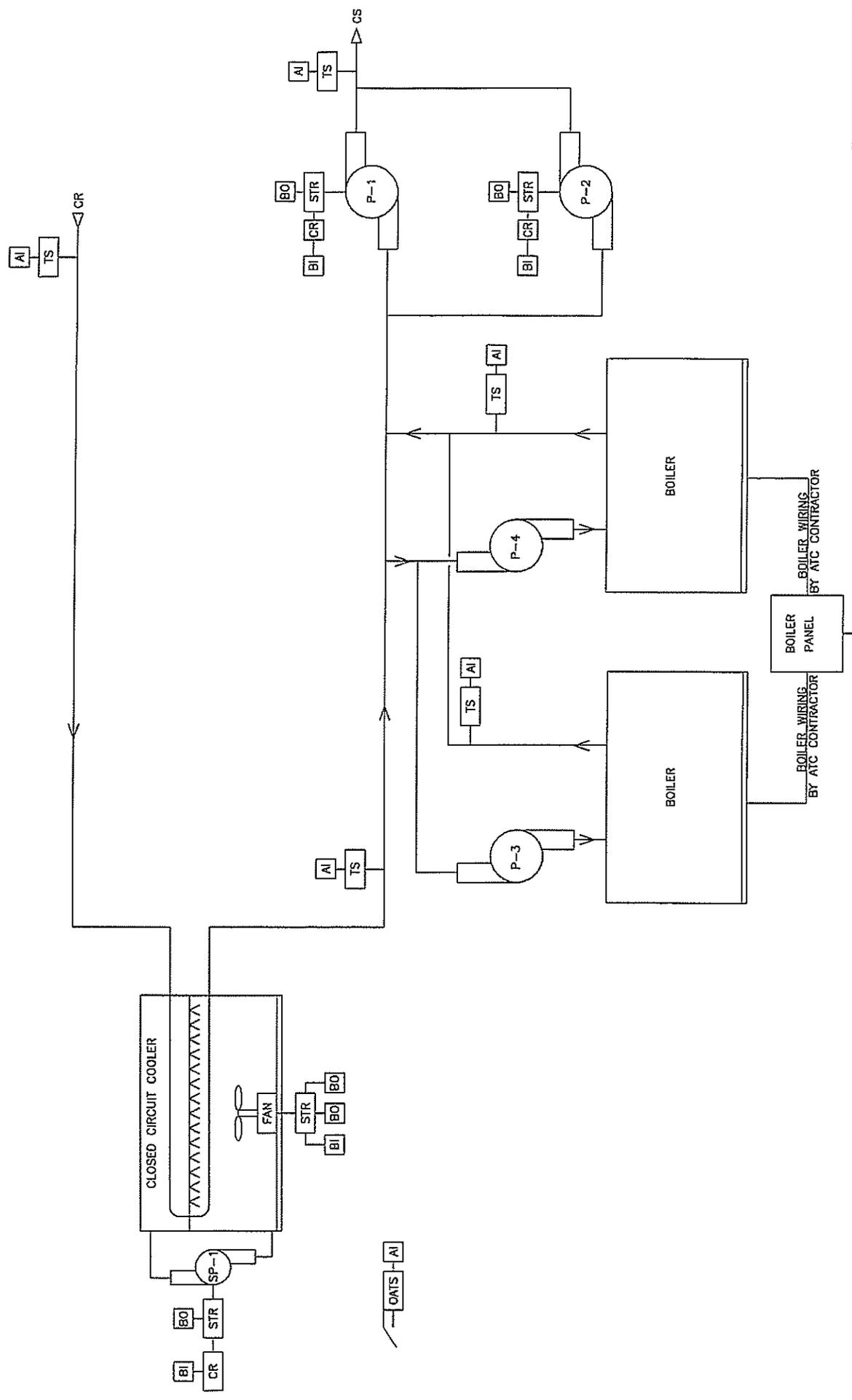
4.4 MINI SPLIT HEAT PUMP CONTROL

- A. Please see unit specifications for "Sequence of Operations". Controls contractor shall furnish the control interlock wiring.

4.5 BOILERS AND CLOSED CIRCUIT COOLER

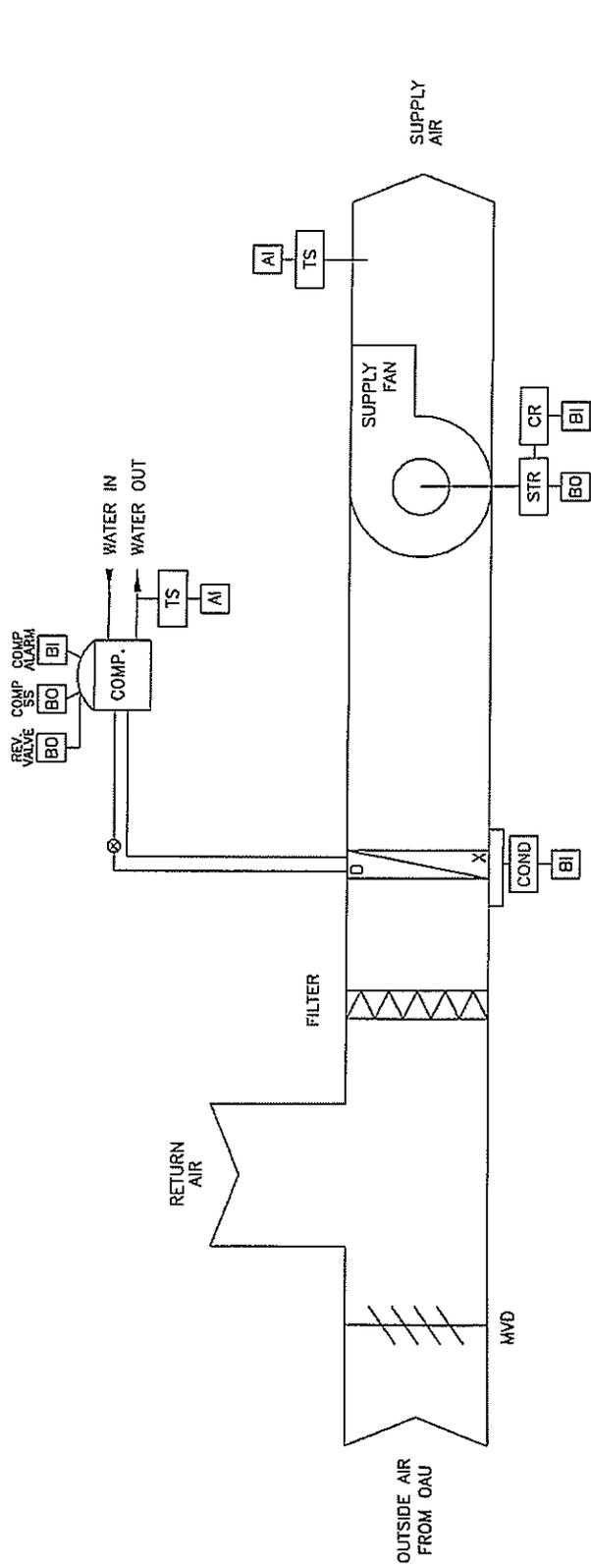
- A. It shall be the responsibility of this contractor to furnish any and all control interlock wiring for the boilers and closed circuit cooler.

END OF SECTION 230900



CLOSED CIRCUIT COOLING SYSTEM
FLOW DIAGRAM

MILLER CENTER



ZONE TEMP SENSOR
 W/ SETPOINT
 PB FOR OVERRIDE
 PB FOR CANCEL

NOTE: INITIAL OVERRIDE SHALL
 BE PROGRAMMED AT 2HRS

WATER SOURCE HEAT PUMP
FLOW DIAGRAM

SECTION 231123 - GAS PIPING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to this Section.

1.2 SUMMARY

- A. Provide gas piping as indicated on the contract drawings and as specified below. Install gas piping in accordance with the current edition of the International Fuel Gas Code and NFPA 54.

PART 2 - PRODUCTS

2.1 PIPING

- A. Piping above ground shall be Schedule 40 black steel. Piping 1-1/2" and under shall be screw fabricated using 150 pound malleable fittings and piping 2" and over shall be fabricated by welding, using Schedule 40 steel welding fittings. Piping exposed to the weather shall be Schedule 40 galvanized pipe and fittings.
- B. Piping run underground shall be type "L" copper piping with wrought fittings, all fittings to be silver brazed encase piping in Schedule 40 PVC conduit.

2.2 GAS VALVES

- A. Valves for natural gas service shall be UL and/or UGA listed and shall be installed as recommended by the Manufacturer. Valves shall conform to standards listed or where appropriate, in accordance with ANSI Z21.15 and ANSI Z21.15a.

2.3 EMERGENCY GAS SHUT-OFF SWITCH

- A. In all Mechanical/Water Heater/Boiler Rooms with gas fired boilers or water heaters, an emergency shut-off solenoid valve shall be installed to the boiler/ water heater gas supply and connected to a switch located at each entrance to the room. The switch shall power the solenoid to close when the switch is activated. See electrical documents for connections. All valves and controls shall be UL/AGA approve and meet state and local requirements.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Encase gas piping underground and/or beneath the building in waterproof conduit. Extend the conduit into a normally usable and accessible portion of the building. Seal the space between the conduit and the gas piping to prevent the possible entrance of any gas leakage. Extend the conduit at least 12" outside the building, vent above grade to the outside and install in a way as to prevent the entrance of water. Conduit shall be minimum 4"diameter Schedule 40 PVC pipe and fittings. Minimum diameter shall be 4".
- B. All valves, regulators, etc. shall be AGA approved.

- C. Provide AGA shut-off valves on gas mains, risers and branches where indicated and at connections to gas burning equipment.
- D. Properly label all gas piping for identification.
- E. Test and purge all gas piping per local codes and NFPA 54.
- F. Support exterior piping on the roof in a manner consistent with and coordinated with the Roofing Contractor.
- G. Coat threads on galvanized piping with a field applied galvanizing after assembly.

END OF SECTION 231123

SECTION 232113 – HYDRONIC PIPING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to this Section.

1.2 SUMMARY

- A. Provide pipe, pipe fittings, specialty items, equipment and materials as indicated on the contract drawings and/or as specified below.

PART 2 - PRODUCTS

2.1 PIPING

- A. Heat pump condenser water piping shall be ASA Schedule 40 black steel or Type "L" copper tubing. Steel piping 2-1/2" and under shall be screw fabricated using 150 pound malleable fittings and piping 3" and over shall be fabricated by welding, using Schedule 40 steel welding fittings and welding pipe rings at all weld connections. Copper tubing shall be assembled with wrought copper soldering fittings using 95-5 solder. All steel piping run below floor slabs shall be welded.
- B. Condensate drain piping shall be Type "M" tubing assembled with wrought soldering fittings using 95-5 solder or Schedule 40 PVC pipe and fittings assembled as recommended by the Manufacturer. PVC piping shall not be installed in plenums.

2.2 PIPING SUPPORTS

- A. Supports shall be as manufactured by Elcen, Grinnell, Fee and Mason, or approved equal.
- B. Support spacing shall be as follows:
 - 1. ½" to 1-1/4" - maximum span (steel or copper) 7' (PVC) 5'.
 - 2. 1-1/2" to 3" - maximum span (steel or copper) 10', (PVC) 6'.
 - 3. 4" to 6" - maximum span (steel or copper) 15', (PVC) 7'.
 - 4. 8" and larger - maximum span (steel or copper) 20', (PVC) 10'.
- C. Supports for un-insulated copper piping shall have copper finish.
- D. Installation of hangers shall be subject to the approval of the Architect. Provide intermediate supports at equipment, piping specialties, and at piping direction changes. Do not support piping from metal deck system.
- E. At insulated piping provide insulation protection shields or saddles at pipe supports.

2.3 VALVES

- A. Gate valves 2" and smaller shall be Class 125 all bronze, rising or non-rising stems with double wedge taper seat. Valves 2-1/2" and larger shall be Class 125 IBBM, OS & Y, rising stem, solid rising stem, solid wedge disc with flanged ends.

- B. Globe valves 2" and smaller shall be Class 125, all bronze, with non-metallic disc. Valves 2-1/2" and larger shall be Class 125 IBBM, rising stem, renewable seat and disc with flanged ends.
- C. Ball valves 2" and smaller, shall be Class 125, bronze body, bronze ball and resilient seat. Valves shall be serviceable from either top or end without removing piping.
- D. Check Valves 2" and smaller shall be one of the following:
 - 1. Swing Type - Class 125 bronze body, with renewable bronze disc.
 - 2. Globe Non-Slam Type - Class 125, bronze body, renewable composition disc, spring loaded.
- E. Check Valves - 2-1/2" and larger shall be one of the following:
 - 1. Swing Type - Class 125, IBBM, renewable bronze seat, with flanged ends.
 - 2. Wafer Non-Slam Type - Class 125, IBBM, renewable bronze seat and disc, and stainless steel spring with flanged ends.

2.4 WATER SPECIALTIES

- A. Water specialties shall be manufactured by Bell and Gossett, Taco, Amtrol or approved equal.
 - 1. Air separators.
 - 2. Boiler fittings.
 - 3. Suction Diffusers.
 - 4. Automatic air vents.
 - 5. Triple Duty Valves.
 - 6. Compression tanks and tank fittings.
 - 7. Circuit setter balance valves.

2.5 AUTOMATIC FLOW CONTROL VALVE PACKAGES

- A. Provide automatic flow control valve package where indicated. Valves shall be selected and sized by the valve Manufacturer for the flow required. Install valves in such a way so that the valve operating mechanism can be serviced/replaced without disturbing the surrounding piping. All valves shall be of one Manufacturer and shall have five (5) year warranties. Valves shall have pressure taps and fittings for connection of flow test meters. Furnish one test meter to the Owner and include training in its use. Valves shall be FlowDesign, Auto Flow-AccuSetter or equal.

2.6 THERMOMETERS AND GAUGES

- A. Thermometers shall be spirit filled liquid type, with adjustable angle and 9" scale. Thermometers shall have range suitable for the service intended and shall be complete with brass or stainless steel socket well.
- B. Pressure gauges shall be minimum of 4-1/2" in diameter. Install gauges with isolating pet-cock to permit gauge removal.

2.7 FLEXIBLE PIPE CONNECTORS

- A. Provide rubber or neoprene vibraflex pipe connectors on suction and discharge of base mounted circulating pumps and where indicated. Pipe connector length, installation and control rods shall be as recommended by the Manufacturer for the service intended.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Slope piping to vent at high points and provide accessible drains at low points.
- B. Use welding pipe rings at welded pipe joints.
- C. Install sleeves where piping passes through masonry construction. Sleeves shall be Schedule 40 steel pipe sized to accommodate piping set sleeves in place as construction progresses. Set sleeves flush with finished surfaces. Inside diameter of sleeves shall match outside diameter of covering. Seal fire wall penetrations with approved fire stop material.
- D. Install escutcheons where pipes pass through any exposed surfaces. Escutcheons shall be split-ring hinged and sized as required. Escutcheons in the equipment rooms shall be suitable for painting. Other escutcheons shall be nickel or chromium finish.
- E. Do not run piping above the Electrical equipment rooms.
- F. Do not install PVC in plenums.

3.2 TESTING, CLEANING AND START-UP

- A. Test piping at one and one-half times normal working pressure or minimum 50 psig and prove tight.
- B. Thoroughly clean and flush piping shall prior to connection of major equipment items, including control valves and balancing valves.

END OF SECTION 232113

SECTION 232513 - HVAC WATER TREATMENT SYSTEMS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to this Section.

1.2 SUMMARY

- A. Install a complete and working water treatment system as herein specified and indicated on the Drawings.
- B. Water Treatment Contractor shall provide all piping, valves, fittings, switches and miscellaneous equipment required. Close coordination with the Mechanical Contractor and packaged pumping system supplier is essential and is required.
- C. The Water Treatment Contractor shall provide the following services:
 - 1. All initial cleanout chemicals.
 - 2. Chemical feed equipment and test equipment as described herein.
 - 3. Instruct the Mechanical Contractor on cleanout procedures and the installation of feeding equipment. Oversee the initial cleanout of all piping systems and provide certification letter to the Owner indicating initial cleanout has been completed to his satisfaction.
 - 4. Obtain and analyze samples from all systems after initial cleanout and furnish written reports and recommendations to the Owner.
 - 5. All chemicals required for start-up and one year supply.

1.3 QUALITY ASSURANCE STANDARDS

- A. Applicable portions of the standard methods of the American Water Works Association (AWWA) and the American Society for Testing and Materials (ASTM) are hereby made part of this Specification.
- B. The Company's laboratory shall be equipped to analyze samples in accordance with the standard methods of the American Water Works Association (AWWA) and the American Society for Testing Materials (ASTM).

1.4 SUBMITTALS

- A. Shop Drawings: Indicate dimensions, materials used, and arrangement of components, and wiring diagrams. Submittal data shall clearly indicate coordination with packaged pumping system supplier.
- B. Instructions: Two bound sets of installation, operating and maintenance instructions, and parts lists with normal maintenance parts noted.
- C. Provide Material Safety Data Sheets (MSDS), regarding chemicals used or treatment with submittal documents. Post another copy for all MSDS, with clear plastic covers, in the chemical work area. Provide safety equipment that is required in the MSDS and will not be furnished by others in the chemical work area. Coordinate with the Architect and the Owner.

PART 2 - PRODUCTS

2.1 WATER TREATMENT

- A. Initial Cleanout: Fill and flush all new recirculating water systems, both open and closed, with a 0.5 solution, by weight, of a non-foaming chemical detergent, to remove all foreign matter. Circulate solution for a minimum of 8 hours and drain as rapidly as possible to remove suspended matter. Flush the system with fresh water, drain a second time and refill. Repeat flush until Water Treatment Contractor is satisfied as to its contents. After final filling, the pH of the water shall not exceed the pH of the fresh incoming water by more than 0.5 pH. Clean systems brought on line in sections in a similar manner. The Take all precautions necessary to prevent cross-contamination of piping system.

2.2 FEEDING EQUIPMENT

- A. Closed Recirculating Water System: The chemical treatment for the closed loop systems shall be Nitrate based. Furnish chemical shot feeder as a component of the packaged pumping system.
- B. Open Cooling Tower Water System Treatment shall be as follows:
 - 1. Phosphate-polymer, polyphosphate-polymer, or other chromate-free treatment.
 - 2. Liquid form shall be suitable for pumping directly from drums into condenser water system and shall be supplied in 55 gallon drums.
- C. Biocides shall be two different types of treatment for alternating application and shall be EPA registered for use in recirculating cooling water systems. Compounds of mercury, copper or arsenic will not be permitted. Treatment shall be in accordance with EPA approved label.
- D. Blowdown shall be controlled by condenser water conductivity. Maintain maximum chloride concentration at 300 ppm as NaCl in condenser water.

PART 3 - EXECUTION

3.1 TESTING

- A. The Water Treatment Chemical and Services Supplier shall furnish basic water test equipment, including carrying case and reagents for use with the supplier's products and specific test for treatment residual. Where specialized or supplementary equipment is required, it shall be furnished as part of the offering.

3.2 WATER MANAGEMENT PROGRAM

- A. The Water Treatment Contractor shall provide a Water Management and Service Program for a period of one year from start-up of the system to include the following: initial water analysis and recommendations, system start-up assistance, training of operating personnel, periodic field service and consultation (all performed by a qualified, full-time local representative), customer report charts and log sheets, plus laboratory and technical assistance.
- B. A qualified service representative shall visit premises monthly for collecting samples of water from each treated system for field testing and analysis at firm's laboratory, inspect all chemical feeders and treatment control and install and collect corrosion coupons first 30 days, next 60 days and subsequent quarterly coupon examination reports.

3.3 WATER TREATMENT CHEMICALS

- A. Provide supply of chemical treatment for all systems for system start-up and one year of operation.
- B. Permanently installed bypass valves have been designed for each heat pump unit. Use these valves (in conjunction with isolation valves) to prevent contamination of heat exchangers and flow control valves during flushing operations.

END OF SECTION 232513

SECTION 233113 - SHEET METAL DUCTWORK

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to this Section.

1.2 SUMMARY

- A. Provide complete systems of supply, return, relief, outside and exhaust ducts as shown on the drawings. Submit ductwork shop drawings (minimum scale of 1/4" = 1'-0") for review by the Engineer prior to fabrication.
- B. Duct sizes shown on drawings are clear inside dimensions. Where sizes must be varied from those indicated on the drawings, the full area of the duct shall be maintained.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Ductwork shall be galvanized steel sheets constructed and supported in accordance with the recommendations of the ASHRAE Guide and SMACNA Duct Construction Standards. Seal all duct joints and seams with approved duct sealant.
- B. Supply and/or return ducts where indicated on plans as internally lined shall be acoustically lined with 1" thick liner. Duct liner shall be permacote, liacoustic HP or equal.
- C. Whenever practicable, elbows shall be radius type with a centerline radius of 1-1/2 times the width or diameter of the duct. Where space does not permit, the use of short radius elbows having a minimum radius of 1.0 times the width or diameter of the duct or square elbows with factory fabricated turning vanes may be used.
- D. Make flexible connections of neoprene covered 20 ounce glass fabric cloth duct connections to all air handling equipment to prevent transmission of vibration.
- E. Exposed spiral round ductwork shall be double wall insulated with solid inner liner and have a minimum 1" fiberglass insulation. Duct shall be of spiral lockseam construction fabricated from galvanized steel meeting ASTM-A527 Standards. All fittings shall be of the same construction and material. Elbows shall be of die-stamped, gored, pleated or mitered construction. Support ductwork per Manufacturer's recommendations with factory provided hanging rings. Provide all ductwork with primer finish and free of any dents for field painting (color as selected by the Architect). Any ductwork that is damaged shall be rejected and, at the Engineer's discretion, replaced with a new section at no additional cost to the Owner.
- F. Furnish and install volume dampers where indicated on the drawings. Dampers shall be constructed of not lighter than 18 gauge galvanized sheet metal and shall be equipped with blade bearings. Terminate damper shafts in locking quadrants. Damper blades shall be bent and center grooved for rigidity. Damper in ducts larger than 220 sq. inch in cross-sectional area shall be opposed blade dampers. Provide all dampers with a minimum of 2" standoffs to clear insulation.
- G. Provide duct access doors at the following locations:

1. 50 feet on center in straight sections of duct. NOTE: A duct runout to a single diffuser less than 50 feet in length shall be provided with a single access door within 2 feet of the take-off damper.
 2. At entering and leaving side of duct mounted coils.
 3. Entering side of 90° elbows and tees.
 4. At leaving side of dampers.
 5. As required for access to fire dampers, duct mounted sensors, smoke detectors and devices requiring periodic service.
 6. Access doors shall be double wall, 1" thick internally insulated with solid inner panel. Provide gasketed frame with double cam-lock, hinged assembly. Doors shall be 12"x12" except where duct dimensions prohibits a door of this size. In smaller ducts, door shall be as large as possible. Doors may be omitted in ducts smaller than 10 inches in largest dimension.
- H. Install fire dampers at locations shown on the drawings. Fire dampers shall be UL classified and installed in accordance to the UL listing and SMACNA guidelines, including the installation of fire seal access doors and mounting sleeves and angles on each side of fire rated partitions, floors or roof. All fire dampers shall be "Dynamic Rated" unless otherwise noted.
- I. Flexible round ductwork shall be 1" thick flexible fiberglass duct with fire-resistant aluminum pigmented plastic vapor barrier, and continuous inner barrier film. Flexible duct runouts shall not exceed 5 feet in length. Runouts longer than 5 feet shall be rigid round duct (field insulated) with the last 5 feet being flexible ducting.
- J. Tie wraps and other duct accessories and materials shall be plenum-rated when located in plenum areas.

2.2 KITCHEN GREASE HOOD EXHAUST DUCT

- A. Ducts shall be constructed of minimum No. 16 Manufacturers' Standard Gauge (0.060 inch) or heavier steel, or No. 18 United States Standard Gauge (0.050 inch) or heavier stainless steel with liquid-tight continuous external weld of all seams and joints. Inside laps on duct joints shall project in a direction against the air flow. Slope duct per code.
- B. Access doors for inspection and cleaning purposes, equipped with tight-fitting doors and latches, shall be provided in horizontal sections of exhaust ducts. Such openings shall be at the sides of the horizontal run in order to prevent dripping of residue. Spacing of such openings shall not exceed 25 ft. on straight runs, and/or after each turn. Openings shall have a minimum dimension of twelve (12) inches.
- C. The duct shall be enclosed in a "3M Firemaster" duct wrap. Intent of duct wrap is to satisfy code required duct chase.
- D. System shall be constructed such that grease cannot be trapped and the duct shall be sloped toward the hood or grease reservoir.
- E. Entire installation shall conform to code. Meet with local inspector or code official prior to fabrication to confirm requirements.

- F. Provide dimensioned drawings for review prior to fabrication.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Ductwork shall be true to the dimensions indicated on the drawings and shall be straight and smooth on the inside with joints neatly finished. Support duct in accordance with SMACNA duct construction standards. Do not support ducts from the metal deck systems.
- B. At exposed ductwork apply a minimum of two coats of paint suitable for the service as intended. Colors shall be as selected or approved by the Architect.
- C. After the installation is complete and prior to insulation application, clean inside and outside of duct system.
- D. Do not run ductwork above the Electrical equipment rooms.

END OF SECTION 233113

SECTION 235216 - CONDENSING BOILERS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to this Section.

1.2 SUMMARY

- A. Boiler capacities shall be as specified on the Contract Drawings.

PART 2 - PRODUCTS

2.1 GENERAL BOILER DESIGN

- A. The boiler shall be a two-drum, flexible watertube design with a tangent-tube waterwall furnace mounted on a heavy steel frame. Top, bottom and sides of the furnace shall be water cooled.
- B. The boiler pressure vessel shall be constructed in accordance with ASME Boiler Code and must receive authorized boiler inspection prior to shipment. A copy of the inspection report shall be furnished to the Owner. The complete packaged boiler-burner unit shall be listed by Underwriters Laboratories and shall have the UL label affixed to the front head.
 - 1. The boiler drums shall be furnished with handholes to facilitate boiler inspection and cleaning.
 - 2. Boiler tubes shall be 1.5" diameter with 0.095" wall thickness and shall be easy to remove and replace without expanding or welding the tube attachment to the drums.
 - 3. The boiler shall have sufficiently sized downcomers to provide natural internal circulation.
 - 4. The burner shall be mounted on a hinged backing plate for easy access to the furnace.
- C. Provide observation ports for the inspection of flame conditions at the rear of the boiler and in the burner assembly at the front.
- D. Cover the tangent-wall tubes with 3 inches of insulation under a gas-tight, 11 gauge casing and a 22 gauge steel outer casing. The boiler base frame and other components shall be factory-painted before shipment using a hard enamel finish.

2.2 HOT WATER BOILER TRIM

- A. A probe type, low water cut off control shall be mounted to the boiler in the upper drum. It shall be wired to the burner control circuit to prevent burner operation if the boiler water falls below a safe level.
- B. A combustion temperature and pressure gauge shall be mounted to the boiler. Temperature controls for regulation of burner operation shall be mounted on the boiler and the temperature sensing element shall be located adjacent to the boiler outlet. Water relief valves (shipped loose) shall be of a type and size to comply with ASME Code requirements.

2.3 BURNER AND CONTROLS

- A. The burner shall be equipped with a UL approved fuel burning system in full accordance with the requirements of State and local codes and any other applicable regulatory bodies.
- B. The complete fuel burning system shall be in full accordance with Factory Mutual (FM) requirements.
- C. The burner shall be forced draft type with full firing rate modulation. All combustion air shall be furnished by the burner fan, which shall be an integral part of the burner. A permanent observation port shall be provided in the burner to allow observation of both the pilot and main flame. Both the pilot and the flame scanner shall be easily accessible without opening or disassembling the burner. A separate pilot gas cock, gas pressure regulator, and pilot safety shut off gas valve shall be provided for the ignition gas supply.

2.4 GAS CONTROL VALVES

- A. Provide one automatically operated motorized safety gas valve. One safety shutoff valve shall be proven closed during pre-ignition by proof of valve closure interlock switch on valve.
- B. Provide a second automatically operated gas safety shutoff valve to operate simultaneously with the above gas valve.
- C. Provide gas pressure monitoring by approved pressure switches interlocked to accomplish a non-recycling safety shutdown in the event of either high or low gas pressure.
- D. Provide gas pressure regulators for incoming gas pressure as indicated on the Contract Drawings. Provide gas control components as required by the prevailing gas code.

2.5 BURNER CONTROLS

- A. The full modulation of the burner shall be controlled by water temperature by means of a temperature control.
- B. Provide an additional high limit safety temperature control of the manual reset type provided to control the burner.
- C. Provide pre and post operation of the burner fan under current UL requirements.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation shall be in accordance with Manufacturer's recommendations.

END OF SECTION 235216

SECTION 237315 - WATER SOURCE HEAT PUMP UNITS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to this Section.

1.2 SUMMARY

- A. Provide heat pump units as shown and as scheduled on the Contract Documents. Install the unit(s) in accordance with this specification to perform at the conditions specified, scheduled or as shown on the Contract Documents.

PART 2 - PRODUCTS

2.1 HORIZONTAL WATER SOURCE HEAT PUMPS

- A. The cabinet shall be constructed of galvanized heavy-duty steel. Provide lift-out removable access panels for access to the compressor and blower assembly compartments. Insulate all panels with ½ inch thick, 1-1/2 lb. density, neoprene-coated, acoustical fiberglass insulation.
- B. The condensate pan shall be constructed of galvanized steel with welded corners. The condensate pan shall be painted with an oven-baked finish.

2.2 REFRIGERATION SYSTEM

- A. The compressor shall be hermetically sealed with internal vibration isolation. External vibration isolation shall be provided by rubber mounting devices located underneath the mounting base of the compressor. Internal thermal overload protection shall be provided. Protection shall be provided against excessive discharge pressure operation by means of a high pressure switch.
- B. The air-to-refrigerant heat exchanger shall be constructed of staggered copper tubes with die formed corrugated aluminum fins mechanically bonded to the tubes. The air-to-refrigerant heat exchanger shall have a working pressure of 400 PSIG.
- C. The water-to-refrigerant heat exchanger shall be of a coil-in-shell design. The coil shall be constructed of a helically formed, enhanced surface copper tube encased within a welded steel shell. The coil shall have a working pressure of 450 PSIG on both the refrigerant and water sides. The coil shall have a bidirectional liquid line filter drier to remove any contaminants from entering the circuit.
- D. The reversing valve shall be a pilot operated, sliding piston type with replaceable encapsulated magnetic coil. The reversing valve shall be energized in the cooling cycle.

2.3 AIR HANDLING SYSTEM

- A. Blower/motor assembly shall be a DWDI forward curved wheel. A PSC fractional horsepower motor shall be supplied for all single compressor equipment. The motor shall have permanently lubricated and sealed bearings.
- B. Filters shall be two-inch, 30-30 type filters and shall be factory installed.

2.4 ROOFTOP WATER SOURCE HEAT PUMPS

- A. The cabinet shall be fabricated from G-90 galvanized steel with minimum gauge thickness of 16-gauge for bases, 18-gauge for corner posts and tops, 20-gauge for access panels. The casing interior shall be thermally insulated with 3/4" thick 1-3/4 pound density glass fiber insulation. The interior of the entire base pan shall be coated with a minimum of 1/4" (6mm) of corrosion resistant hot tar material. Panels shall be provided access to the fan, compressor/control box, and return air compartments. Panels shall be secured with corrosion resistant stainless steel fasteners and hardware. The fan access panel(s) shall be gasketed. Unit shall have a filter rack for side filter removal. Filters shall be 2" thick throw-away type. Unit shall have a galvanized steel drain pan with 3/4" FPT drain fittings extended to the outside of the cabinet. The cabinet shall have separate holes and knockouts for entrance of line voltage and low voltage control wiring. Supply and return water piping for the rooftop units shall enter through individual sleeves in the compressor base pan section. Supply and return water connections shall be O.D. sweat type. The unit shall be mounted on steel rails to aid in installation.
- B. Each unit shall contain sealed refrigerant circuits including hermetic compressors, suction line accumulators, compressor crankcase heaters, bidirectional thermal expansion valves, water-to-refrigerant heat exchangers, air-to-refrigerant heat exchangers, reversing valves, sightglass, drier and safety controls. Units eight tons and larger shall have multiple independent refrigerant circuits. Service ports shall be provided on the high and low side of each refrigerant circuit. Compressors shall be hermetic type with external vibration isolator mounts and thermal overload protection. The finned tube coil shall be constructed of a copper inner tube and a steel outer tube and be U.L. listed. The heat exchanger shall be rated for 300 PSIG on the water side and 450 PSIG on the refrigerant side. Safety controls shall include both a low and a high refrigerant pressure switch to lock out compressor operation and an anti-short cycle timer on the lead compressor. Unit shall be capable of being reset by interrupting the power supply to the unit.
- C. A control box shall be located within the unit compressor section and shall contain controls for compressor(s), reversing valve(s), and fan motor operation and shall have a 24 volt transformer and a terminal block for low voltage field wiring and connections. Unit shall be name plated to accept time delay fuses for current overload protection of power source.
- D. Supply fans shall be DWDI centrifugal, forward curve type. Unit sizes eight tons and larger shall have two fans. Each fan shall be statically and dynamically balanced for quiet operation. The forward curved fan wheel and housing shall be fabricated from galvanized steel. The unit shall have a solid steel shaft mounted in heavy-duty ball bearings.
- E. Unit shall be factory furnished with a pre-fabricated, heavy gauge, galvanized steel, factory assembled mounting curb for installation to the roof door decking prior to unit shipment. The roof curb shall be a full perimeter type with complete unit support, with a closed cell neoprene liner of the bottom to create a seal between the unit the roof curb. The curb shall be a minimum of 14" high and include a nominal 2"x4" pressure treated nailer strip. The roof curb shall meet the guidelines of the National Roofing Contractors Association.
- F. Rooftop units indicated to receive outdoor air intakes shall have a two position, spring return motorized outside air damper for outside air intake when the fan is operating. Complete with rainhood and bird screen. A fully adjustable damper shall be furnished and installed within the intake hood to allow outside air to be set per CFM indicated within the schedule or as noted on the contract drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation shall be in accordance with manufacturer's recommendations.

END OF SECTION 237315

SECTION 237320 – DEDICATED OUTDOOR AIR UNIT

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to this Section.

1.2 SUMMARY

- A. Provide outside air unit as manufactured by Valent or pre-approved equal.
- B. Project is based on the specified equipment. Any additional costs associated with using alternate manufacturer's equipment shall be borne by the installing contractor or equipment provider.

1.3 WARRANTY

- A. Unit shall subject to manufacturer's standard warranty for the following periods:
 - 1. Overall unit, 12 months from substantial completion but no more than 18 months from shipment.
 - 2. Compressors, 60 months substantial completion but no more than 66 months from shipment.
 - 3. Energy recovery wheel, 60 months from substantial completion but no more than 66 months from shipment.

PART 2- PRODUCTS

2.1 CASING CONSTRUCTION

- A. Unit shall be constructed for outdoor installation on a roof curb.
- B. Base
 - 1. Base rails shall be constructed of a minimum of 10 gage galvanized steel with 16 gage integral floor pan.
 - 2. Base shall have a minimum 4" overhang over the top of a roof curb to prevent water infiltration.
 - 3. All floor seams shall have a raised rib joint.
 - 4. There shall be no penetrations through the floor of the unit within the perimeter of the curb except for duct openings and utility chases.
 - 5. Penetrations through the floor shall have a ½" raised rib around each opening.
- C. Base pan shall be insulated with ½" closed-cell neoprene liner.
- D. Panels
 - 1. Casing shall be constructed with minimum 2-inch, foam-injected, double-wall panels.
 - 2. Individual panels shall be constructed so that they are thermally broken (there shall be no metal-to-metal contact between the interior and exterior sheet metal of each panel).
 - 3. Interior side of panel shall be 22 gage G-90 galvanized steel.
 - 4. Exterior side of panel shall be 22 gage painted steel rated for 1000 hours in accordance with ASTM B117 and ASTM D1654.
 - 5. Insulation
 - a. Insulation shall be 2 lb/ft³ foam insulation with an average R-value of 6 per inch.
 - b. Insulation water absorption must be no more than 0.038 lb/ft per ASTM D 2842 and show "no growth" per ASTM G21 biocide testing.
 - c. No insulation shall be exposed to the air stream.

- d. Fiberglass insulation is not acceptable due to possibility of sloughing and moisture retention.
- E. Access doors
 - 1. Access doors shall be provided for access to all components requiring regular maintenance or inspection.
 - 2. Access doors shall have a minimum of two quarter-turn compression latches with adjustable catches.
 - 3. Access door construction shall be identical to unit casing.
 - 4. Interior side of access doors shall be 22 gage G-90 galvanized steel.
 - 5. Exterior side of panel shall be 22 gage painted steel rated for 1000 hours in accordance with ASTM B117 and ASTM D1654.
 - 6. Access doors shall be sealed with a full-perimeter gasket constructed of Mylar-encased low-density foam.
 - 7. Insulation
 - a. Insulation of shall be 2 lb/ft³ foam insulation with an average R-value of 6 per inch.
 - b. Insulation water absorption must be no more that 0.038 lb/ft per ASTM D 2842 and show "no growth" per ASTM G21 biocide testing.
 - c. No insulation shall be exposed to the air stream.
 - d. Fiberglass insulation is not acceptable due to possibility of sloughing and moisture retention.
- F. Weatherhood with bird screen shall be provided on outside air inlet.
- G. Roof shall be pitched with a minimum ½" roof overhang around the perimeter of the unit.

2.2 BLOWERS/MOTORS

- A. Blowers
 - 1. Fan assemblies shall be direct-drive without the use of belts or adjustable sheaves.
 - 2. Manufacturer shall provide a variable frequency drive for each fan section.
 - 3. Variable frequency drive shall be mounted, wired, and programmed by the manufacturer.
 - 4. Variable frequency drive shall be located in an enclosed compartment outside of the supply or exhaust air stream.
 - 5. Fan wheels shall have backward inclined blades constructed out of corrosion-resistant, fiber-reinforced polyamide.
 - 6. Fan wheels shall have backward inclined blades constructed of welded aluminum.
 - 7. Fan wheel shall be tested in accordance to AMCA 210.
- B. Motors
 - 1. Fan motor shall be VFD rated, ODP type, EPACT compliant.
 - 2. Fan motor shall be of premium efficiency (PE).

2.3 DAMPERS

- A. Motorized dampers
 - 1. Frame shall be constructed of a 16 gage galvanized steel hat-channel.
 - 2. Blades shall be constructed of 16 gage galvanized steel strengthened by three longitudinal 1 inch deep "vee" grooves.
 - 3. Blades shall be symmetrical relative to its axle pivot point.
 - 4. Axle bearings shall be synthetic sleeve-type and rotate inside extruded holes in the damper frame.
 - 5. Blade seals shall be extruded vinyl permanently bonded to the appropriate blade edges.
 - 6. Frame shall include flexible stainless steel compression-type jamb seals.

7. Modulating spring-return actuators shall be provided by the factory, installed on the damper, and wired to the control center.
8. Damper leakage shall be no more than 5 cfm/sq.ft. at 1 in.wg static pressure.

2.4 FILTERS

- A. Outdoor air intake hood
 1. Filter rack shall accommodate 1" media.
 2. Manufacturer shall provide 1 set of 1" aluminum filter media.
 3. Filter sections shall be accessible outside the unit and located in the outdoor air intake hood.
- B. Outdoor air filters
 1. Outdoor air filter rack shall accommodate factory-provided 2" MERV 8, 2" aluminum filters.
 2. Filter sections shall be accessible through a 2" foam-injected, double-wall, hinged access door with quarter-turn latches.
- C. Supply air filters
 1. Supply air filter rack shall accommodate 2" MERV 8 filters.
 2. Filter sections shall be accessible through a 2" thick, foam-injected, double-wall, hinged access door with quarter-turn latches.
- D. Return air filters
 1. Return air filter rack shall accommodate factory-provided 2" MERV 8, 2" aluminum filters.
 2. Filter sections shall be accessible through a 2" thick, foam-injected, double-wall, hinged access door with quarter-turn latches.

2.5 ENERGY RECOVERY – ENTHALPY WHEEL

- A. Energy recovery shall be an integral part of unit from the manufacturer.
- B. No field assembly, ducting, or electrical wiring shall be required with energy recovery.
- C. Energy recovery shall be provided through a total enthalpy wheel providing sensible and latent energy transfer.
- D. Construction
 1. Energy recovery wheel shall be constructed of lightweight polymer substrate with permanently-bonded silica gel desiccant.
 2. Individual pie-shaped wheel sections shall be removable from wheel cassette for maintenance.
 3. Wheel bearings shall be selected to provide an L-10 life in excess of 400,000 hours.
 4. Rim shall be continuous rolled stainless steel and the wheel shall be connected to the shaft by means of taper locks.
 5. Energy wheel cassette shall include seals, drive motor and drive belt.
- E. Latent energy shall be transferred entirely in the vapor phase.
- F. The energy recovery cassette shall be an Underwriters Laboratories Recognized Component for electrical and fire safety.
- G. The wheel drive motor shall be an Underwriters Laboratory Recognized Component and shall be mounted in the cassette frame and factory wired to main ventilator disconnect.

- H. Thermal performance shall be certified by the wheel manufacturer in accordance with ASHRAE Standard 84, Method of Testing Air-to-Air Heat Exchangers and ARI Standard 1060, Rating Air-to-Air Energy Recovery Ventilation Equipment.
- I. Energy recovery wheel cassette shall be mounted perpendicular to the base of the unit.
- J. Energy recovery wheel cassette shall be accessible through a 2" thick, foam-injected, double-wall, hinged access door with quarter-turn latches.

2.6 COOLING - WATER-SOURCE HEAT-PUMP

- A. Unit shall include factory piped, charged, and tested packaged water source heat pump direct expansion refrigeration system.
 - 1. All refrigeration systems 13 nominal tons and above shall be equipped with two stages of capacity control, each on an independent refrigerant circuit.
- B. Refrigeration system shall be provided with thermal expansion valve (TXV) incorporating adjustable superheat.
- C. Evaporator coil
 - 1. Coil shall be rated in accordance to ARI standards and pressure tested for 250 psi working pressure.
 - 2. Coil shall be a minimum of 4 rows deep.
 - 3. Refrigeration systems with more than one circuit shall have interlaced evaporator coils.
 - 4. Coil casing shall be constructed of 16 gage galvanized steel.
 - 5. Coil tubes shall be constructed of 1/2" diameter, 0.016" thick seamless copper tubing.
 - 6. Coil fins shall be constructed of 0.0060" thick aluminum.
- D. Drain pan
 - 1. Drain pan shall be constructed of a minimum of 18 gage 201 stainless steel.
 - 2. Drain pan shall be double-sloped to ensure condensate removal from unit.
 - 3. Drain pan shall extend a minimum of 8" past the evaporator coil to ensure condensate retention.
- E. Modulating hot-gas reheat
 - 1. Hot-gas reheat coil shall be separated from the evaporator coil by a minimum of 6" in the direction of airflow to prevent the re-evaporation of condensate, provide room for coil cleaning, and allow control system to monitor evaporator coil leaving air temperature.
 - 2. Hot-gas reheat coil shall be constructed entirely of aluminum.
 - 3. Hot-gas reheat shall be controlled through a factory-supplied modulating control valve.
- F. Compressors
 - 1. Compressors shall be hermetic scroll type and include the following items:
 - a. Suction and discharge service valves.
 - b. Reverse rotation protection.
 - c. Oil level adjustment.
 - d. Oil filter.
 - e. Rotary dirt trap.
 - f. Short cycling control.
 - g. High and low pressure limits.
 - h. Crankcase heaters.

2. Compressors shall be installed in an isolated compartment separate from supply airflow, return airflow, microprocessor controller, non-fused disconnect, compressor relays, fan motor VFD, and all other electrical components inside the unit.
 3. Compressors shall be installed using manufacturer's recommended rubber vibration isolators.
 4. Lead refrigeration circuit shall utilize Digital Scroll™ compressor capable of 10:1 turndown.
- G. Water-to-refrigerant heat exchanger: each independent refrigerant circuit shall be provided with a coaxial water-to-refrigerant heat exchanger.

2.7 ELECTRICAL

- A. Units shall be factory wired with a single point power connection.
- B. Units shall be wired according to NEC and listed per ETL.
- C. ETL listing shall cover all components of the ventilator and not be limited to the control panel.
- D. All major electrical components shall be UL listed.
- E. Unit shall be constructed with an integral control center isolated from supply airflow, exhaust airflow, compressors, and heating elements.
- F. The following items shall be provided and wired within the control center by the factory:
1. Non-fused disconnect.
 2. Sub-circuit fusing.
 3. Low voltage transformers.
 4. Control circuit fusing.
 5. Terminal block.
 6. Fan motor variable frequency drives.
- G. Electrical panel must house all high voltage components such as terminal blocks, variable frequency drives, and fuse blocks.

2.8 CONTROLS

- A. Units shall include factory supplied, mounted, wired, and tested stand-alone microprocessor controls.
- B. Microprocessor controller shall be factory-programmed for discharge air control and use an internal 7-day time clock.
- C. Microprocessor controller shall be mounted in a weather-proof enclosure and accessible without exposing the operator to high voltage wiring or having to turn off or circumvent the main disconnect.
- D. Microprocessor controller shall include local liquid crystal display (LCD) for user interface.
- E. The following sensors shall be factory supplied, mounted, and wired inside the unit:
1. Outdoor air humidity sensor.
 2. Outdoor air temperature sensor.
 3. Evaporator coil leaving air temperature sensor.
 4. Supply air filter pressure monitoring.

5. Energy wheel rotation sensor.
- F. The following devices shall be factory supplied but ship loose and require field installation and wiring:
1. Wall-mounted room air temperature sensor with manual adjuster.
 2. Wall-mounted room air humidity sensor.
 3. Supply air temp temperature sensor.
 4. Wall-mounted CO2 sensor.
 5. Space static pressure sensor.
 6. Duct static pressure sensor.
 7. Smoke detectors.
- G. Microprocessor controller shall include BACnet IP communications for building management system interface.
- H. Microprocessor controller shall include a Web UI interface for remote web-based access.

2.9 FACTORY VERIFICATION TESTING

- A. Unit shall be run tested prior to shipment from the factory.
- B. Factory run test report shall be provided at the request of the engineer, contractor, or owner.
- C. Testing Procedures
1. Unit shall be subjected to and pass a dielectric (hipot) test.
 2. All motorized dampers shall be cycled one full stroke while installed in the unit using the factory-provided motorized actuators.
 3. Supply fan
 - a. Visually inspect ramp-up, ramp-down, and rotation direction of fan when enabled.
 - b. Verify fan pressure proving switch operation.
 - c. Measure and record current draw through supply fan motor(s).
 4. Exhaust fan
 - a. Visually inspect ramp-up, ramp-down, and rotation direction of fan when enabled.
 - b. Verify fan pressure proving switch operation.
 - c. Measure and record current draw through exhaust fan motor(s).
 5. Energy recovery wheel.
 - a. Visually inspect energy recovery wheel cassette is free to rotate within cassette.
 - b. Visually inspect energy recovery belt drive mechanism.
 - c. Enable energy recovery wheel motor and ensure proper rotation.
 - d. Measure and record current draw through energy recovery wheel motor.
 6. Indirect gas furnace
 - a. Indirect gas furnace shall be run tested while installed inside unit with 8.5 in.wg of natural gas.
 - b. Measure and record leaving air temperature and manifold pressure at minimum fire.
 - c. Measure and record leaving air temperature and manifold pressure and maximum fire.
 7. Condensing fans
 - a. Ensure fans rotate freely without obstruction.
 - b. Energize fans and ensure proper rotation.
 - c. Measure and record the amount of current draw through each condensing fan.
 8. Refrigeration system
 - a. Measure and record subcooling and superheat on circuit A with hot-gas reheat valve closed (0%) after 15 minutes of steady-state operation.

- b. Measure and record subcooling and superheat on circuit A with hot-gas reheat valve open (100%) after 15 minutes of steady-state operation.
- c. Measure and record subcooling and superheat on circuit B after 15 minutes of steady-state operation.

D. Test report shall be included with unit and available from the factory upon request.

PART 3 - EXECUTION

3.1 SEQUENCE OF OPERATION OCCUPANCY

A. Occupied

1. Unit shall enter occupied mode if one of the following conditions is met:
 - a. Internal time clock in microprocessor controller determines occupied mode.
 - b. Dry contact for occupied mode is closed.
2. The controller shall perform the following operations in occupied mode:
 - a. Supply fan shall enable.
 - b. 30 seconds (adj.) after confirmation of supply fan pressure switch, outside air damper shall be energized to the minimum position (adj., default set at 100%).
 - c. 30 seconds (adj.) after confirmation of supply fan pressure switch, return air damper shall be energized and controlled inversely to the outside air damper.
 - d. 30 seconds (adj.) after confirmation of the supply fan pressure switch, exhaust fan shall enable.

B. Unoccupied

1. Unit shall enter unoccupied mode if one of the following conditions is met:
 - a. Internal time clock in microprocessor controller determines unoccupied mode.
 - b. Dry contact for occupied mode is opened.
2. The controller shall perform the following operations in unoccupied mode:
 - a. Cooling, dehumidification, heating, or economizer shall be disabled.
 - b. After 30 seconds (adj.) the supply fan shall be disabled.
 - c. Outside air damper shall be de-energized and fail closed.
 - d. Return air damper shall be de-energized and fail open.

3.2 DISCHARGE AIR CONTROL SEQUENCE:

- A. Discharge Air Control with Space Temperature and Humidity Reset: The discharge air temperature set point shall be automatically determined based on the difference between the measured space temperature and active space temperature set point (discharge air temperature reset).
- B. Discharge Air Control: The discharge air set point is determined based on the discharge air heating and cooling set points (adj.) stored in the controller.
- C. Energy Recovery (Constant Speed Heat Wheel)
 1. Upon entering the occupied mode of operation, the controller shall enable the energy recovery sequence if one of the following conditions is met:
 - a. The outdoor air temperature is 5°F (adj.) below the space temperature set point.
 - b. The outdoor air temperature is 5°F (adj.) above the space temperature set point.
 - c. The outdoor air relative humidity is above 65% RH (adj.).
 - d. Unit is in heating mode.
 2. Upon enabling the energy recovery sequence, the controller shall perform the following functions:
 - a. Energy recovery wheel motor energized.
 3. If the exhaust air temperature drops below 35°F (adj.), the controller shall perform the following operations:

- a. Energy wheel de-energized for 90 seconds.
- b. Energy wheel energized for 3 minutes.

3.3 COOLING & DEHUMIDIFICATION: WATER-SOURCE HEAT PUMP WITH DIGITAL SCROLL™ COMPRESSORS

A. Cooling

1. Cooling sequence shall be enabled when all of the following conditions are met:
 - a. Unit is in occupied mode.
 - b. Outside air temperature is greater than 50°F (adj.).
 - c. Outside air dew point is less than 50°F by 2 to 5°F (adj.).
2. Upon entering cooling mode the controller shall perform the following functions:
 - a. Hot gas reheat valve shall remain disabled in the closed position.
 - b. Digital Scroll compressor shall modulate to meet the discharge air temperature set point.
 - c. If the unit is unable to meet the discharge air set point, additional fixed stages of cooling shall enable in addition to the Digital Scroll compressor to meet the discharge air set point.
 - d. If the discharge air set has been met and the Digital Scroll compressor is at its minimum modulation, a fixed compressor stage shall be disabled.
 - e. Water valve on coaxial heat exchanger shall modulate water flow to maintain refrigerant head pressure set point.
3. Cooling mode shall be disabled when Outside air temperature falls below 50°F by 2 to 5°F maximum (adj.).

B. Dehumidification

1. Dehumidification mode shall be enabled if one of the following two conditions are met:
 - a. Outside air dew point is greater than 50°F (adj.).
 - b. Space relative humidity is greater than 55% RH (adj.).
2. The controller shall provide the following operations in dehumidification mode:
 - a. Digital Scroll compressor shall modulate to meet the evaporator coil set point.
 - b. If the unit is unable to meet the evaporator coil set point, additional fixed stages of cooling shall enable in addition to the Digital Scroll compressor to meet the discharge air set point.
 - c. If the evaporator coil set point has been met and the Digital Scroll compressor is at its minimum modulation, a fixed compressor stage shall be disabled.
 - d. Hot gas reheat valve shall modulate capacity to maintain discharge air set point.
 - e. Water valve on coaxial heat exchanger shall modulate water flow to maintain refrigerant head pressure set point.
3. If hot gas reheat is in the open position for 5 minutes, one of two modes shall enable:
 - a. Dehumidification priority (default): The hot-gas reheat gets locked to 100%, and the Digital Scroll will modulate to maintain the coil leaving air temperature. Getting the most dehumidification possible, but allowing the discharge air temperature to get cooler than the discharge air temperature set point.
 - b. Temperature priority: The hot-gas reheat gets locked to 100%, and the Digital Scroll will modulate to maintain the discharge air temperature set point. Getting as much dehumidification as possible, while maintaining the discharge air temperature.
4. Once every 45 minutes (adj.) the hot gas reheat valve shall be controlled full open for 45 seconds (adj.) to allow oil return to the compressors.
5. Dehumidification mode shall be disabled if both of the following conditions are true:
 - a. Outside air dew point falls below 55°F by 2 to 5°F maximum (adj.)
 - b. Space relative humidity falls below 55% RH by 2 to 5% maximum (adj.).

3.4 HEATING SEQUENCE

- A. Water Source Heat Pump
 - 1. Heating shall be enabled when unit is not in cooling, dehumidification, or economizer mode.
 - 2. The controller shall perform the following operations in heating mode:
 - a. Digital Scroll compressor shall modulate to meet the discharge air temperature set point.
 - b. If the unit is unable to meet the discharge air set point, additional fixed stages of heating shall enable in addition to the Digital Scroll compressor to meet the discharge air set point.
 - c. If the discharge air set has been met and the Digital Scroll compressor is at its minimum modulation, a fixed compressor stage shall be disabled.
 - d. Water valve on coaxial heat exchanger shall modulate water flow to maintain refrigerant head pressure set point.
 - 3. Heating mode shall disable if any of the conditions below are met:
 - a. Cooling mode enabled.
 - b. Dehumidification mode enabled.
 - c. Occupied mode disabled.
- B. Economizer mode enabled.

3.5 ECONOMIZER

- A. Economizer mode shall be enabled if both of the following two conditions are met:
 - 1. Outside air enthalpy is less than space / return air enthalpy.
 - 2. Space / discharge air requires cooling.
 - 3. Economizer enable is set to true on LCD or UMT.
- B. Upon entering economizer mode the controller shall provide the following operations:
 - 1. Outside air damper and return air damper shall modulate inversely in order to maintain the cooling discharge air temperature set point.

3.6 AIRFLOW MONITORING

- A. Provide an airflow monitoring device to constantly record outdoor airflow. Airflow quantity shall be reported to the BAS system through the BACnet interface. Coordinate with the BAS contractor to configure an alarm point when airflow decreases 10% below design outdoor airflow quantity.

END OF SECTION 237320

SECTION 238000 - CLOSED-CIRCUIT, MECHANICAL-DRAFT EVAPORATIVE COOLER

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions.

1.2 SUMMARY

- A. This Section includes factory-assembled and -tested, closed-circuit, forced draft, counterflow evaporative coolers.

1.3 SUBMITTALS

- A. Product Data: Include rated capacities, water inlet pressure drop, performance rating curves with selected points indicated, furnished specialties, and accessories.
- B. Shop Drawings.
 - 1. Detail equipment assemblies and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field piping and wiring connection.
 - 2. Wiring Diagrams: Power, signal, and control wiring.
- C. Coordination Drawings: Plans, elevations, and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
 - 1. Structural supports.
 - 2. Piping and wiring roughing-in requirements (determine spaces reserved for electrical equipment).
 - 3. Access requirements for service and maintenance.
- D. Operation and Maintenance Data: For closed circuit coolers to include in emergency, operation, and maintenance manuals.
- E. Warranties: Special warranties specified in this Section.

1.4 COORDINATION

- A. Coordinate installation of equipment supports with manufacturer's recommendations.

1.5 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace the following components of closed circuit coolers that fail in materials or workmanship within specified warranty period:

1. Complete unit, parts only warranty.
2. Warranty Period: 1 year from date of substantial completion.

PART 2 - PRODUCTS

2.1 FORCED-DRAFT, COUNTERFLOW CLOSED CIRCUIT COOLERS

- A. Description: Factory-assembled and -tested, forced-draft, counterflow closed circuit coolers complete with distribution system, fans, motors, coil, louvers and accessories as specified below.
- B. Characteristics and Capacities: as listed in the schedule
- C. Fan(s): Fans shall be forwardly curved centrifugal type of hot dip galvanized steel construction. The fans shall be factory installed into hot-dip galvanized steel housings in the basin/fan section, statically and dynamically balanced for vibration free operation. Fans shall be mounted on either a solid steel shaft or a hollow steel shaft with forged bearing journals. The fan shaft shall be supported by heavy-duty, self-aligning bearings with cast iron housings and lubrication fittings for maintenance. Lubrication lines shall be extended to the exterior of the unit for ease of maintenance.
 1. Type and Material: Centrifugal, G-235galvanized steel
 2. Drive: V-belt.
- D. Water Distribution System: The spray header and branches shall be constructed of Schedule 40 polyvinyl chloride (PVC) pipe for corrosion resistance. The spray header and branches shall be removable for cleaning purposes and have threaded end caps to allow debris to be removed. The water shall be distributed over the coil by precision molded ABS spray nozzles with large orifice openings and integral sludge ring to eliminate clogging. The nozzles shall be threaded into the water distribution piping to assure positive positioning. If an open gravity type distribution system is utilized, distribution pans and covers shall be constructed of type 316 stainless steel. If two gravity pans are required, 316 stainless piping to convert to a single inlet per cell shall be provided.
 1. Evenly distribute water over coil, with pressurized nozzles.
 2. Pipes: Schedule 40, PVC
 3. Nozzle Materials: ABS plastic
- E. Water Circulation Pump: A close-coupled, bronze fitted centrifugal pump equipped with a mechanical seal shall be unit mounted and piped to the suction strainer and water distribution system. It shall be installed so that it can be drained freely when the pan is drained. The pump motors shall be totally enclosed, fan cooled (TEEFC) type.
- F. Casing: The casing shall be constructed of G-235 hot dipped galvanized steel. The casing panels shall totally encase the sides of the coil section to protect the surface from direct atmospheric contact.
 1. Fasteners: Corrosion resistance equal to or better than materials being fastened.
 2. Joints: Sealed watertight.
 3. Welded Connections: Continuous and watertight.

- G. Collection Basin Material: The wetted parts of the pan shall be constructed of type 304 stainless steel for long life and durability (water touch basin option). The remainder of the pan shall be G-235 galvanized steel.
 - 1. Removable stainless-steel strainer with openings smaller than nozzle orifices.
 - 2. Overflow connection.
 - 3. Makeup water connection.
 - 4. Side drain connection.
- H. Heat Transfer Coil: The heat transfer coil must be completely encased by the unit to protect from UV exposure and inhibit biological growth on the coil. Heat transfer coil shall be constructed of prime surface steel tubes, encased in steel framework with the entire assembly hot-dip galvanized after fabrication. The tubes shall be sloped for liquid drainage and rated at 400 psig. Heat transfer coil shall be encased such that it is not exposed to direct sunlight. Coil pressure drop shall not exceed that of the units being replaced.
- I. Drift Eliminator Material: The eliminators shall be constructed entirely of inert polyvinyl chloride (PVC) in easily handled sections. The eliminator design shall incorporate three changes in air direction to assure removal of all entrained moisture from the discharge air stream. Maximum drift rate shall be less than 0.001% of the circulating water rate.
- J. Water-Level Control: provide electric water level control package consisting of a vertical stand pipe assembly with three stainless steel probes and a factory installed make-up water solenoid valve.
- K. Basin Heater: provide electric pan heater package consisting of heaters, contactors/controllers thermostat and low water cutoff.

2.2 MOTORS and DRIVES

- A. General requirements for motors.
 - 1. Motor Sizes: Maximum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - 2. Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 26 Sections.
- B. Enclosure Type: Totally enclosed air over or fan cooled.
- C. Motor Speed: Inverter type for variable-speed controller, two speed or single speed as indicated on the plans.
- D. Belt drive system with motor mounted on an adjustable base.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for concrete bases, anchor-bolt sizes and locations, piping, and electrical to verify actual locations and sizes before cooling tower installation and other conditions affecting unit performance, maintenance, and operation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install units on steel I-Beams or concrete base as shown. Maintain manufacturer's recommended clearances for service and maintenance.
- B. Loose Components: Install electrical components, devices, and accessories that are not factory mounted.
- C. Install water treatment devices per manufacturer's recommendations.

3.3 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to units to allow service and maintenance.
- C. Connect overflow drain and bleed lines to sanitary sewage system.
- D. Domestic Water Piping: Connect to water-level control with shutoff valve and union or flange at each connection.
- E. Condenser-Water Piping: Connect to supply and return cooling-tower connections with shutoff valve, flow-control valve, and union or flange on supply connection to the tower and shutoff valve and union or flange to return connection from the tower to the chiller.
- F. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 STARTUP:

- A. Inspect field-assembled components, equipment installation, and piping and electrical connections for proper assemblies, installations, and connections.
- B. Complete installation and startup checks according to manufacturer's written instructions and perform the following:
 - 1. Clean entire unit including basins.
 - 2. Verify that accessories are properly installed.
 - 3. Check makeup water level control.
 - 4. Verify clearances for airflow and for servicing.
 - 5. Check for vibration isolation and structural support.
 - 6. Lubricate bearings on fans and shafts.
 - 7. Verify fan rotation for correct direction and for vibration or binding. Correct vibration and binding problems.
 - 8. Adjust belts to proper alignment and tension.

9. Verify water level in tower basin. Fill to proper startup level.
10. Verify operation of basin heater and control. Replace defective and malfunctioning units.
11. Check conductivity and PH and setup treatment devices to maintain proper water quality.

C. Follow manufacturer's written startup procedures.

3.5 ADJUSTING

- A. Set and balance as required.
- B. Adjust water-level control for proper operating level.

END OF SECTION 238000

SECTION 260010 – ELECTRICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to this Section.

1.2 SUMMARY

- A. The work required for this Division includes demolition, labor, materials, equipment, appurtenances, coordination and services to provide a complete and fully operational electrical system as shown on the drawings and specified in the specifications, including special systems indicated.
- B. The Contractor shall install the systems as specified herein and indicated on the drawings and shall furnish the labor, material, tools, scaffolds, erection equipment, services and other items of expense as necessary as a part of this Contract. This Contract further includes placing the systems into operation and properly testing, adjusting, and balancing the items of equipment as specified and as approved by the Architect/Engineer.

1.3 APPLICABLE SPECIFICATIONS, CODES AND STANDARDS

- A. The latest effective publications of the following standards, codes, etc., as applicable form a part of these specifications the same as if written fully herein and shall be followed as minimum requirements. The Contractor shall be responsible for furnishing and installing higher grade materials and workmanship in excess of the minimum requirements where indicated on the drawings and in the specifications.
 - 1. National Electrical Code (NEC)
 - 2. Underwriters Laboratories (UL)
 - 3. Institute of Electrical and Electronic Engineers (IEEE)
 - 4. National Fire Protection Association (NFPA)
 - 5. National Electrical Manufacturer's Associations (NEMA)
 - 6. American National Standards Institute (ANSI)
 - 7. American Society for Testing and Materials (ASTM)
 - 8. Occupational Safety and Health Act (OSHA)
 - 9. Certified Ballast Manufacturers Association (CBMA)
 - 10. Insulated Cable Engineers Association (ICEA)
 - 11. Americans with Disabilities Act (ADA)
 - 12. International Building Code (IBC)
 - 13. Service Rules and Regulations of the local Utility Companies
 - 14. State and Local Building Codes
 - 15. Local Authority Having Jurisdiction (LAHJ)
 - 16. National Electrical Safety Code (NESC)
 - 17. Virginia Uniform Statewide Building Code (VUSBC)
- B. The Contractor shall give the required notices, obtain the necessary permits, and pay the permit and inspection fees.
- C. The Contractor shall provide the necessary information to assist the Owner in obtaining permanent Electrical service from the Power Company. For additional information, see Division 26 Section "Electrical Service."
- D. The Contractor shall coordinate with the local Power, Cable Television, and Telephone

companies and install the services as required.

- E. The equipment, material, apparatus, and work shall conform to the requirements of the NEC. If the Contractor observes that the drawings and specifications are at variance therewith, he shall notify the Architect/Engineer in writing. If the Contractor performs such work contrary to the above referenced rules and regulations and without written acknowledgment or notice thereto, he shall correct this work and bear the cost arising therefrom.

1.4 SUPERVISOR

- A. As required by the laws of the Commonwealth of Virginia, the Electrical Contractor shall have a Supervisor on the job at all times that any electrical work is being installed. This shall include the work being accomplished by the contractors who are subcontractors to the prime Electrical Contractor.
- B. The Supervisor shall be licensed by the Commonwealth of Virginia as a "Master" in the electrical construction trade.

1.5 DEFINITIONS

- A. Where the word "Contractor" appears in this Division of the specifications, it shall apply to the Contractor performing the Electrical portion of the work, unless explicitly noted otherwise.
- B. "Install" shall mean to place, fix in position, secure, anchor, etc., including necessary appurtenances and labor so the equipment or installation will function as specified and intended.
- C. "Furnish" shall mean to purchase and supply equipment or components.
- D. "Provide" shall mean "Furnish and Install".
- E. "Or approved equal" shall mean equal in type, design, quality, etc., as determined by the Engineer.

1.6 CONTRACT DOCUMENTS

- A. The Architectural, Structural, Mechanical, Electrical and Equipment drawings and specifications are hereby incorporated into and become a part of this Division. The Contractor shall examine all such drawings and specifications and become thoroughly familiar with provisions contained herein and the submission of this bid shall be constructed as indicating such knowledge.
- B. The drawings and specifications are intended to cover the work enumerated under respective headings. The drawings are diagrammatical only. The exact locations of apparatus, fixtures, equipment and conduits shall be ascertained from the Architect. Minor variations in location of equipment shall be made upon written approval of the Architect at no additional cost to the Owner.
- C. This Contractor shall examine the architectural, structural, plumbing, mechanical and electrical drawings and specifications to avoid conflict with other trades. Minor variations in location of equipment shall be made upon written approval of the Architect at no additional cost to the Owner. No Contractor shall take advantage of conflict or error between the drawings and specifications or between general drawings and Plumbing, Mechanical and/or Electrical drawings but shall request a clarification of such from the

Architect/Engineer should this condition exist. If there is insufficient time to issue an addendum for this clarification, the Contractor shall be required to assume the most expensive item in conflict.

- D. Cooperate and coordinate the work of this Division with other trades.
- E. The Electrical drawings and specifications are intended to supplement each other and any material called for by one shall be as binding as if specifically mentioned in both. Labor and/or materials neither shown nor specified but necessary for the complete installation and proper functioning of the systems shall be provided by the Contractor.
- F. Equipment provided under this Division of the specifications shall be installed in accordance with the recommendations of the equipment or material manufacturer.

1.7 VISIT TO THE SITE

- A. The Contractor shall visit the site of the work and familiarize himself with the conditions affecting his work, and submission of his proposal shall be construed as indicating such knowledge. No additional payment will be made on claims that arise from lack of such knowledge of existing conditions.

1.8 TEMPORARY LIGHTING AND POWER

- A. Provide in accordance with NEC, NFPA and Division 26 Section "Electrical Service" of this specification.
- B. Provide temporary service and wiring as required to support construction of the project. Permanent wiring provided by this project shall not at anytime be used as temporary wiring, unless otherwise noted.

1.9 COORDINATION

- A. Before installing any of this work, verify that it does not interfere with clearances for the erection of finish beams, columns, pilasters, walls and other structural or architectural members as shown on the Architectural drawings. If any work is so installed and it later develops that the Architectural design cannot be followed, the Contractor shall, at his own expense, make such changes in his work as the Architect may direct to permit the completion of the Architectural work in accordance with the drawings and specifications.
- B. It shall be the duty of the Contractor to report any interferences between his work and that of any other Division to the Architect as soon as they are discovered. The Architect will determine which equipment shall be relocated regardless of which was first installed, and his decision shall be final.
- C. Installation of various conduit runs and equipment shall conform to conditions in the building and any changes shall be submitted in sketch form to the Architect for approval.
- D. The Electrical Contractor shall obtain the electrical requirements for intended motors and/or equipment from the Mechanical/Plumbing Contractor(s), the Food Service Contractor, the Civil Contractor, and the General Contractor during the Submittal/Shop Drawing phase. Any electrical modifications required to support the intended motors/and/or equipment shall be the responsibility of the Contractor providing the motor and/or equipment.

1.10 EQUIPMENT CONNECTIONS

- A. Disconnect switches, starters, controllers, variable frequency drives and line voltage connections to fan switches and thermostats shall be provided under this Division, unless otherwise indicated. The control wiring regardless of voltage shall be provided under the Division providing the motor and/or equipment. Coordinate connection requirements with given trade prior to electrical equipment order and release. The Contractor shall be responsible for reviewing the drawings and coordinating with other trades and Divisions to determine the exact quantity, sizes and locations of the equipment. Provide adequately sized power wiring and conduit and make final connections to this equipment, whether indicated or not on the Electrical drawings, to allow proper functioning of the systems. Provide junction boxes with line voltage power source for control voltage wiring by other Divisions, as required.
- B. Power wiring and power connections to the equipment shall be provided under Division 26 unless otherwise indicated on the Electrical drawings.
- C. When substituted motors and/or equipment require electrical modifications to support said motors and/or equipment, the cost of the electrical modifications, associated work and coordination shall be included under the Division providing the motor and/or equipment.
- D. Connect kitchen equipment complete. Rough in for kitchen equipment. Final connection shall be by equipment supplier or Owner. Coordinate with equipment supplier or Owner prior to rough-in.

1.11 CUTTING AND PATCHING

- A. The work shall be carefully laid out in advance, and where cutting, channeling, chasing, or drilling of floors, walls, partitions, ceiling, or other surfaces is necessary for the proper installation, support, or anchorage of the conduit, raceways, or other electrical work, this work shall be carefully done, and any damage to building, piping, or equipment shall be repaired by skilled mechanics of the trades involved, at no additional cost to the Owner. Cutting of masonry block shall be done with masonry saw.

1.12 EQUIPMENT MARKING AND PAINTING

- A. Disconnect switches, cabinets, etc. shall be provided with permanently attached (adhesives not acceptable), laminated black phenolic label with 3/8" engraved white letters to indicate equipment or circuit controlled. Safety Switches associated with HVAC, Plumbing or Kitchen Equipment shall indicate the circuit controlled.
- B. The electrical apparatus such as switchgear, disconnect switches, panelboard enclosures, transformer housings, motor controllers, terminal cabinets, and light fixture housings, shall be post-fabrication factory painted.
- C. Interior exposed, metal, conduit, etc., in finished spaces shall be painted with two coats of paint to match adjacent surfaces as directed by the Architect. Additional marking and painting shall be as indicated in the specific equipment specification sections. Interior exposed, metal, conduit, in unfinished spaces shall be painted as directed by the Architect.

1.13 DEFACEMENT OF EQUIPMENT

- A. Equipment shall not be defaced with any form of personal advertisement, stickers, or nameplates.
- B. Manufacturers rating plates and other acceptable identification as required by code for equipment is permitted, and this material shall be applied in usual and acceptable

manner.

- C. Protect the equipment provided against damage during construction to the satisfaction of the Architect/Engineer. If damage occurs to materials, refinish, repair, or replace the equipment or material as directed by the Architect/Engineer.

1.14 ACCESS DOORS

- A. This Contractor shall furnish and the General Contractor shall install steel access doors where necessary and where required by the LAHJ, especially for electrical access, style necessary for surface in which placed, sized as indicated or required, with cylinder lock.

1.15 SHOP DRAWINGS

- A. Submit complete shop drawings covering the equipment listed in Division 26 Section "Electrical Materials and Methods" for review. The Contractor shall check the shop drawings, and arrange the shop drawings for submittal as described.

1.16 PROJECT INSPECTIONS

- A. The Contractor shall notify the Engineer to perform project inspections to verify that the installed materials and workmanship conform to codes and the specifications. The inspections shall include, but not be limited to:
 - 1. Electrical rough-in.
 - 2. Above ceiling inspection prior to installation of final ceiling.
- B. If any electrical material, device or workmanship does not meet the intent of these specifications, the Contractor shall remove the material and devices complete, and then reinstall the material or devices per these specifications, at no additional cost to the Owner. If any of the electrical material is damaged during this removal, the Contractor shall be required to provide new electrical devices or material.
- C. If the final ceiling has been installed prior to the inspection, the Contractor shall provide access to above the ceiling as required. This work shall be performed by the Contractor at no additional cost to the Owner.

1.17 FINAL INSPECTION AND TESTS

- A. Upon completion of the entire work, the Contractor shall perform such tests as required by the Architect. The Architect shall be given 48 hours notice before tests are made. The Contractor shall provide the manpower and equipment necessary to perform the tests required by the Architect. Upon completion of the tests and inspections, the Contractor shall furnish the Architect a certificate of approval from the LAHJ.

1.18 RECORD DRAWINGS

- A. Keep accurate records of the deviations in work as indicated and as actually installed. Record drawings shall be kept at the project site and available for monthly review.
- B. Upon completion of the work, submit corrected reproducible drawings and specifications indicating deviations made in the actual installation to the contract plans.
- C. When work is completed, make one complete record set of marked prints, certify the accuracy of each print by endorsement and signature thereon, and deliver same to the Architect/Engineer who will, after approval, deliver the set to the Owner. Record drawings

will be revised as required by the Engineer until the Engineer accepts them as correct and accurately reflecting the project as constructed.

1.19 WARRANTY

- A. This Contractor shall furnish written warranty, countersigned and guaranteed by the General Contractor, stating that the work executed under this Division of the specifications shall be free from defects of materials and workmanship for a period of 12 months from the date of final acceptance of building, except as otherwise noted in these specifications.

1.20 SCHEDULE OF VALUES

- A. This Contractor shall furnish and the General Contractor shall include as a minimum the following list of items. This shall form the basis for determining the completed work as part of the Application for Payment process.

Electrical

Demolition
Fire Alarm System (material)
Fire Alarm System (labor)
Conduit, Boxes and Fittings (material)
Conduit, Boxes and Fittings (labor)
Lighting Fixtures (material)
Lighting Fixtures (labor)
Panels, Starters, Disconnect Switches and Transformers (material)
Panels, Starters, Disconnect Switches and Transformers (labor)
Main Switchboard (material)
Main Switchboard (labor)
Wiring Devices (material)
Wiring Devices (labor)
Generator (material)
Generator (labor)
Wire and Cable (material)
Wire and Cable (labor)

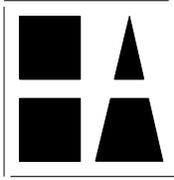
1.21 TRAINING

- A. Refer to each Division 26 Section for the required Training.
- B. Use the attached form to document the training and include it in the Maintenance and Operation Manuals.

PART 2 - PRODUCTS - NOT APPLICABLE

PART 3 - EXECUTION - NOT APPLICABLE

END OF SECTION 260010



HICKMAN • AMBROSE
INCORPORATED • CONSULTING ENGINEERS

Owner Training Certification

Project:

Equipment:

Contractor Certification

The undersigned as the Contractor's authorized training agent for the above noted equipment certifies that all required and applicable training has been provided to the Owner's representative(s) per the project Contract.

Contractor Representative: _____ **Date:** _____

Owner Certification

The undersigned as the Owner's authorized agent certifies that all required and applicable training has been provided to the Owner's satisfaction.

Owner Representative: _____ **Date:** _____

SECTION 260050 – ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to this Section.

1.2 SUMMARY

- A. Install materials in a first class and workmanlike manner and specifically, run conduit concealed throughout building, except as indicated or approved by the Architect.

1.3 REFERENCES

- A. Electrical materials furnished under these specifications shall be new and listed, inspected and approved by the Underwriters' Laboratories (UL) and shall bear the UL label where labeling service is available.
- B. Where the UL labeling service is not available, the Contractor shall submit a statement from a nationally recognized, adequately equipped testing agency indicating that the items have been tested in accordance with required procedures and that the materials and equipment comply with all contract requirements. Materials and equipment shall also comply with the requirements of all applicable Codes.

1.4 SUBMITTALS

- A. Submit complete schedules of material and equipment proposed for installation to the Architect within 90 days after award of the contract, in quantities as indicated in Division 1. The schedules shall include catalogs, cuts, diagrams and such other descriptive data and/or samples as indicated in the SUBMITTALS paragraph of each Division 26 Section. Schedules of material which consist of facsimiles or copies of facsimiles shall be unacceptable. If after expiration of the 90 day period or any extension thereof as authorized by the Architect the Contractor fails to submit a schedule of acceptable material or equipment, the Engineer reserves the right to accept no substitutions, and the Contractor may be required to submit material and equipment as specified. In the event any items of material or equipment submitted within the 90 day period fail to comply with the specification requirements, such items will be rejected and approved items shall be submitted for the items rejected. If the resubmitted material or equipment fails to comply with the specification requirements, the Contractor shall then be required to submit material and equipment as specified without additional cost to the Owner.
- B. Submittals that do not adhere to the following format will be rejected without review. Submittals shall be bound by staples, or in book form. The first page of the submittal shall be a Title page, which shall indicate the Project name and Project address, the General Contractor's name, address, phone number and contact and the Electrical Contractor's name, address, phone number and contact. The second page of the submittal shall be a Table of Contents indicating the specification section number and name, and contain the General Contractor's and the Electrical Contractor's stamps of approval. Blank page dividers shall separate each section and shall be tagged with the corresponding specification section number as listed under the SHOP DRAWINGS paragraph, Division 26 Section "Electrical General Provisions." One of the submittals shall be hole-punched and placed in a 3-ring binder, which shall be retained by the Engineer. Partial submittals shall be allowed only when requested by the Contractor in writing and approved by the Engineer. The copies shall be clear and readable. Approved

copies of all shop drawings shall be kept on the job site at all times accessible to the Architect/Engineer.

- C. Submittals that do not contain the General Contractor's and Electrical Contractor's stamps of approval shall be returned without review.
- D. Where Drawings are required, they must be submitted along with product data. Separate submittals will not be reviewed.
- E. Submittal data shall include (See individual Specification Sections for detail requirements), but not be limited to the following:

Fuses

Conduit and Fittings

- Rigid Steel Conduit and Fittings
- IMC Conduit and Fittings
- EMT Conduit and Fittings
- PVC Conduit and Fittings
- FMC Conduit and Fittings
- Liquid Tight FMC Conduit and Fittings
- Supports

Wire and Cable

- Aluminum conversion chart (where applicable)

Wiring Devices

- Wiring devices
- Device plates/or covers

Outlet Boxes

- Outlet boxes and fitting
- Multi-service flush floor boxes, fittings and covers

Panelboards

- Catalog data (cabinet, covers circuit breakers)
- Drawing indicating detentions, location of main, branch and solid neutral and equipment ratings for voltage, amperage and short circuit. Series rating riser diagram and calculations as required.

Disconnect Switches

- Catalog data-Interior mounted switches
- Catalog data-Nema-3R switches

Main Switchboard

- Catalog data
- Drawing indicating detentions, location of main, branch and solid neutral and equipment ratings for voltage, amperage and short circuit. Series rating riser diagram and calculations as required.
- Single line diagram

TVSS data

TVSS Devices

- Catalog data
- Category C3 independent clamp voltage test results

- UL 1449 clamp voltage documentation

Meter Centers

Grounding

- Ground rod and clamp
- Ground wire

Loadcenters

Circuit Breakers

Low Voltage Automatic Transfer Switches

Lighting Fixtures

- Aiming charts (where applicable)
- Foot candle point grips (where applicable)

Lighting Controls

- Photocells
- Timeclocks
- Contactors
- Ultrasonic occupancy sensors
- Infrared occupancy sensors
- Interconnecting diagrams
- Light harvesting systems

Theatrical Dimming System

- Single line system diagram
- Dimmer rack
- Electronic modules
- Dimmer modules
- Automatic transfer system (switch & panel)
- Remote control stations
- Theater control console
- Auxiliary controls and devices
- Stage electrical rigging equipment
- Lighting instruments and accessories

Theatrical Lighting and Rigging System

- Lighting Fixtures lamps and distribution components
- Lighting control components
- Single line system diagram
- Rigging systems

Packaged Engine Generator

- Product data
- Shop Drawings

Fire Alarm System

- Control panel/cabinet
- Peripheral devices
- Graphic Annunciator
- Duct mounted smoke detector
- Point to point CAD drawing
- Batteries with calculations

- Construction process narrative

Fire Control Communicator

1.5 SUBSTITUTIONS

- A. The name of a certain brand, make, Manufacturer or definite specification is to denote the quality standard of article desired, but does not restrict bidders to the specified brand, make, Manufacturer or specification named. Substitution of any other brand, make, or Manufacturer, which in the opinion of the Architect or Engineer, and approved by the Owner, is recognized the equal of that specified, shall be accepted, but only if submitted within the requirements of Division 01. The Contractor shall make available a sample of the substituted equipment within fourteen (14) calendar days when requested by the Engineer to determine if the equipment is equal to that specified. If substitute equipment is allowed, the Contractor shall be responsible for any building or utility modifications and for its ability to fulfill the intended functions in the completed system, with no additional cost to the Owner.
- B. When substituted equipment is provided, the Contractor may be requested by the Engineer to submit electrical equipment room/space layout drawings (drawn to scale) indicating the proposed method of installation, including all required clearances. All cost associated with such modifications shall be the responsibility of the Contractor providing the substitute equipment.
- C. When three or more Manufacturers are specified, there will be no substitution.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Replace or repair defective equipment and materials, or material damaged in the course of delivery, storage or installation.
- B. Switchboards, panelboards, and disconnect switches shall be manufactured by the same Manufacturer. Wiring devices shall be manufactured by the same Manufacturer.

PART 3 - EXECUTION

3.1 STORAGE AND PROTECTION

- A. Material and equipment shall be properly stored and protected until installed by the Contractor and acceptance by the Owner. Materials intended for indoor use must be stored inside or adequately protected from the weather.

3.2 SUPPORT AND MOUNTING

- A. Provide all angle iron, channel iron, rods, supports or hangers required to install or mount switchboards, panelboards, or any electrical equipment called for on the plans and in the specifications, or as necessary to mount any piece of electrical equipment, material or device.
- B. Do not support conduit, fixtures or any electrical devices from the steel roof deck, the ceiling, or the ceiling support wires.

3.3 CLEANING

- A. Remove dirt, trash, and oil from raceways, boxes, fittings, cabinets, panelboards, and switchgear.

3.4 OPERATION AND MAINTENANCE MANUALS

- A. Submit maintenance manuals for the electrical equipment. After approval by the Architect/Engineer, provide copies as required by Division 01 or two copies, whichever is greater, bound in hardback, loose-leaf binders, properly identified and indexed, and turn these copies over to the Owner's representative.
- B. Maintenance manuals shall include the necessary information to provide complete instructions of servicing and maintenance of the equipment installed. Manuals shall include, but are not limited to, light fixtures, electric switchgear, panelboards, transformers, starters and controllers, contactors, disconnect switches, and auxiliary systems equipment and devices. Provide a copy of each panelboard index in the maintenance manuals.

3.5 REPAIR OF EXISTING WORK

- A. Repair of existing work, demolition, and modification of existing electrical systems shall be performed as follows:
 - 1. Workmanship: Lay out work in advance. Exercise care when cutting, channeling, chasing, or drilling of floors, walls, partitions, ceilings, or other surfaces as necessary for proper installation, support, or anchorage of conduit, raceways, or other electrical work. Repair damage to buildings, piping, and equipment using skilled craftsmen of trades involved.
 - 2. Existing Concealed Wiring to be Removed: Disconnect wiring from its source. Remove conductors; cut conduit flush with floor, underside of floor, and through walls; and seal openings.
 - 3. Removal of Existing Electrical Distribution System: Equipment shall include associated wiring, including conductors, cables, exposed conduit, surface metal raceways, boxes, fittings, etc., back to equipment's source as indicated.
 - 4. Maintain access and power supplied to existing electrical installations and devices which are to remain active. Modify installation or provide access panel as required.
 - 5. Repair surfaces damaged by demolition and unfinished surfaces exposed by demolition and paint to match surrounding surfaces.

END OF SECTION 260050

SECTION 260510- ELECTRICAL SERVICE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to this Section.

1.2 SUMMARY

- A. Electrical service shall be as indicated on the drawings and as specified herein. All service work shall conform to the NEC, and the Contractor shall contact the Power Company for coordination prior to commencing any service work.

1.3 REFERENCES

- A. The electrical service shall be designed and installed according to the latest revision of the following specifications:
 - 1. Local Power Requirements for Electric Service (Blue Book) - 2012
 - 2. Conduit shall be specified under Division 26 Section "Conduit and Fittings".
 - 3. Conductors shall be specified under Division 26 Section "Wire and Cable".

1.4 SUBMITTALS

- A. Submit the following Shop Drawings and Submittals listed below. Submittals shall indicate conformance with the hereinbefore listed References, or provide certification of meeting those requirements.
 - 1. Service entrance conductors
 - 2. Service entrance conduit

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Shop Drawings shall clearly indicate Manufacturer, catalog numbers and trade sizes of service entrance conductors and conduit which will be used on the project.
- B. Electrical service equipment and panelboards shall be by same equipment Manufacturer.

PART 3 - EXECUTION

3.1 COORDINATION WITH POWER COMPANY

- A. Make application with the Power Company for temporary service and pay any associated fees to permit the Power Company to provide temporary service.
- B. Arrangement shall be as indicated and as required by the Power Company, including exact point of service and requirements of metering, etc.
- C. Verify complete electrical service installation with the Power Company before commencing any work.
- D. Make application with the Power Company for electric service in a manner to permit the

Power Company to provide service prior to completion of work under this contract.

- E. Complete and file all forms required by the Power Company in connection with application for electric services.

3.2 INSTALLATION

- A. Provide all on-site trenching and backfilling required for installation of electric service. Verify size and routing of trenches with Power Company prior to start of construction.
- B. Provide sealable meter compartment, where required, for metering by electric Power Company. Install metering transformers, revenue meter and other devices furnished by Power Company. Furnish and install interconnecting raceway and conductors between metering transformers and revenue meter. Install all equipment in accordance with the Power Company's requirements.
- C. Provide conduits under paved areas for Power Company use. Verify size and locations with Power Company prior to start of construction.
- D. Provide underground raceways and conductors from Power Company transformer to main service equipment.

END OF SECTION 260510

SECTION 260513 - WIRE AND CABLE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to this Section.

1.2 SUMMARY

- A. Feeder and branch circuit wire and cable shall be intended for lighting and power circuits at 600 volts in commercial and industrial buildings. The wire shall be operated at a minimum of 75⁰C in wet or dry locations and shall be listed by UL for use in accordance with Article 310 of the NEC.

1.3 REFERENCES

- A. Wire and cable shall conform to the following:
 - 1. Type THW - UL 83, Fed. Spec. J-C-30B
 - 2. Type THWN/THHN - UL 83, Fed. Spec. J-C-30B
 - 3. Type XHHW-2 - UL 44, Fed. Spec. J-C-30B

1.4 SUBMITTALS

- A. Submit the following Shop Drawings and Submittals listed below. Submittals shall indicate conformance with the hereinbefore listed References, or provide certification of meeting those requirements.
 - 1. Wire and cable

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Shop Drawings shall clearly indicate Manufacturer, catalog numbers, trade sizes and type of wire and cable which will be used on the project.

2.2 TYPE THW

- A. Conductors shall be solid or Class B stranded, annealed uncoated copper per UL 83.
- B. Each conductor shall be insulated with PVC complying with the physical and electrical requirements of UL 83. In addition, the PVC insulation shall comply with the optional Oil Resistant I listing of UL 83.
- C. The average thickness of insulation, for a given conductor size, shall be as specified in UL 83. The minimum thickness at any point shall not be less than 90% of the specified average thickness. The insulation shall be applied tightly to the conductor and shall be free-stripping.

2.3 TYPE THWN/THHN

- A. Conductors shall be solid or Class B stranded, annealed uncoated copper per UL 83.

- B. Each conductor shall be insulated with PVC and sheathed with nylon complying with requirements of UL 83. In addition, the PVC insulation shall comply with the optional Oil Resistant II rating of UL 83, and shall comply with UL requirements for 105 degrees Centigrade Appliance Wiring material.
- C. The average thickness of PVC insulation, for a given conductor size, shall be as specified in UL 83. The minimum thickness at any point of the PVC insulation shall not be less than 90% of the specified average thickness. The minimum thickness at any point of the nylon sheath, shall be as specified in UL 83 for Types THWN or THHN. The insulation shall be applied tightly to the conductor and shall be free-stripping.

2.4 TYPE XHHW-2

- A. Conductors shall be solid or Class B stranded, annealed uncoated copper per UL 44.
- B. Each conductor shall be insulated with a crosslinked polyethylene complying with the physical and electrical requirements of UL 44.
- C. The average thickness of insulation, for a given conductor size, shall be as specified in UL 44. The minimum thickness at any point shall not be less than 90% of the specified average thickness. The insulation shall be applied tightly to the conductor and shall be free-stripping.

2.5 TYPE USE-2

- A. Conductors shall be solid or Class B stranded, annealed uncoated copper per UL 854 and UL 44.
- B. Each conductor shall be insulated with a cross-linked polyethylene complying with the physical and electrical requirements of UL 854.
- C. The average thickness of insulation, for a given conductor size, shall be as specified in UL 44. The minimum thickness at any point shall not be less than 90% of the specified average thickness. The insulation shall be applied tightly to the conductor and shall be free-stripping.

2.6 IDENTIFICATION

- A. All insulated conductors shall be new and the outer covering shall be marked with the name and trademark of the Manufacturer, the voltage, insulation type, conductor size, and shall be tagged showing UL acceptance.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install wire and cable in conduit, unless otherwise indicated.
- B. Wires No. 10 and 12 shall be connected with coil spring insert "Wire-Nut" or "Wing-Nut" connectors manufactured by Ideal Industries or 3M Company. Wires No. 8 and larger shall be joined or terminated with 600 volt pressure type copper connectors.
- C. Wire shall be color coded as follows, and each circuit conductor of the same color shall be connected to the same ungrounded feeder conductor throughout the installation. Phase tape shall not be permitted for wires No. 2 and smaller. Other conductors shall be of other colors.

120/208 Volt System

Phase A	Black
Phase B	Red
Phase C	Blue
Neutral	White
Ground	Green

- D. Electrical designs are based on copper wire and cable. Aluminum wire and cable shall be permitted to be used for panel feeders 250 kcmil and larger only. If at the option of the Contractor, aluminum is selected the equivalent ampacity aluminum conductor and corresponding conduit sizes shall be provided.
- E. Should the Contractor elect to use aluminum, he shall submit for approval during the Shop Drawing review a tabulated list indicating feeder conductor and conduit sizes, sizes of protective devices and current carrying capacity of aluminum conductors.
- F. Should the Contractor elect to exercise the aluminum option, it shall be the Contractor's responsibility to insure switchboards, panelboards, disconnect switches, junction boxes and applicable equipment is of sufficient size to accommodate aluminum connectors and increased conduit sizes. The Contractor shall also insure that the building construction will accommodate the increased sized equipment.
- G. Should the Contractor elect to use the aluminum option as outlined above, aluminum terminations shall be made with compression type connectors in accordance with the following:
1. Terminations under set-screw lugs in panelboards, disconnect switches, etc., shall be made with Burndy "Hyplug" plug type compression sleeve connectors.
 2. In-line conductor splices shall be made with two-way compression connectors.
 3. Bolt stud connections shall be made with one-hole spade compression lugs.
 4. Aluminum conductors shall be coated with an approved oxide-inhibiting compound before any terminations are made.
 5. The use of wing-nuts and aluminum conductors terminating under set screw type connectors shall not be permitted.
 6. Compression connections shall be made with a tool specifically approved for the use and connector being used and shall be in accordance with the Manufacturer's recommendations.

END OF SECTION 260513

SECTION 260526 - GROUNDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to this Section.

1.2 SUMMARY

- A. Provide grounding for service, conduits, motor frames, metal casings, wiring devices, solid neutral, etc. and as required by NEC as a minimum. Resistance to ground shall not exceed 25 ohms.

PART 2 - PRODUCTS

2.1 GROUND WIRE

- A. Provide a green insulated ground wire, sized per NEC in all conduits, junction and pull boxes.

2.2 GROUND ROD

- A. Provide a 3/4" diameter x 10'-0" long copper clad ground rod.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Grounding conductors shall be connected to the panelboard equipment ground bus and not to the panelboard neutral bus. Grounding bushings shall also be connected to the ground bus. The neutral bus shall have only the system neutral wire connected thereto.
- B. Provide a bonding wire sized per NEC 250.66 between the equipment ground bus and the neutral bus in the main distribution equipment only, thus the grounding system (conduit, cabinets, enclosures, grounding conductors, etc.) and the grounded system (neutral conductors and service equipment ground) shall be a separate and independent system except at the main distribution equipment.
- C. Provide a grounding electrode conductor sized per NEC Table 250.66 from the service entrance grounded conductor to the interior metal water-pipe system, and supplement this connection by bonding to the grounded building steel, the reinforcing bars in footings or foundation, and the driven ground rod, as applicable.
- D. Install ground rod below ground outside of the building. Bond a grounding wire to the rod and connect to the equipment ground bus of the service entrance panel.

END OF SECTION 260526

SECTION 260533 - CONDUIT AND FITTINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specifications section, apply to this Section.

1.2 SUMMARY

- A. Run conduit concealed within finished walls, ceilings, and floors unless otherwise shown on the drawings. Conduit may be exposed above joist in mechanical rooms and spaces with exposed construction as approved by the Architect. Conduit sizes shown are based on use of copper conductors with THHN/THWN insulation types, unless a specific type of insulation is called for on the drawings.
- B. Install conduit as a complete system, including fittings and hangers as specified herein or as required by the NEC, and continuous from outlet to outlet and from fitting to fitting, and mechanically and electrically connected to all boxes, fittings, wire ways, etc., and grounded in accordance with the NEC.

1.3 REFERENCES

- A. Conduit and fittings shall conform to the following:
 - 1. Rigid Steel - ANSI C80.1, UL 6
 - 2. Intermediate Metal Conduit (IMC) - ANSI C80.6, UL 1242
 - 3. Electrical Metallic Tubing (EMT) - ANSI C80.3, UL 797
 - 4. Flexible Metal Conduit - UL 1
 - 5. Liquid-Tight Flexible Metal Conduit - UL 360
 - 6. Plastic Conduit (PVC) - NEMA TC2, NEMA TC3, UL 651

1.4 SUBMITTALS

- A. Submit the following Shop Drawings and Submittals listed below. Submittals shall indicate conformance with the hereinbefore listed References, or provide certification of meeting those requirements.
 - 1. Conduit
 - 2. Fittings
 - 3. Supports

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Shop Drawings shall clearly indicate Manufacturer and catalog numbers of trade sizes and type of conduit, fittings and supports which will be used on the project.

2.2 CONDUIT

- A. Minimum size conduit shall be 1/2" with larger sizes as required by the NEC for number of wires contained therein.
- B. Conduit and tubing shall be hot dipped galvanized or sheradized steel, except as

hereinbefore specified.

- C. Intermediate metal conduit shall be permitted in lieu of rigid where allowed in Article 345 of the NEC.
- D. Flexible conduit shall be ½" galvanized, single strip type, minimum 18 inches and a maximum 6 feet in length. In areas subject to moisture, or where called for on the drawings, flexible conduit shall have plastic covering in accordance with NEC, Article 351-A. Flexible conduit shall be used for connections to motors and other equipment subject to vibration and for connections to recessed or semi-recessed fixtures.
- E. Plastic conduit shall be PVC Type EPC-40-PVC.

2.3 FITTINGS

- A. All conduits entering or leaving panelboards, cabinets, outlet boxes, pull boxes, or junction boxes shall have lock nuts and bushings, except provide insulated throat connectors on EMT sizes 1" and smaller. Rigid steel conduit shall have a lock nut installed both inside and outside of the enclosure entered. Bushings shall be installed on the ends of IMC and rigid steel conduit and EMT larger than 1". Insulating bushings shall be O.Z. Gedney Type "A" for rigid steel and IMC, and Type "B" for EMT. Conduit entering enclosures through concentric knockouts shall have grounding-type bushings with copper bond wire to enclosure.
- B. Fittings for rigid steel and IMC shall be threaded. Where rigid steel or IMC changes to EMT above slab, fittings may be threadless type. EMT fittings shall be galvanized steel, concrete-tight, set screw type.
- C. Cast metal fittings shall not be allowed for any type of conduit or cable system.
- D. Provide O.Z. Gedney Type "AX" expansion fittings where conduits cross expansion joints.
- E. Flexible conduit fittings shall be standard UL approved with ground connector. Watertight connectors shall be used with plastic covered conduit.
- F. Provide O.Z. Gedney Type "M" cable supports as required by Article 300-19 of NEC.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Conduits and tubing concealed in walls and above ceiling shall be electrical metallic tubing and conduits in the floor shall be rigid steel. Conduits within the slab shall be minimum ¾" rigid steel with a minimum spacing of 2 inches between parallel runs; larger sizes shall be run below the slab. Conduits run below the first floor shall be adequately supported by approved hangers supported entirely from the building structural system if the building has a crawl space or if the building has a pile foundation.
- B. Run exposed conduits parallel or perpendicular to building walls and supported as hereinafter specified and in accordance with NEC.
- C. Conduits run outside of building perimeter shall be minimum ¾ inch and buried a minimum of 24" below finished grade. Conduits run below slab on grade shall be minimum ¾ inch and buried a minimum as specified in Table 300-5 of the NEC. Provide any extensions required to ensure conduits are protected below slab. These conduits shall be rigid non-metallic polyvinylchloride conduit, minimum Schedule 40, unless a

specific type of conduit is specified or indicated on the drawings. Schedule 40 nonmetallic PVC conduit shall be changed to Schedule 80 non-metallic PVC conduit when passing through the floor slab and remain Schedule 80 up to the first Electrical box. The first two masonry block courses shall be grouted where conduits pass through the slab. Fiber duct shall not be allowed.

- D. Metallic conduits shall be securely fastened in place at intervals not greater than 10 feet. All conduits shall be securely fastened in place within 3 feet of boxes, cabinets, and fittings, with approved pipe straps, wall brackets, conduit clamps, conduit hangers, threaded C-clamps, or ceiling trapeze. C-clamps or beam clamps shall have strap or rod-type retainers. Contractor shall coordinate loads and supports with the General Contractor in order to prevent damage or deformation to the supporting structure, but no loads shall be supported from metal roof decks, from lay-in ceiling grid or run tight against metal roof decks.
- E. Fastenings shall be by wood screws or screw-type nails to wood, by toggle bolts on hollow masonry units, by expansion bolts on concrete or brick, and by machine screws, welded threaded studs, heat-treated or spring-steel-tension clamps on steel work. Nail-type nylon anchors or threaded studs driven in by powder charge and provided with lock washers and nuts may be used in lieu of expansion bolts or machine screws. Raceways or pipe straps shall not be welded to steel structures. In partitions of light steel construction, sheet-metal screws may be used. Conduit shall not be supported using any type of wire or nylon ties.
- F. Metal conduits installed in earth shall be field painted with two coats bitumastic paint prior to installation in the ductbank, trench or earth.
- G. Make conduits passing through exterior concrete walls, floors or footings below grade watertight. Provide O.Z. Gedney Type "FSK" conduit entrance seals. Provide conduit sealing bushings O.Z. Gedney Type "CSB" or "CSBG" series as applicable and provide with cabinet adapter plate when required.
- H. Seal conduits and cables passing through fire rated walls and/or floors by approved methods, or by installing O.Z. Gedney fire-seal Type "CFSI" or "CFSF" series as applicable to maintain UL classified fire rating.
- I. All empty conduits shall contain a plastic pullwire.
- J. Seal conduits passing through roofs by approved methods of the Roof Manufacturer to maintain the integrity of the roof.
- K. Conduits installed above grade in damp or wet locations shall be rigid galvanized steel.

END OF SECTION 260533

SECTION 260534 - OUTLET BOXES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to this Section.

1.2 SUMMARY

- A. Fixture outlets, receptacles, switches, devices, etc., requiring outlet boxes shall have steel outlet boxes as required, constructed as required by NEC and installed as indicated.
- B. Exercise special care in the location of the outlet and junction boxes in order that the hanging or recessing of light fixtures will not be obstructed by the piping or ductwork installed by other trades. To this end, the work shall be coordinated with representatives of the other trades involved and by reference to the Mechanical, Plumbing, Structural, and Architectural drawings.

1.3 REFERENCES

- A. Outlet boxes shall conform to the following:
 - 1. Metallic Boxes - NEMA OS1, UL 514A
 - 2. Multiservice Flush Floor Box

1.4 SUBMITTALS

- A. Submit the following Shop Drawings and Submittals listed below. Submittals shall indicate conformance with the hereinbefore listed References, or provide certification of meeting those requirements.
 - 1. Outlet boxes
 - 2. Fittings

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Shop Drawings shall clearly indicate Manufacturer, catalog numbers, trade sizes and type of outlet boxes which will be used on the project.

2.2 OUTLET BOXES

- A. Outlet boxes shall be hot dipped galvanized steel type with standard knock-outs as required for conduit termination. Minimum size of outlet box shall be 4" square, 1-1/2" deep, and shall be increased in dimensions to accommodate conductors and devices as required by the NEC, and as indicated. Outlet boxes for exposed tile and block shall be provided with square cornered tile ring, size as required. Outlet boxes shall not be installed back-to-back in any wall and thru-the-wall boxes shall not be used.
- B. Location of the outlets for lighting, devices, power, and equipment are shown on the drawings. Due to the small scale of the drawings, it is not possible to indicated the exact location. The Contractor shall examine the Architectural, Structural, Plumbing and Mechanical drawings and finish conditions and arrange his work as may be required to

meet such conditions.

- C. The Contractor shall verify the exact swing of doors and locations of built-in cabinetry prior to installing outlets for switches and receptacles. The Contractor shall also coordinate outlets with change orders, addendums, and job site differences.
- D. Shallow outlet boxes may be employed where construction prohibits use of 4" square, 1-1/2" deep box specified above.
- E. Multiservice Flush Floor Box:
 - 1. Concrete Tight Steel Box for Pours of 2-7/16" or greater
 - a. Box must have (2) 1/2" and (2) 3/4" knockouts per side and (1) 1/2" and (1) 3/4" knockouts per end.
 - b. Box must have (3) 1/2", (1) 3/4", and (1) 1-1/4" knockouts located on the bottom.
 - c. Flange provided on ends of box for nailing box to form.
 - d. Box must be available with choice of brass or polycarbonate activation.
 - e. Capacity must be 82.5 cubic inches total or split into two compartments of 43.8 and 38.6 cubic inches.
 - f. Box partition to be removable.
 - g. Floorbox to be fully adjustable and UL listed.
 - 2. Concrete Tight Steel Box for Pours of 3-9/16" or greater
 - a. Box must have (2) 1/2" and 3/4" concentric and (2) 1" and 1-1/4" concentric knockouts per side and (1) 1" and 1-1/4" concentric knockout per end.
 - b. Box must be available with choice of brass or polycarbonate activation.
 - c. Capacity must be 86.3 cubic inches total or split into two compartments of 44.8 and 41.5 cubic inches.
 - d. Box partition to be removable.
 - e. Floorbox to be fully adjustable and UL listed.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Check all door swings and built-in equipment and cabinetry prior to roughing-in boxes for switches and receptacles.
- B. Mounting heights of outlets in tile or un-plastered masonry shall be adjusted plus or minus to the nearest block joint. Outlet boxes in the same space shall be installed at the same height above finished floor.
- C. Check location of all wall outlets to verify that the outlet will clear wall fixtures, shelving, work tables, etc. that will be installed prior to roughing-in conduit. If discrepancies are noted, contact the Architect/Engineer before proceeding.
- D. Outlet boxes occurring in finished outside walls, wet areas or areas designed for wash down such as kitchens and can wash areas, shall be cast and provided with gaskets between box and waterproof cover.
- E. Ceiling and bracket outlets shall be boxes suitably supported by headers and 3/8" fixture stud for supporting fixtures as required. In areas of exposed steel beams, fixture shall be supported by steel channel as required. Fixtures weighing over 20 pounds shall be

supported independently of box.

- F. Outlet boxes in finished areas shall be flush mounted with raised plaster rings suitable to accommodate device and hold it flush with finish wall line. Surface outlets requiring device plates shall be provided with raised covers serving both purposes. Blanked outlets and junction boxes shall be provided with flush blank covers.
- G. Outlet boxes that are surface mounted on finished walls shall be of the cast type with hub sizes and number as required.
- H. Install junction and pull boxes where indicated or necessary for installation of the electrical system. Junction or pull boxes not over 100 cubic inches in volume shall be standard outlet boxes. Junction boxes over 100 cubic inches in volume shall be constructed in accordance with the requirements of the NEC. Junction boxes shall have covers and be accessible after completion of the building. Where several feeders pass through a common pull box or junction box, the feeders shall be tagged to indicate clearly their electrical characteristics, circuit number, and panel designation. Paint same information on cover of the box.

END OF SECTION 260534

SECTION 260923 - LIGHTING CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to this Section.

1.2 SUMMARY

- A. Provide all labor, equipment, materials, and performance of all operations in connection with the installation of the lighting controls as shown on the drawings and as herein specified.

1.3 REFERENCES

- A. Lighting controls shall conform to the following:
 1. Photocells - UL 273D
 2. Timeclocks - UL 916
 3. Contactors - NEMA ICS2, NEMA ICS6
 4. Ultrasonic Occupancy Sensors - UL listed
 5. Infrared Occupancy Sensors - UL listed

1.4 SUBMITTALS

- A. Submit the following Shop Drawings and Submittals listed below. Submittals shall indicate conformance with the hereinbefore listed References, or provide certification of meeting those requirements.
 1. Photocells
 2. Timeclocks
 3. Contactors
 4. Ultrasonic Occupancy Sensors and wiring diagrams
 5. Infrared Occupancy Sensors and wiring diagrams
 6. Interconnecting diagrams of all components of the lighting control system, including, but not limited to, power packs, sensing units, relays, etc.

1.5 QUALITY ASSURANCE

- A. Occupancy sensor manufacturers shall have a minimum of five (5) years experience in the manufacture and application of occupancy sensors and shall extend a full five year warranty to its products.
- B. Occupancy sensors shall be commissioned by manufacturer's representative at no additional cost outside of contract base bid. The Commissioning Agent shall set sensors to satisfaction of Owner's Representative. Commissioning shall also include training or instructions for sensors.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Shop Drawings shall clearly indicate Manufacturer, catalog numbers, type and number of lighting control devices and installation instructions. Photocells and timeclocks shall be as

manufactured by Tork, contactors shall be as manufactured by Square D, and lighting controls shall be as manufactured by Unenco.

2.2 PHOTOCELLS

- A. The photo control shall provide automatic switching for outdoor lighting loads. Control shall have built-in delay to ensure the controlled lighting does not switch off due to ambient light or lightning striking the photocell. Photo control shall have a rating of 2000 watts and 16 amps for tungsten, and 1800 watts and 15 amps for ballast loads. Photo control shall provide switching for nominal voltage fixtures of 120 volts +/-10% to accommodate fluctuations in supply voltage.
- B. Photo control wiring shall be stem mounted with all necessary mounting hardware and instructions included with control. Photo control shall have on/off adjustment which is easily accomplished by moving a light level selector to range from 2 foot candles to 50 foot candles. Turn-off shall be approximately three times turn-on. Photo control shall be 100% factory tested for function within specified light levels.
- C. Photo control shall be UL listed and shall meet all applicable agency requirements. Photo control shall function over temperature range of -40 degrees Fahrenheit to 140 degrees Fahrenheit.

2.3 TIMECLOCKS

- A. Timeclock shall be a 2-channel digital time switch and capable of being programmed in AM/PM or 24 hour format with one minute resolution.
- B. Timeclock shall be capable of 48 event per channel per week with separate scheduling for each day of the week.
- C. Timeclock shall have 365 day holiday capabilities with 16 single dates and 5 holiday blocks of unlimited duration utilizing 8th and 9th day schedules.
- D. Timeclock shall have user selectable Daylight Savings or Standard Time with automatic leap year correction.
- E. Timeclock shall have 72 hour memory backup with rechargeable battery.
- F. Timeclock shall have astronomic feature for both channels with 1-99 minutes plus or minus offset from Sunrise or Sunset.

2.4 CONTACTORS

- A. Multiple lighting contactor shall be mechanically held and electrically operated with encapsulated coils. Standard coil clearing contacts are to be provided so that the contactor coils shall be energized only during the instance of operation.
- B. Contactor shall have a coil voltage rating and number of poles as indicated on the drawings, with each set of contacts rated at 20 amps for all types of ballast and tungsten lighting.
- C. Contacts shall be totally enclosed, double-break silver cadmium oxide power contacts. Contact inspection and replacement shall be possible without disturbing line wiring. All contacts shall have clearly visible N.O. and N.C. contact status indicators.
- D. Wiring for the device shall be straight-through with all terminals clearly marked and shall

be housed in a NEMA Type 1 enclosure.

2.5 OCCUPANCY SENSORS

- A. Corridor occupancy sensors shall be a 120 volt line voltage ceiling mounted unit with four (4) air transducers. Unit is an ultrasonic, self-contained detector capable of covering a hallway 15'-0" by 100'-0' and controlling up to a 20 amp circuit. Unit shall have adjustable time delay of 30 seconds to 30 minutes and an easily accessible sensitivity adjustment which can be used to accommodate various room sizes. Unit shall have a shunt provision to bypass the sensor in case of failure so lighting may be operated manually. Unit shall have an LED means for walk testing.
- B. Room occupancy sensors shall be a 120 volt line voltage ceiling mounted unit with two (2) air transducers. Unit is an ultrasonic, self-contained detector capable of covering 800 square feet and controlling up to a 20 amp circuit. Unit shall have adjustable time delay of 30 seconds to 30 minutes and an easily accessible sensitivity adjustment which can be used to accommodate various room sizes. Unit shall have a shunt provision to bypass the sensor in case of failure so lighting may be operated manually. Unit shall have an LED means for walk testing.
- C. Toilet occupancy sensor shall be a ceiling mounted unit with two (2) air transducers. Unit is an ultrasonic detector capable of covering 800 square feet. Unit shall operate on 24 volts DC supplied by power packs controlling up to a 20 amp circuit. Unit shall have adjustable time delay of 30 seconds to 30 minutes and an easily accessible sensitivity adjustment which can be used to accommodate various room sizes. Unit shall have a shunt provision to bypass the sensor in case of failure so lighting may be operated manually. Unit and power pack shall have a factory installed, low voltage plug. All low voltage connections shall take place through the use of a factory pre-assembled plenum rated interconnecting harness. Unit shall have an LED means for walk testing.

2.6 POWER PACK

- A. Power pack shall consist of a 24 volt DC power supply and a 20 amp relay. The unit shall produce a 24 volt DC, 100 mA output with a 120 volt AC input. The device shall be mounted inside an approved enclosure or standard outlet box. The device packaging shall be UL fire rated 94 V-O plastic.

2.7 REMOTE VOLTAGE SENSING UNIT

- A. The remote voltage sensing unit shall consist of a 24 volt DC power supply and a set of N.O. and N.C. contacts rated at 5 amps at 28 volts DC or AC. This device shall be used to monitor high voltage loads with low voltage controls and wiring.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install all lighting controls per Manufacturer's written instructions.

END OF SECTION 260923

SECTION 260961 - THEATRICAL SYSTEMS ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes but is not limited to:
 - 1. General requirements for provision of electrical services and materials, and raceway and outlet box system suitable to accommodate installation of the Division 11 Theatrical Systems, including Theatrical Rigging, Theatrical Lighting, and Audio Visual Systems and Fixed Auditorium Seating.
 - 2. Coordinate Theatrical Systems-related electrical materials installation with Division 11 Theatrical Systems drawings.
 - 3. Provide Theatrical Systems-related electrical materials and methods in accordance with all requirements and related sections of Division 26 and as detailed herein.
 - 4. Provide all Theatrical Systems junction boxes, pull boxes, terminal cabinets, cable trays, conduit, enclosures, standard outlet and device back boxes, and other electrical materials and hardware for a complete Theatrical Systems electrical infrastructure as specified herein and in quantities and location as shown on Electrical drawings.
 - 5. Provide all disconnects, panelboards and company switches for Theatrical Systems Equipment as specified herein and in quantities as shown on Electrical drawings.
 - 6. Provide test reports and verification that wiring installations comply with applicable standards and the requirements set forth in the Division 11 Theatrical Systems documents and by the equipment manufacturers.
- B. Audio visual systems
 - 1. Provide all conduit wire, standard backboxes and wire pulling for the AV Systems.
 - 2. Provide and terminate all wiring and receptacles required for the AV Systems isolated technical ground AC power system, isolated technical ground UPS system and general AC power system.
 - 3. Install all AV Systems equipment provided by Division 11, as furnished under Section 116183.
- C. Theatrical lighting system
 - 1. Provide all conduit wire, and wire pulling for theatrical lighting systems.
 - 2. Provide all line voltage terminations for theatrical lighting systems racks and devices, low voltage termination will be the responsibility of the Theatrical lighting contractor.
 - 3. Provide and terminate all wiring and receptacles required for the Theatrical lighting system "LS" power system as indicated on drawings. Theatrical rigging and mechanized equipment
 - 4. Provide all wire, wire pulling and terminations for Motorized Theatrical Equipment.
 - 5. Provide interface to dim architectural LED lighting fixtures within the auditorium with input control signal (DMX control protocol) provided under section 116163.
 - 6. Provide interface to bypass architectural LED fixture power from normal to emergency and control signal to drive all loads to full.

- D. Fixed auditorium seating
 - 1. Provide all conduit, wire, wire pulling, junction boxes for fixed auditorium seating aisle light fixtures. Fixture provided as an integrated arm end panel. Coordinate requirements with seating manufacturer.
 - 2. Install and terminate LED control drivers and connections to the theatrical lighting control system.

1.3 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

- A. Audio visual systems (Refer to Division 11 Section "Theatrical Audio Visual Systems")
 - 1. Terminate all AV Systems AC power receptacles and devices for equipment racks (including receptacles, isolated ground busbars, etc.).
 - 2. Install all AV Systems specialty panel and device back boxes including custom panel wall-mount rack frames, floor boxes, recessed ceiling loudspeaker back boxes, etc. furnished by Division 11 where noted. Provide all required conduit, electrical hardware, and mounting brackets.
 - 3. Install all AV Systems equipment provided by Division 11.
- B. Theatrical lighting system (Refer to Division 11 Section "Theatrical Lighting and Dimming Control")
 - 1. Receive, store and install dimmed power distribution equipment and associated control equipment.
 - 2. Receive, store and install all power and control distribution and connection devices.
 - 3. Install terminal boxes.
 - 4. Install all head-end control equipment under the direct supervision of the equipment manufacturer.
- C. Theatrical rigging and mechanized equipment (Refer to Division 11 Section "Theatrical Rigging and Drapery")
 - 1. Terminate all power and control wiring to motors, motor starters and motor control panels.
 - 2. Install all power and control distribution and connection devices.

1.4 SEQUENCE AND SCHEDULING

- A. Do not install theatrical system wiring devices until all painting in the area has been completed.
- B. Do not install computer grade network components, rack processors and modules, and any other equipment sensitive to construction debris and dust until all debris and dust has been removed. Typical "office" cleanliness shall be required in rooms in which computer grade equipment is to be installed.
- C. Do not install computer grade network components, rack processors and modules, and any other valuable equipment until equipment rooms are secure.
- D. Do not unpack and install computer control consoles and peripheral devices until the control room is secure and climate controlled.

PART 2 - PRODUCTS

2.1 RACEWAYS

- A. Conduit and Fittings: Provide electrical metallic tubing (EMT) conduit for all Theatrical Systems wiring with the following exceptions:
 - 1. Provide rigid steel conduit (GRS) for AV Systems wiring installed in poured concrete and masonry, and where specifically required.
 - 2. PVC conduit is NOT acceptable.
 - 3. Compression-type conduit connectors and couplings, rated for maximum continuity (conduit-to-box and conduit-to-conduit), shall be used for all AV Systems metallic conduit.
- B. AV Systems Cable Trays
 - 1. Provide 16-gauge steel cable tray, 18"w x 6"d, with three barriers for four wiring compartments. Cable tray interiors to be smooth and free of nicks, burrs, or any protrusions.
 - 2. Length as required to carry AV Systems cabling from the terminal cabinets to the top or bottom of the equipment racks, or as indicated. Refer to Section 116183 AV drawings.
 - 3. Cable trays shall be electrically and mechanically connected (bonded) to the building electrical safety ground and isolated from the AV Systems equipment racks in order to maintain the integrity of the AV Systems technical isolated technical ground system.
 - 4. Cable tray shall be by B-Line, Chalfant Series-6, or equal.

2.2 BOXES

- A. Pull and Junction Boxes: Pull and junction boxes shall be as specified under Division 26 Section "Outlet Boxes".
- B. Outlet Boxes: Outlet boxes shall be as specified under Division 26 Section "Outlet Boxes" with the following additional requirements:

Outlet boxes shall be as specified under Division 26 Section 260534: with the following additional requirements:

 - 1. Recessed outlet boxes: Provide outlet boxes as standard steel gang boxes for devices of 2-1/2" minimum depth.
 - a. Provide plaster rings of appropriate size, and depth (per site conditions).
 - b. 3" x 2" gangable steel switch boxes ("GEM" boxes) shall not be acceptable as single or multiple-gang recessed back boxes.
 - 2. Surface-mounted outlet boxes:
 - a. Provide surface-mounted outlet boxes as Wiremold-type boxes or weatherproof cast metal boxes ("bell boxes"), of 2-5/8" depth. Single-gang "bell boxes" of 2-5/8" depth shall be acceptable.
 - b. Any surface mount back box which allows the receptacle cover plate to overhang the edge of the box presents a safety hazard and shall not be acceptable.
- C. AV Panel Back Boxes
 - 1. Provide standard NEMA Type 1 screw cover back boxes for "C" Series AV panels, unless noted otherwise.
 - 2. Back Box sizes and mounting conditions are as indicated on the Division 11 AV Systems and Theatrical Lighting Dimming and Controls drawings and specifications.
 - 3. All surface mount AV panel and device back boxes to be finished flat black, unless noted otherwise.

2.3 THEATRICAL SYSTEMS CONTROL CABLE

A. General

1. Provide only wire types specified in Electrical Documents and verified by Theatrical Systems Manufacturer's shop drawings. No substitutions allowed without written approval of the Architect and Theatrical Systems Manufacturers.
2. Wire types provided in Electrical documents represent the information available at the time of bid and are provided for development of conduit size requirement and bidding purposes. Determination of the final wire type is dependent on the proprietary systems of the successful Division 11 manufacturer. Do not purchase or install any Theatrical Systems control cable until shop drawings for these systems are approved.
3. All wire to be installed in conduit unless otherwise noted or by specific written agreement by Electrical Engineer. Should an exception be made allowing cable to be run outside of conduit, contractor shall provide appropriate plenum rated cable for approval by Engineer and Theatrical Systems Manufacturers.
4. Network cable runs shall be continuous. Cable splicing will not be acceptable.

2.4 WIRING DEVICES

- ### A. Provide Theatrical systems receptacles and other required wiring devices, complete with associated hardware and wall plates, as specified below. Verify cover plate finish color with Architect.

B. AV System Isolated Ground Receptacle – UPS and Non-UPS

1. AV System isolated ground receptacles fed from UPS power shall be colored grey.
2. AV System isolated ground receptacles fed from Non-UPS power shall be colored orange.
3. AV System isolated ground UPS and Non-UPS circuits may not be housed within the same backbox.
4. Provide cover plate labeled "SOUND SYSTEM ISOLATED GROUND" with labeling identifying panelboard and breaker number feeding receptacle.
5. Edison/Straight Blade Receptacle Types
 - a. Simplex 15 Amp 120V isolated ground Edison receptacles shall be standard NEMA 5-20R configuration, 2-pole, 3-wire: Receptacles shall be Hubbell IG5251, or approved equal.
 - b. Duplex 20 Amp 120V isolated ground Edison receptacles shall be standard NEMA 5-20R configuration, 2-pole, 3-wire: Receptacles shall be Hubbell IG5362, or approved equal.
 - c. Duplex 30 Amp 120V isolated ground Edison receptacles shall be standard NEMA 5-30R configuration, 2-pole, 3-wire: Receptacles shall be Hubbell IG9308, or approved equal.
6. Twist-Lock/Locking Receptacle Types
 - a. Simplex 20 Amp 120V isolated ground Twist-Lock receptacles shall be standard NEMA L5-20R configuration, 2-pole, 3-wire: Receptacles shall be Hubbell IG2310, or approved equal.
 - b. Duplex 20 Amp 120V isolated ground Twist-Lock receptacles shall be standard NEMA L5-20R configuration, 2-pole, 3-wire: Receptacles shall be (2) Hubbell IG2310 in two-gang backbox, or approved equal.
 - c. Simplex 30 Amp 120V isolated ground Twist-Lock receptacles shall be standard NEMA L5-30R configuration, 2-pole, 3-wire: Receptacles shall be Hubbell IG2610, or approved equal
 - d. Simplex 20 Amp 208V isolated ground Twist-Lock receptacles shall be standard NEMA L6-20R configuration, 2-pole, 3-wire: Receptacles shall be Hubbell IG2320, or approved equal

- e. Provide Theatrical Lighting system receptacles and other required wiring devices, complete with associated hardware and wall plates, as specified below and shown on Electrical drawings. Verify cover plate finish color with Architect.
- f. Theatrical lighting system power receptacles "LS"
 - (1) Duplex receptacles shall be standard NEMA 5-20R configuration, 20A/120V 2-pole, 3-wire.
 - (2) Receptacle shall be fed from Lighting Systems "clean power" panel board as shown on drawings or from a general panel board dedicated to feeding similar computerized control electronics.
 - (3) Receptacles shall be Hubbell 5362, or equal.
 - (4) Provide cover plate, labeled "LIGHTING SYSTEM POWER"

2.5 THEATRICAL SYSTEMS CONTROL CABLES

- A. Theatrical Systems Ethernet network shall be Category 5E UTP /100Base TX cabling installed in accordance with all applicable standards including but not limited to IEEE 802.3u standard.
 - 1. Cable runs between hubs shall not exceed 100m. Contractor shall verify run lengths prior to installation.
 - 2. No splices. No exceptions.
 - 3. Contractor shall provide field installation reports verifying that cable installations comply with specifications.
- B. Theatrical Systems Fiber Optic (single-mode fiber back bone) /100Base-FX cabling shall be installed in accordance with all applicable standards including but not limited to IEEE 802.3u standard.
- C. Termination of all control cabling shall be undertaken only under the direct supervision of Theatrical Lighting Manufacturer's authorized field service personnel.

2.6 AV SYSTEM RACEWAY INSTALLATION

- A. General: Proceed as directed under all related sections of Division 26, and as directed below. Should any requirements conflict, the most stringent condition shall apply.
- B. Rigid Conduit, Steel Electrical Metallic Tubing.
 - 1. All AV Systems empty conduit has been sized for wire and cable based on full use of the maximum "40% fill" area of each conduit, per the NEC.
 - 2. Provide ¾" minimum conduit size.
 - 3. Provide a complete, continuous and clean conduit system, as indicated on the drawings, including all conduits, conduit supporting means, all electrical boxes and enclosures, etc., and all connections to terminal cabinets, pull boxes, and AV panels and receptacles.
 - 4. Provide separate and independent conduit systems for AV Systems wire and cable of the following different wiring/conduit groups, as shown on the drawings, without exception:
 - Group A - Microphone Level
 - Group B - Line Level
 - Group C - Video / RF / Communication Level
 - Group D - Loudspeaker Level
 - Group E - Spare (empty conduit only)
 - Group F – Fiber Optic Level
 - 5. Maintain minimum separation required between AV Systems conduit groups, and between all AV Systems, production lighting system control, and AC power conduit as indicated in the separation schedules below.

6. All conduit must be clean and free of burrs, nicks, etc. Ream all conduit ends to prevent damage to cables.
7. Provide a pull box for any conduit run which is greater than 100 feet or which requires more than two 90-degree bends.
8. Provide nylon pull cord in all conduit runs, point to point.
9. All conduit and boxes shall be bonded to the building safety ground as required.
10. All conduit shall be electrically isolated from AV Systems equipment racks to maintain the integrity of the sound system technical isolated ground system. Mechanical conduit connections to equipment racks shall be made with non-conductive fittings.
11. Take the following conduit installation precautions to prevent and guard against electro-magnetic interference (EMI), radio frequency interference (RFI), and electro-static interference:
 1. AV conduit shall not be run through any electrical distribution or transformer rooms, lighting dimmer rooms, mechanical equipment rooms, backstage or engineering "shops," telephone or communication rooms, and computer rooms. No exceptions.
 2. Do not install AV conduit near devices and conduit for incandescent light dimmers, high-density architectural or theatrical dimming systems, and fluorescent or vapor lamp fixtures (including separate lamps and remoted ballasts).
 3. Do not install AV conduit directly parallel and adjacent to any AC power conduit. No exceptions.
 4. AV Systems conduits may only cross AC power conduit at 90-degrees. No exceptions.
 5. Minimum AV Systems conduit separation distances shall be considered most important for all conduit runs over fifty (50) feet. In some instances AV Systems conduit and other conduit may, by necessity, need to be installed closer than the distances indicated on the AV Systems Conduit Separation Schedule. In these cases, the length of closely spaced conduit shall be kept to an absolute minimum, and the frequency of these close spacings in a single run of conduit shall be kept to an absolute minimum. In particular, AV Systems conduit shall not run parallel to any AC power conduit.
 6. Note: For example, if "Group A - Microphone Level" conduit is installed in close proximity to AC power feeder conduit in five locations of 10' each over a total run of 200', the resulting 50' of potential interference in the microphone conduit shall be considered unacceptable.
12. When it is physically impossible to maintain the minimum conduit separation distances for AV Systems conduit, the following special measures shall be taken to ensure adequate shielding from electro-magnetic and radio frequency interference:
 1. For below grade slab conduit runs where the distance between any AV Systems conduit (only) is less than the specified minimum, rigid steel (GRS) conduit shall be substituted for the full run of each affected AV Systems conduit.
 2. For below grade slab conduit runs where the distance between any AV Systems conduit and any AC Power conduit is less than the specified minimum, rigid steel (GRS) conduit shall be substituted for the full run of each affected AV Systems conduit and AC power conduit which is less than the minimum.

2.7 AV SYSTEM LOUDSPEAKER ENCLOSURES

- A. Flush recessed ceiling loudspeaker back box enclosures (supplied by Division 11) shall be installed as shown on the AV drawings and as detailed below:
 1. Loudspeaker enclosures mounted in suspended tile type ceilings: Connect enclosure to intermediate 4" square box in the loudspeaker trunk conduit by a section of flexible conduit (Greenfield). Extend flexible conduit a minimum of 36" beyond loudspeaker location. Use pull box for wiring to adjacent loudspeakers in the same zone.

2. Loudspeaker enclosures mounted in plaster and gypsum board ceilings: Connect loudspeaker enclosure directly to loudspeaker branch conduit by a section of flexible conduit (Greenfield). Extend flexible conduit a minimum of 36" beyond the loudspeaker location. Do not provide intermediate 4" square junction box at these locations.
3. Provide mounting brackets as required for all flush recessed ceiling loudspeaker enclosures. Mounting brackets must support the entire weight of the loudspeaker assembly on the ceiling framing or structure.
4. Loudspeaker enclosures shall not be directly supported from acoustic tile, gypsum board, or plaster ceiling construction. No exceptions.
5. Surface wall mount loudspeaker back box enclosures (supplied by Division 11) shall be installed as shown on the AV drawings and as detailed below:
 1. Wall loudspeaker enclosures shall mount directly to a standard 4" square box. Run conduit down to wall mount volume control directly below loudspeaker enclosure.

2.8 AV PULL BOXES

- A. Provide NEMA Type 1 AV Systems pull boxes as necessary in accordance with the NEC and as indicated on the drawings. Provide pull boxes in accessible areas with removable screw cover.
- B. AV Systems pull boxes may be provided as follows:
 1. Provide separate, individual pull boxes for each AV Systems wiring/conduit group.
 2. Provide one pull box with full size, removable barriers for each AV Systems wiring/conduit group.
 3. Size pull boxes to accommodate the quantity of conduits indicated, per NEC requirements.
 4. Install pull boxes so as to allow complete pulls of AV Systems wire and cable without break or splice.

2.9 AV ELECTRICAL IDENTIFICATION

- A. General: Proceed as directed under all related sections of Division 26, and as directed below.
 1. Provide a coordinated system of labeling and identification for the AV system empty conduit and outlet box system to allow future installation of the AV system by Division 11.
 2. Individual pull cords in conduits shall be clearly and securely tagged at each end with an indelible legend indicating the conduit group and destination of the specific run.

2.10 AV SYSTEMS ISOLATED TECHNICAL GROUND

- A. All components of the AV Systems shall be connected to an independent isolated technical ground. The AV Systems isolated technical ground shall originate separately at the building main service ground and connect through the isolation transformer directly to an insulated ground bus in the main AC power distribution panel.
- B. The AV Systems isolated technical ground and the building safety ground must only be connected at this one point.
- C. The isolated technical ground must not be connected to conduit, neutral, water pipes or other ground sources. Establishing the AV Systems isolated technical ground by connection to steel frame structural members will not be acceptable.
- D. The AV Systems isolated technical ground shall be established in a star configuration that radiates out from the distribution panel to insulated ground busses located at each technical power panelboard and then to uninsulated busses bonded to each equipment rack and to individual isolated ground power receptacles.

- E. All AV Systems isolated technical ground conductors must be insulated, stranded copper cable sized to provide an impedance of 0.1 ohms or less between any point in the system and the main service entrance ground. Provide 3/0 AWG stranded copper welding cable for all isolated ground busbar conductors.
- F. All cable splices must be fully insulated.
- G. All conductors must be contained within metallic conduit.
- H. Each AV Systems equipment rack will be bonded to an internal uninsulated copper busbar provided by Division 11. Where more than one rack forms a group, the busbar from each rack shall be bonded together at one central rack and then connected to the isolated ground conductor to maintain the star configuration. Physically ganging equipment racks together shall not be an acceptable method of bonding to the AV Systems isolated technical ground.
- I. All conduits and raceways entering equipment racks must be insulated from the racks with insulated couplings. All equipment racks must be insulated from the floor and situated so as to not come in contact with any ground items during normal operations.
- J. When the AV Systems isolated technical ground is complete, the Division 26 contractor must prove that it is not grounded at any other point than the main service entry panel. With the power to the system switched off, the contractor shall disconnect the isolated technical ground from the technical ground busbar at the main distribution panel. At this point, an open circuit (greater than 1-megaohm) must be measurable between the AV Systems isolated technical ground and the building safety ground.
- K. Isolated Ground Receptacles
 1. All power receptacles for AV Systems use shall be isolated ground type with an insulated ground wire. Color of receptacle shall be orange. Type as specified herein or as determined by Electrical Engineer.
 2. Power receptacles within racks shall have insulated ground conductors connected to the AV Systems isolated technical ground bus in each rack.
 3. Individual isolated ground power receptacles shall have insulated ground conductors connected to the AV Systems isolated technical ground bus in the branch circuit panelboard from which they are fed.

2.11 AV SYSTEMS EMERGENCY MUTING FROM LIFE SAFETY SYSTEM

- A. Provide relay contact closure from the life safety system to the AV Systems equipment rack. Relay closure shall cause all loudspeaker circuits and other selected audio circuits to be on during "normal" conditions, and muted during "emergency" conditions.
- B. Provide all wiring from the main life safety control center to the equipment racks located in the AV Equipment Rack Room. Provide relay and switching devices and all incidental materials in order to provide the Division 11 AV Contractor with a normally open dry contact closure for connection to the loudspeaker mute circuits. Refer to the AV Systems Drawings.

2.12 AV SYSTEMS CONDUIT ADJACENCY SCHEDULES

- A. Conduits serving circuits for AV Systems wiring groups shall be separated from each other according to the following schedule:

AV Wiring Group	Group A	Group B	Groups C	Group D	Group E	Group F
Group A	Adjacent	6"	12"	12"	6"	Adjacent
Group B	6"	Adjacent	12"	12"	Adjacent	Adjacent
Group C	12"	12"	Adjacent	6"	12"	Adjacent
Group D	12"	12"	6"	Adjacent	12"	Adjacent
Group E	6"	Adjacent	12"	12"	Adjacent	Adjacent
Group F	Adjacent	Adjacent	Adjacent	Adjacent	Adjacent	Adjacent

- B. Conduits serving AV Systems wiring groups shall be separated from conduits serving other uses according to the following schedule:

Wiring Group in Conduit	Group A	Group B	Group C	Group D	Group E	Group F
Electronic Dimmer-Controlled Lighting or Other Electronically Switched Power Services	36"	12"	12"	6"	12"	Adjacent
Convenience Outlet Power Service	12"	6"	6"	Adjacent	6"	Adjacent
All Other Power Services	18"	6"	6"	Adjacent	6"	Adjacent

PART 3 - EXECUTION

Not Used.

END OF SECTION 260961

SECTION 262413 - MAIN SWITCHBOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to this Section.

1.2 SUMMARY

A. The main switchboard shall consist of an incoming cable compartment, utility metering compartment, main circuit breaker section, and circuit breaker distribution section as indicated on the drawings. Main switchboard shall conform to the latest NEMA standards and shall bear UL label.

B. The distribution switchboard shall consist of an incoming cable compartment, main circuit breaker section, and circuit breaker distribution section as indicated on the drawings. Distribution switchboard shall conform to the latest NEMA standards and shall bear UL label.

1.3 REFERENCES

A. The switchboard and overcurrent protection devices shall be designed and manufactured according to the latest revision of the following specifications:

1. Code for Electricity Metering - ANSI/IEEE C12.1
2. Instrument Transformers - ANSI C57.13
3. Molded Case Circuit Breakers - NEMA AB 1, UL 489
4. Enclosed Switches - NEMA KS 1, UL 98
5. Deadfront Distribution Switchboards - NEMA PB 2, UL 891
6. Proper Handling, Installation, Operation and Maintenance of Deadfront Switchboards Rated 600 Volts or less - NEMA PB 2.1
7. Ground Fault Protective Devices - NEMA PB 2.2, UL943
8. Cabinets and Boxes - UL 50
9. Fused Power Circuit Devices - UL 977

1.4 SUBMITTALS

A. Submit the following Shop Drawings and Submittals listed below. Submittals shall indicate conformance with the hereinbefore listed References, or provide certification of meeting those requirements.

1. Catalog Data
2. Detailed Drawings
3. One-Line Diagrams

B. Submit the following Shop Drawings for the main switchboard listed below to the local Power Company for its review and approval. Submittals shall indicate the overall dimensions and construction of the equipment, with particular attention to the utility metering compartment.

1. Catalog Data
2. Detailed Drawings

C. Prior to the providing submittals for switchboards and/or circuit breakers serving

equipment provided under Division 23, the Electrical Contractor is required to coordinate with the electrical requirements as outlined within the "REVIEWED" Division 23 equipment to be furnished and installed. Any electrical cost increase necessary to meet the requirements of the "REVIEWED" equipment, shall be the responsibility of the Contractor furnishing the equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Switchboard shall be QED as manufactured by Square D, Cutler-Hammer, General Electric, and Siemens shall be considered. The TVSS shall be as manufactured by Advanced Protection Technologies, Leviton, or United Power.

2.2 SWITCHBOARD INTERIOR

A. Main switchboard shall consist of an incoming cable compartment, utility metering compartment, main circuit breaker section and circuit breaker distribution section. The switchboard shall be suitable for operation on a 120/208 volts, three phase, four wire, 60 Hertz system with a solidly grounded full size neutral. The switchboard shall have a minimum short circuit rating of 100,000 in RMS symmetrical amps at 208 volts AC maximum.

B. Distribution switchboard shall consist of an incoming cable compartment, main circuit breaker section and circuit breaker distribution section. The switchboard shall be suitable for operation on a 120/208 volts, three phase, four wire, 60 Hertz system with a solidly grounded full size neutral. The switchboard shall have a minimum short circuit rating of 65,000 in RMS symmetrical amps at 208 volts AC maximum.

C. The CT and PT transformer compartment of the main switchboard shall be arranged for mounting transformers furnished by the Power Company. Bus dimensions, connections, and arrangements shall be as required and approved by the Power Company. Compartment doors shall have provisions for installation of Power Company seals.

D. Switchboard bus shall be plated aluminum with plating applied continuously to all bus work. The bussing shall be of sufficient cross-sectional area to meet UL 891 temperature rise requirements. The phase and neutral through-bus shall have an ampacity as shown on the schedules. Bus connections shall be bolted with Grade 5 bolts and conical spring washers, welded connections are not acceptable. Full provisions for the addition of future sections shall be provided. Bussing shall include all necessary hardware to accommodate splicing for future additions.

E. Switchboard ground bus shall be sized per UL 891 Tables 25.1 and 25.2 and shall extend the entire length of the switchboard. Ground bus shall include all necessary hardware to accommodate splicing for future additions.

F. All unused spaces available in the switchboard shall be fully equipped for future devices, including all appropriate connectors and mounting hardware, unless otherwise specified.

2.3 SWITCHBOARD ENCLOSURE

A. The switchboard shall be of deadfront construction with a NEMA Type 1 enclosure with all sections aligned at the rear. The frame shall be of formed UL gauge steel rigidly bolted together to support all cover plates, bussing and component devices.

B. Each switchboard section shall have an open bottom and an individually removable top plate for installation and termination of conduit.

C. The enclosure shall be painted on all exterior surfaces with a medium light gray paint, ANSI #49, applied by the electro-deposition process over an iron phosphate pre-treatment. All front covers shall be screw removable with a single tool and all doors shall be hinged with removable hinge pins.

2.4 MAIN DEVICE SECTION

A. The main device shall be an electronic trip molded case standard function 80% circuit breaker. The circuit breaker shall be fixed and individually mounted in the section. The power terminals shall accommodate either cable or bolted bus connections. The device shall be of the molded case breaker type LX. Frame/Sensor ampere ratings shall be as shown on the schedules.

B. The circuit breaker shall be factory sealed and shall have a date code on the face of the device. Poles shall be labeled with respective phase designations. Circuit breaker handle accessories shall provide provisions for locking handle in the "ON" or "OFF" position.

C. The breaker handle and faceplate shall indicate rated ampacity, and the device shall be equipped with a push-to-trip button to mechanically operate the circuit breaker tripping mechanism. The circuit breaker shall have quick-make, quick-break contacts with an overcenter toggle operating mechanism. Provide local visual trip indicators for overload, short circuit and ground fault trip functions.

D. The electronic trip system shall be a microprocessor-based, peak sensing design. The system shall be independent of any external power source and shall contain electronic components to measure ampacity and time the output from internal current sensors and initiate automatic tripping action.

E. Provide a fixed instantaneous (High Level Selective Override) circuit on the circuit breaker with a defeatable instantaneous adjustment to allow the circuit breaker to remain closed for up to 30 cycles during overcurrents below the RMS symmetrical short time withstand ratings and to trip instantaneously when current levels exceed applicable withstand ratings.

F. The trip system shall include a memory circuit to detect intermittent overcurrent conditions. Provide magnetic/thermal backup for all electronic trip circuit breakers.

G. The circuit breaker shall be UL listed to accept solid and/or stranded copper and aluminum conductors. Lugs shall be suitable for 75 degree C wire, and shall be bolted in place, snap-in designs are not acceptable. Circuit breakers shall be suitable for bus connection, and shall be UL listed to accept field installable/removable mechanical type lugs.

H. Circuit breaker shall be provided with integral equipment protection for grounded systems. The breaker shall be suitable for use on three phase, three wire circuits and three phase, four wire circuits. Provide a separate neutral current transformer for three phase, four wire systems.

I. The ground fault sensing system shall be of the residual type, and shall include a memory circuit for positive tripping action despite intermittent arcing ground faults. Provide an integral means of testing the ground fault system to meet the on-site

requirements of NEC article 230-95(c).

2.6 DISTRIBUTION SECTION

A. The distribution section shall contain thermal magnetic molded case circuit breakers, group mounted on a common pan or rail assembly. Circuit breakers shall be mounted in the switchboard to permit installation, maintenance and testing without reaching over line side bussing.

B. The interior shall have three flat bus bars stacked and aligned vertically with glass reinforced polyester insulators laminated between phases. The molded polyester insulators shall support and provide phase isolation to the entire length of the bus. There shall be one (1) continuous bar per phase; each bus bar having a pair of exposed longitudinal edge portions providing non-specific mounting means for branch circuit breakers.

C. Circuit breakers shall not require additional external mounting hardware. Circuit breakers shall be held in mounted position by a self-contained bracket secured to the mounting pan by fasteners. Each individual circuit breaker shall be capable of being mounted independently. Circuit breakers of different frame sizes shall be capable of being mounted across from each other without means of a common bucket.

D. Circuit breakers shall be Square D Current Limiting interrupting molded case type construction. Ampere ratings and voltage shall be as shown on the drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install main switchboard in accordance with Manufacturer's written instructions, and arranged as indicated on the drawings. Coordinate installation of incoming service conductors and metering with Power Company.

3.2 TESTING AND INSPECTION

A. Perform insulation resistance tests per Manufacturer's written instructions. Minimum insulation resistance shall be 1 megohm.

B. Inspect completed installation for physical damage, proper alignment, anchorage, and grounding. Adjust all operating mechanisms for free mechanical movement per Manufacturer's instructions, and touch up scratched or marred surfaces to match original finish.

END OF SECTION 262413

SECTION 262416 - PANELBOARDS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to this Section.

1.2 SUMMARY

- A. Panelboards shall be circuit breaker type conforming to the latest NEMA standards and shall bear UL label. Panels shall be flush or surface mounted as indicated, and shall have a minimum 20" wide enclosure. A directory, completely typed to identify circuits, with transparent protector shall be provided in each panel.

1.3 REFERENCES

- A. The panelboard(s) and circuit breaker(s) shall be designed and manufactured according to the latest revision of the following specifications:
 - 1. Panelboards - NEMA PB 1.1, UL 67
 - 2. Molded Case Circuit Breakers - NEMA AB 1, Fed. Spec. W-C-375
 - 3. Boxes and Cabinets - UL 50

1.4 SUBMITTALS

- A. Submit the following Shop Drawings and Submittals listed below. Submittals shall indicate conformance with the hereinbefore listed References, or provide certification of meeting those requirements.
 - 1. Catalog Data
 - 2. Detailed drawings indicating dimensions, location of the main, branches and solid neutral, and equipment ratings for voltage, amperage and short circuit. Provide series rating riser diagram and calculations if utilizing series rated equipment.
- B. Prior to the providing submittals for panels and/or circuit breakers serving equipment provided under Division 23, the Electrical Contractor is required to coordinate with the electrical requirements as outlined within the "REVIEWED" Division 23 equipment to be furnished and installed. Any electrical cost increase necessary to meet the requirements of the "REVIEWED" equipment, shall be the responsibility of the Contractor furnishing the equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Panelboards shall be as manufactured by Square D. Panelboards manufactured by Cutler-Hammer, General Electric, or Siemens shall be considered equal.

2.2 PANELBOARD TYPE

- A. Panelboards rated 240 volts AC shall be Square D, Type "NQOD", "NEHB", or "I-Line" as required. Minimum short circuit rating shall be as indicated on the schedules.

2.3 PANELBOARD INTERIOR

- A. Provide one continuous bus bar per phase. Each bus bar shall be suitable for plug-on or bolt-on circuit breakers. Bussing rated 100-400 amps shall be aluminum, all other bussing shall be copper. Panelboards shall be suitable for use as Service Equipment when application complies with UL 67 and NEC 230-F and 230-G.
- B. All current carrying parts shall be insulated from ground and phase-to-phase.
- C. Split solid neutral shall be plated and located in the mains compartment up to 225 amps, so all incoming neutral cables may be the same length. Provide 200% rated plated copper solid neutral for non-linear load applications subject to harmonics as shown on the drawings.
- D. Interior trim shall be of dead-front construction with preformed twist-outs covering unused mounting space.
- E. Metal nameplates shall be secured to dead-front with rivets or screws. Sticker or foil nameplates are not acceptable. Interior wiring diagram, neutral wiring diagram, UL label and short circuit current rating shall be displayed on the interior.
- F. Interiors shall be field convertible for top or bottom incoming feed. Interior leveling provisions shall be provided for flush mounted applications.

2.4 MAIN CIRCUIT BREAKER

- A. Molded case circuit breakers shall have an overcenter, trip-free, toggle mechanism which will provide quick-make, quick-break contact action. Circuit breakers shall have a permanent trip unit with thermal and magnetic trip elements in each pole.
- B. Two and three pole circuit breakers shall have an internal trip crossbar to provide simultaneous tripping. Circuit breakers shall have a push-to-trip button for maintenance and testing purposes.
- C. Breaker handle and faceplate shall indicate rated ampacity. Standard construction circuit breakers shall be UL listed for reverse connection without restrictive line or load markings.
- D. Circuit breaker escutcheon shall have standard ON/OFF markings. Circuit breaker handle accessories shall provide provisions for locking handle in the "ON" or "OFF" position.
- E. Lugs shall be UL listed to accept solid or stranded copper and aluminum conductors. Lugs shall be suitable for 75 degree C rated wire and shall be bolted in place.

2.5 BRANCH CIRCUIT BREAKERS

- A. Branch circuit breakers shall be UL listed with amperage ratings, interrupting ratings, and number of poles as indicated on the schedules. Breakers shall have bolt-on type bus connectors.
- B. Circuit breakers shall have an overcenter toggle mechanism which will provide quick-make, quick-break contact action. Circuit breakers shall have thermal and magnetic trip elements in each pole. Two and three pole circuit breakers shall have an internal common trip crossbar to provide simultaneous tripping.
- C. Single pole 15 and 20 ampere circuit breakers intended to switch fluorescent lighting loads at the panel shall have the SWD marking and shall have lockable provisions.

- D. Two and three pole circuit breakers 15-60 amperes intended for use with air conditioning, heating and refrigeration equipment having motor group combinations and marked as such shall have the HACR marking.
- E. Provide UL Class A ground fault interrupter circuit breakers where scheduled on the drawings.
- F. The exposed faceplates of all branch circuit breakers shall be flush with one another.
- G. Lugs shall be UL listed to accept solid or stranded copper and aluminum conductors. Lugs shall be suitable for 75 degree C wire.

2.6 NEMA TYPE 1 ENCLOSURES

- A. Boxes shall be galvanized steel constructed in accordance with UL 50 requirements. Boxes shall have removable end walls with knockouts located on one end, and welded interior mounting studs. Box width shall be 20" wide minimum.
- B. Trim front steel shall meet requirements of UL 50. Trim fronts shall be 1-piece with door, and mounting shall be as indicated on the schedules.
- C. Panelboards rated 225 amps and below shall have concealed door hinges and trim screws. Front is not removable with the door locked. Panelboards rated above 225 amps shall have fronts with trim clamps and concealed door hinges. Trim front doors shall have rounded corners and edges shall be free of burrs.
- D. Front shall have cylindrical tumbler lock with catch and spring loaded stainless steel door pull. All lock assemblies shall be keyed alike. Two (2) keys shall be provided with each lock. A clear plastic directory card holder shall be mounted on the inside of the door.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install panelboards in accordance with Manufacturer's written instructions, NEMA PB 1.1 and NEC standards.
- B. Panelboards are permitted to be series rated in developing the overall power distribution system, unless otherwise noted on the drawings. Submit riser diagrams and calculations indicating the series rating and conformance with the NEC.
- C. Breaker arrangement shall be as detailed on the plans. Check tightness of bolted connections, and circuit breaker connections using calibrated torque wrench or torque screwdriver per Manufacturer's written specifications.
- D. Room numbers and names shown on the drawings are Architectural designations for identification only during the construction phase. Typed panel directories shall indicate the room numbers and names and connected equipment for each circuit, with the actual room numbers or names assigned by the Owner and/or as designated by the Architect.

END OF SECTION 262416

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to this Section.

1.2 SUMMARY

- A. Provide wiring devices complete with required adapters, wall plates, screws and device rings.

1.3 REFERENCES

- A. Wiring devices and device plates shall conform to the following:
 1. AC Wall Switches - Fed. Spec. WS-896E, UL 20, NEMA WD-1
 2. Duplex and Single Receptacles - Fed. Spec. WC-596F, UL 498, NEMA WD-1, NEMA WD-6
 3. GFCI Receptacles - UL 943 Class A, UL 498, NEMA WD-1, NEMA WD-6
 4. Isolated Ground Receptacles - UL 498, NEMA WD-1
 5. Device Plates - UL-514
 6. Weatherproof Covers - UL Listed (UL File #E-18897, NEMA 3R, NEC 410-57(b))

1.4 SUBMITTALS

- A. Submit the following Shop Drawings and Submittals listed below. Submittals shall indicate conformance with the hereinbefore listed References, or provide certification of meeting those requirements.
 1. Wiring devices
 2. Device plates
 3. Weatherproof cover

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Wiring devices provided on this project shall be by the same Manufacturer and shall be as manufactured by Bryant or equal.

2.2 INDUSTRIAL SPECIFICATION GRADE DEVICES

- A. Ground fault interrupter receptacles shall be molded of impact-resistant thermoplastic material, 20 ampere, 125 volt, 2 pole, 3 wire, and with NEMA 5-20R configuration. Color shall be as selected by the Architect. The receptacles shall incorporate design to be sensitive to fault currents as low as 5 milliamperes from no-load to full-rated load, and a disconnect speed of 0.025 seconds (25 milliseconds). The receptacles shall be capable of withstanding voltage transients of 6000 volts in a ringwave configuration. Silver alloy contacts shall be required for maximum conductivity. Units shall be UL listed Hospital Grade receptacle construction where required. The device shall have dual slot terminal and installation screws and the capability of feed-through GFCI protection to other receptacles on the same circuit when connected in that configuration.

1. GFCI Receptacle

- B. Isolated ground grounding type receptacles shall be 20 ampere, 125 volt, 2 pole, 3 wire, and orange color with NEMA 5-20R configuration. The receptacles shall have a smooth face molded of high-impact thermoplastic nylon. The grounding system shall include an isolated ground circuit with insulated green color steel screw and brass grounding contact mounted in isolated ground shunt. The zinc-plated steel mounted strap with riveted self-grounding clip shall be insulated from the ground contact.

1. Isolated Ground Receptacles

- C. Special devices shall be indicated on the drawings.

2.3 COMMERCIAL GRADE WIRING DEVICES

- A. A.C. switches shall be single pole, double pole, three-way and/or four way as shown on the drawings, back and side wiring, 20 ampere, 120/277 volts. Color shall be selected by the Architect. Switches shall have one piece, copper alloy, rivetless contact arms and silver cadmium oxide contacts. Switch toggle shall be nylon, and have an insulation barrier between interior and yoke. Terminals shall be clamp-type, back and side wired with provision for two solid or stranded wires. One-piece yoke shall be heavy duty steel, zinc plated to resist corrosion, with an integral grounding clip and green grounding screw.

1. Single pole switch
2. Two pole switch
3. Three way switch
4. Four way switch

- B. Duplex grounding type receptacles shall be nylon, 20 ampere, 125 volts, 2 pole, 3 wire, and with NEMA 5-20R configuration. **Color shall be selected by the Architect.** Receptacles shall have a wrap around, full face design, constructed of nylon to resist physical abuse and chemical attack. Yoke shall be heavy duty steel, wrapped around the device and locked in place, zinc plated to resist corrosion. Grounding system shall consist of high performance copper alloy, consisting of double wipe contacts, green terminal screw and grounding strap. Line contacts shall be one-piece, triple wipe, high performance copper alloy with clamp-type terminals, for side wiring, stranded or solid wire.

1. Duplex receptacles

- C. Special devices shall be as indicated on the drawings.

2.4 DEVICE PLATES

- A. Unless otherwise shown on the drawings or herein specified, all plates for wiring devices shall be 0.032" thick stainless steel, satin finish on unfinished walls and smooth nylon on finished walls, as manufactured to suit devices. Color shall be selected by the Architect. Screws shall be metal with countersunk heads, in a color to match the finish of the plate. One piece type device plates shall be provided for all outlets and fittings. Sectional type device plates shall not be allowed.

2.5 OUTDOOR RECEPTACLE COVER

- A. Outdoor receptacle enclosure shall comply with NEC Article 406.8 and shall be clearly marked "suitable for wet locations while in use". There shall be a gasket between the enclosure and the mounting surface, and between the cover and base to assure proper

seal. Outdoor enclosures shall be lockable where the receptacle is accessible to the public.

1. Outdoor receptacle enclosure
2. Rooftop receptacle enclosure

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install wiring devices in accordance with the NEC. Install device plates with all four edges in continuous contact with finished wall surfaces without the use of mats or similar devices. Plaster fillings shall not be allowed. Install plates with an alignment tolerance of 1/16 inch.
- B. Location of wiring devices shall be as indicated on drawings or as directed in field where specific requirements for location are required. Contractor shall verify location of special devices prior to roughing in.
- C. Mounting heights of devices as shown on the drawings shall be from finished floor to the center of the outlet box or device, unless otherwise noted.
- D. Receptacles occurring in outside walls, wet areas or areas designed for wash down such as kitchens and can wash areas shall be GFCI type.
- E. Test each GFCI receptacle for proper polarity and proper operation in accordance with Manufacturer's instructions.
- F. Provide blank device plates for telephone, intercommunication, data and television outlets, unless otherwise indicated.

END OF SECTION 262726

SECTION 262813 - FUSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to this Section.

1.2 SUMMARY

- A. Provide a complete set of fuses for each fusible switch and disconnect switch. Fuses shall have a voltage rating of not less than the circuit voltage.
- B. Do not install fuses until equipment is ready to be energized.

1.3 REFERENCES

- A. The fuses shall be UL Class RK1, J, or L as applicable.

1.4 SUBMITTALS

- A. Submit the following Shop Drawings and Submittals. Submittals shall indicate conformance with the hereinbefore listed References, or provide certification of meeting those requirements.
 - 1. Catalog Data
 - 2. Time-Current Curves
 - 3. Current Limitation Curves
- B. Prior to the providing submittals for fuses serving equipment provided under Division 23, the Electrical Contractor is required to coordinate with the electrical requirements as outlined within the "REVIEWED" Division 23 equipment to be furnished and installed. Any electrical cost increase necessary to meet the requirements of the "REVIEWED" equipment, shall be the responsibility of the Contractor furnishing the equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Fuses shall be time delay current limiting type as manufactured by Bussmann. Should the Contractor wish to furnish substitute materials, the fuse Manufacturer shall provide a complete short circuit and selective coordination study, which shall be submitted with the Shop Drawings.

2.2 MAINS, FEEDERS, AND BRANCH CIRCUITS

- A. Circuits 601 to 6000 amperes shall be protected by UL Class L current limiting Bussmann LOW-PEAK Time-Delay fuses KRP-C(amp)SP. Fuses shall hold 500% of rated current for a minimum of four seconds, clear 20 times rated current in 0.01 seconds or less, and have an interrupting rating of 200,000 amperes RMS symmetrical.
- B. Circuits 0 to 600 amperes shall be protected by Time-Delay UL Class RK1 or UL Class J current limiting Bussmann LOW-PEAK dual-element fuses LPN-RK(amp)SP/LPS-RK(amp)SP or LPJ(amp)SP. The dual-element fuses shall have separate overload and short-circuit elements. Fuses shall hold 500% of rated current for a minimum of ten

seconds (30A, 250V Class RK1 case shall be a minimum of eight seconds), and have an interrupting rating of 200,000 amperes RMS symmetrical.

2.3 MOTOR CIRCUITS

- A. The individual motor circuits with full load ampere ratings (FLA) of 400 amperes or less shall be protected by UL Class RK1, or Class J, dual-element time-delay Bussmann LOW-PEAK dual-element fuses LPN-RK(amp)SP/LPS-RK(amp)SP or LPJ(amp)SP. The following guidelines apply for motors protected by properly sized overload relays: fuses for motors with a marked service factor not less than 1.15 shall be installed in ratings of 125% of motor full load current (or next larger size if 125% does not correspond to a fuse size) except where high ambient temperatures prevail, or where the motor drives a heavy revolving part which cannot be brought up to speed quickly. Under such conditions the fuse may be 150% to 175% of the motor full load current. Larger H.P. motors shall be protected by Bussman LOW-PEAK Time-Delay KRP-C(amp)SP fuses of the ratings shown on the drawings. For all other motors, (such as 1.0 service factor motors) fuses shall be sized in ratings of 115% of the motor full load current (or next larger size if 115% does not correspond to a fuse size) except as noted above. The following guidelines apply where fuses are used as the only overload protection for the motor: For motors with a 1.15 service factor or more, fuses should be sized at 125% of motor full load current (or next smaller size if 125% does not correspond to a fuse size). For other motors, fuses should be sized at 115% of motor full load current (or next smaller size if 115% does not correspond to a fuse size).

2.4 MOTOR CONTROLLERS

- A. NEMA and IEC Style motor controllers shall be protected from short circuits by Bussmann LOW-PEAK dual-element, time-delay fuses, to provide Type 2 coordination for the controller. This level of protection shall allow no damage to the controller, under low and high level fault conditions, as required by IEC Publication 947-4. For IEC Style controllers, the fuses shall be installed in ratings to coordinate with the overload relays, such that the relay/fuse curves crossover at 7-10 times the IEC contactor rating. The fuses shall be LPN-RK(amp)SP/LPS-RK(amp)SP or LPJ(amp)SP.

2.5 CIRCUIT BREAKER PANELS

- A. Circuit breaker panels shall be protected by UL Class RK1, Class J, or Class L Bussmann LOW-PEAK fuses LPN-RK(amp)SP/LPS-RK(amp)SP, LPJ(amp)SP or KRP-C(amp)SP as shown on the drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Final tests and inspections shall occur prior to energizing the equipment. These tests shall include a thorough cleaning, tightening, and review of the electrical connections and inspection of the grounding conductors. The Electrical Contractor shall also verify the voltage rating of the fuse is not less than the circuit voltage.
- B. Install "LOW-PEAK YELLOW" notice labels in the field to alert the Owner of the engineered level of protection of the electrical equipment. Labels shall be marked with the proper fuse rating and placed in a conspicuous location on the enclosure.
- C. Upon final acceptance of the building, provide the Owner with three of each type and rating of installed fuse as spare.

END OF SECTION 262813

SECTION 262816 - DISCONNECT SWITCHES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to this Section.

1.2 SUMMARY

- A. Disconnect switches shall be rated 240 or 600 volts as required with number of poles and current rating as indicated. Switches shall be fused type where indicated and shall conform to applicable NEMA standards.

1.3 REFERENCES

- A. The disconnect switches shall be designed and manufactured according to the latest revision of the following specifications:
 - 1. Enclosed and Dead Front Switches - UL 98, NEMA KS1
 - 2. Enclosures for Electrical Equipment - NEMA 250

1.4 SUBMITTALS

- A. Submit the following Shop Drawings and Submittals listed below. Submittals shall indicate conformance with the hereinbefore listed References, or provide certification of meeting those requirements.
 - 1. Catalog Data
 - 2. Detailed drawings indicating dimensions, and equipment ratings for voltage, amperage, horsepower and short circuit.
- B. Prior to the providing submittals for disconnect switches serving equipment provided under Division 23, the Electrical Contractor is required to coordinate with the electrical requirements as outlined within the "REVIEWED" Division 23 equipment to be furnished and installed. Any electrical cost increase necessary to meet the requirements of the "REVIEWED" equipment, shall be the responsibility of the Contractor furnishing the equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Disconnect switches shall be as manufactured by Square D. Disconnect switches manufactured by Cutler-Hammer, General Electric, or Siemens shall be considered equal.

2.2 SWITCH INTERIOR

- A. Switches shall have switch blades which are visible when the switch is off and the cover is open. All current carrying parts shall be plated to resist corrosion.
- B. General duty switch lugs shall be UL listed for 60 degree C or 75 degree C conductors (30-100 amps), and 75 degree C conductors (200-800 amps).
- C. Heavy duty switch lugs shall be front removable and UL listed for 60 degree C or 75 degree C conductors (30-100 amps), 75 degree C conductors (200-1200 amps),

aluminum or copper conductors. Switches shall have removable arc suppressors to facilitate easy access to line side lugs.

2.3 SWITCH MECHANISM

- A. Switch operating mechanism shall be quick-make, quick-break such that, during normal operation of the switch, the operation of the contacts shall not be capable of being restrained by the operating handle after the closing or opening action of the contacts has started.
- B. The operating handle shall be an integral part of the box, not the cover. Provisions shall be provided for padlocking the switch in the OFF position.
- C. Heavy duty switches shall have a dual cover interlock mechanism to prevent unintentional opening of the switch cover when the switch is ON and prevent turning the switch ON when the cover is open. The cover interlock mechanism shall have an externally operated override but the override shall not permanently disable the interlock mechanism. The tool used to override the cover interlock mechanism shall not be required to enter the enclosure in order to override the interlock.

2.4 SWITCH ENCLOSURES

- A. The enclosure shall be finished with gray baked enamel paint which is electrodeposited on cleaned, phosphate pre-treated steel.
- B. Heavy duty switches shall have covers attached with welded pin-type hinges, with ON and OFF markings stamped into the covers, and a dual colored, red/black position indicator.
- C. Enclosures installed in exterior locations shall be NEMA - 3R.

2.5 SWITCH RATING

- A. The UL short circuit current rating of the switches shall be 200,000 rms symmetrical amps when used with or protected by Class R fuses (30-600 amp switches employing appropriated fuse rejection hardware).

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide NEMA type "GD" or "HD" switches as required. Main disconnect switches, switches rated 600 volts and all fused switches shall be NEMA Type "HD" unless otherwise indicated with Class "R" fuse clips.
- B. Switches shall be horsepower rated when used for motor disconnect means and shall be provided as required by NEC whether indicated or not.
- C. Provide fused switches complete with fuses.
- D. Switches used as service entrance equipment shall be listed and labeled as "Suitable for Use as Service Equipment".
- E. Securely mount switches to wall, structure or equipment. Provide miscellaneous accessories for mounting switches, including steel angles where required.

END OF SECTION 262816

SECTION 263200 - PACKAGED ENGINE GENERATOR

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes packaged engine generator set with the following features and accessories:
 - 1. Battery charger.
 - 2. Day tank.
 - 3. Engine generator set.
 - 4. Muffler.
 - 5. Outdoor enclosure.
 - 6. Remote annunciator.
 - 7. Starting battery.
 - 8. Automatic transfer switch.

1.3 DEFINITIONS

- A. Standby Rating: Power output rating equal to the power the generator set delivers continuously under normally varying load factors for the duration of a power outage, with capability for a minimum overload of 10 percent of the rating for 2 out of 36 continuous operating hours.
- B. Operational Bandwidth: The total variation from the lowest to the highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.
- C. Power Output Rating: Gross electrical power output of generator set minus total power requirements of electric motor-driven cooling fan and pump.
- D. Steady-State Voltage Modulation: The uniform cyclical variation of voltage within the operational bandwidth, expressed in Hz or cycles per second.

1.4 GENERATOR-SET PERFORMANCE, NOMINAL

- A. Steady-State Voltage Operational Bandwidth: 4 percent of rated output voltage from no load to full load.
- B. Steady-State Voltage Modulation Frequency: Less than one Hz.
- C. Transient Voltage Performance: Not more than 10 percent variation for 50 percent step-load increase or decrease. Voltage recovers to remain within the steady-state operating band within 2 seconds.
- D. Steady-State Frequency Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.
- E. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there are no random speed variations outside the steady-state operational

band and no hunting or surging of speed.

- F. Transient Frequency Performance: Less than 2-Hz variation for a 50 percent step-load increase or decrease. Frequency recovers to remain within the steady-state operating band within 3 seconds.
- G. Output Waveform: At no load, harmonic content measured line-to-line or line-to-neutral does not exceed 5 percent total and 3 percent for single harmonics. The telephone influence factor, determined according to NEMA MG 1, does not exceed 50.
- H. Sustained Short-Circuit Current: For a 3-phase, bolted short circuit at the system output terminals, the system will supply a minimum of 250 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to any generator system component.
- I. Temperature Rise of Generator: Within limits permitted by NEMA MG 1 when operating continuously at full-rated load, including 2 hours per 24 hours at 110 percent of rated capacity.
- J. Starting Time: Maximum total time period for a cold start, with ambient temperature at the low end of the specified range, is 5 seconds. Time period includes output voltage and frequency settlement within specified steady-state bands.

1.5 GENERATOR-SET PERFORMANCE, CRITICAL

- A. Oversizing of generator with respect to the rated power output of the engine to meet certain performance requirements below is permissible.
 - 1. Generator Nameplate: For oversized generators, show ratings required by the Contract Documents that are consistent with engine capacity rather than component oversize ratings.
- B. Steady-State Voltage Operational Bandwidth: 2 percent of rated output voltage from no load to full load.
- C. Steady-State Voltage Modulation Frequency: Less than one Hz.
- D. Transient Voltage Performance: Not more than 10 percent variation for 50 percent step-load increase or decrease. Voltage recovers to remain within the steady-state operating band within 0.5 second.
- E. Steady-State Frequency Operational Bandwidth: Plus or minus 0.25 percent of rated frequency from no load to full load.
- F. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there are no random speed variations outside the steady-state operational band and no hunting or surging of speed.
- G. Transient Frequency Performance: Less than 2-Hz variation for a 50 percent step-load increase or decrease. Frequency recovers to remain within the steady-state operating band within 3 seconds.
- H. Output Waveform: At no load, harmonic content measured line-to-neutral does not exceed 2.0 percent total with no slot ripple. The telephone influence factor, determined according to NEMA MG 1, does not exceed 50.

- I. Sustained Short-Circuit Current: For a 3-phase, bolted short circuit at the system output terminals, the system will supply a minimum of 300 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to winding insulation or any other generator system component.
- J. Temperature Rise of Generator: Within limits permitted by NEMA MG 1 when operating continuously at full-rated load, including 2 hours per 24 hours at 110 percent of rated capacity.
- K. Nonlinear Load Performance: System performance is not degraded from that specified in this Article by continuous operation, with full-load current having a minimum total harmonic content of 25 percent RMS, with a minimum single harmonic magnitude of 16 percent RMS.
- L. Starting Time: Maximum total time period for a cold start, with ambient temperature at low end of specified range, is 5 seconds. Time period includes output voltage and frequency settlement within specified steady-state bands.

1.6 SUBMITTALS

- A. Product Data: For each component. Include data on features, components, ratings, and performance. Include dimensioned outline plan and elevation drawings of engine generator set and other system components.
- B. Shop Drawings: Show details of fabrication, piping, wiring, and installation of field-installed portions of system. Include general arrangement drawings showing locations of auxiliary components in relation to engine generator set and duct, piping, and wiring connections between generator set and auxiliary equipment. Show connections, mounting, and support provisions and access and workspace requirements.
 - 1. Wiring Diagrams: Show details of power and control connections and differentiating between factory-installed and field-installed wiring.
- C. Qualification Data: For firms and persons specified in the "Quality Assurance" Article.
- D. Field Test and Observation Reports: Indicate and interpret test results for compliance with performance requirements.
- E. Certified summary of prototype-unit test report.
- F. Certified Test Reports of Components and Accessories: For devices that are equivalent, but not identical, to those tested on prototype unit.
- G. Certified Summary of Performance Tests: Demonstrate compliance with specified requirement to meet critical performance criteria.
- H. Factory Test Reports: For units to be shipped for this Project showing evidence of compliance with specified requirements.
- I. Exhaust Emissions Test Report: To show compliance with applicable regulations.
- J. Sound measurement test report.
- K. Certification of Torsional Vibration Compatibility: Comply with NFPA 110.
- L. Field test report of tests specified in Part 3.

- M. Maintenance data for system and components to include in the maintenance manuals specified in Division 01. Include the following:
 - 1. List of tools and replacement items recommended to be stored at the site for ready access. Include part and drawing numbers, current unit prices, and source of supply.
 - 2. Detail operating instructions for both normal and abnormal conditions.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver engine generator set and system components to their final locations in protective wrappings, containers, and other protection that will exclude dirt and moisture and prevent damage from construction operations. Remove protection only after equipment is safe from such hazards.

1.8 WARRANTY

- A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
- B. Special Warranty: Submit a written warranty signed by Contractor and manufacturer, with single-source responsibility for engine generator and auxiliary components, agreeing to repair or replace items that do not meet requirements or that deteriorate as defined in this Section within the specified warranty period.
- C. Warranty Period: 5 years from date of Substantial Completion.

1.9 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents. Deliver extra materials to Owner.
 - 1. Fuses: 1 for every 10 of each type and rating, but not less than 1 of each.
 - 2. Indicator Lamps: 2 for every 6 of each type used, but not less than 2 of each.
 - 3. Filters: One set each of lubricating oil, fuel, and combustion air filters.

1.10 OPERATION AND MAINTENANCE MANUALS

- A. Provide three (3) operation manuals and turn over to the Owner upon project completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Generator Manufacturer: Subject to compliance with requirements, provide products by: Caterpillar, Inc.; Engine Division.
- B. Transfer Switch Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Conventional Transfer Switches: Caterpillar, Inc.; Engine Division.

2. Transfer Switches Using Molded-Case Switches or Circuit Breakers:
 - a. Eaton Corp.; Westinghouse & Cutler-Hammer Products.
OR
 - b. Lake Shore Electric Corp.

2.2 SERVICE CONDITIONS

- A. Environmental Conditions: Engine generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:
 1. Ambient Temperature: Minus 15 deg C to plus 40 deg C.
 2. Relative Humidity: 0 to 95 percent.
 3. Altitude: Sea level to 1000 feet.
- B. Unusual Service Conditions: Engine generator equipment and installation is required to operate in the following conditions:
 1. Seismic risk zone 4 location as defined in the Uniform Building Code.

2.3 ENGINE GENERATOR

- A. Furnish a coordinated assembly of compatible components.
- B. Ratings: Voltage, frequency, and power output ratings of system are as indicated.
- C. Output Connections: 3 phase, 4 wire.
- E. Safety Standard: Comply with ASME B15.1.
- F. Nameplates: Each major system component is equipped with a conspicuous nameplate of component manufacturer. Nameplate identifies manufacturer of origin and address, and model and serial number of item.
- G. Resistance to Seismic Forces: Supports for internal and external components, and fastenings for batteries, wiring, and piping are designed to withstand static or anticipated seismic forces, or both, in any direction. For each item, use a minimum force value equal to weight of item.
- H. Limiting dimensions indicated for system components are not exceeded.
- I. Power Output Rating: Nominal ratings as indicated, with capacity as required to operate as a unit as evidenced by records of prototype testing.
- J. Skid: Adequate strength and rigidity to maintain alignment of mounted components without dependence on a concrete foundation. Skid is free from sharp edges and corners. Lifting attachments are arranged to facilitate lifting with slings without damaging any components.
- K. Rigging Diagram: Inscribed on a metal plate permanently attached to skid. Diagram indicates location and lifting capacity of each lifting attachment and location of center of gravity.

2.4 ENGINE

- A. Comply with NFPA 37.

- B. Fuel: Diesel fuel oil grade DF-2.
- C. Maximum Engine Speed: 1800 rpm.
- D. Maximum Piston Speed for 4-Cycle Engines: 2250 fpm.
- E. Lubrication System: Pressurized by a positive-displacement pump driven from engine crankshaft. The following items are mounted on the engine or skid:
 - 1. Filter and Strainer: Rated to remove 90 percent of particles 5 microns and smaller while passing full flow.
 - 2. Oil Cooler: Maintains lubricating oil at manufacturer's recommended optimum temperature throughout 2 hours of operation of generator set at 110 percent of system power output rating.
 - 3. Thermostatic Control Valve: Controls flow in system to maintain optimum oil temperature. Unit is capable of full flow and is designed to be fail-safe.
 - 4. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without the use of pumps or siphons or special tools or appliances.
- F. Engine Fuel System: Comply with NFPA 30. System includes the following:
 - 1. Integral Injection Pumps: Driven by engine camshaft. Pumps are adjustable for timing and cylinder pressure balancing.
 - 2. Main Fuel Pump: Mounted on engine. Pump ensures adequate primary fuel flow under starting and load conditions.
 - 3. Parallel Fuel Oil Filters: Ahead of injection pumps. Changeover valves allow independent use of either filter.
 - 4. Relief/Bypass Valve: Automatically regulates pressure in fuel line and returns excess fuel to source.
- G. Jacket Coolant Heater: Electric-immersion type, factory installed in jacket coolant system. Unit is rated and thermostatically controlled to maintain an engine temperature of 102.6 deg F at the low end of the ambient temperature range specified in "Environmental Conditions" Paragraph above.

2.5 GOVERNOR

- A. Type: Adjustable isochronous type, with speed sensing.

2.6 ENGINE COOLING SYSTEM

- A. Description: Closed loop, liquid cooled, with radiator factory mounted on engine generator-set skid and integral engine-driven coolant pumping.
- B. Radiator: Horizontal air discharge. Unit is rated for specified coolant.
 - 1. Radiator Core Tubes: Nonferrous-metal construction other than aluminum.
 - 2. Size of Radiator: Adequate to contain expansion of total system coolant from cold start to 110 percent load condition.
 - 3. Fan: Driven by multiple belts from engine shaft.
- C. Coolant: Solution of 50 percent ethylene glycol and 50 percent water.
- D. Expansion Tank: Constructed of welded steel plate and equipped with gage glass and

petcock. Capacity is as indicated.

- E. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer. Features include the following:
 - 1. Thermostatic Elements: Interchangeable and nonadjustable.
 - 2. Actuator Design: Normally open valves to return to open position when actuator fails.
- F. Coolant Hose: Flexible assembly with nonporous rubber inside surface and aging, ultraviolet, and abrasion-resistant fabric outer covering.
 - 1. Rating: 50-psig maximum working pressure with 180 deg F coolant, and non-collapsible under vacuum.
 - 2. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.
- G. Coolant piping external to engine generator set is as specified in Division 23 Section "Hydronic Piping."

2.7 FUEL SUPPLY SYSTEM

- A. Comply with NFPA 30 and NFPA 37.
- B. Base-Mounted Fuel Oil Tank: Factory-installed and -piped, listed and labeled fuel oil tank. Features include the following:
 - 1. Tank level indicator.
 - 2. Capacity: Fuel for 36 hours of continuous operation at 100 percent rated power output.
 - 3. Vandal-resistant fill cap.

2.8 FUEL OIL STORAGE

- A. Comply with NFPA 30.
- B. Base-Mounted Fuel Oil Tank: Factory installed and piped, complying with UL 142 fuel oil tank. Features include the following:
 - 1. Tank level indicator.
 - 2. Capacity: Fuel for 36 hours' continuous operation at 100 percent rated power output.
 - 3. Vandal-resistant fill cap.
 - 4. Containment Provisions: Comply with requirements of authorities having jurisdiction.
 - 5. Containment: Integral rupture basin with a capacity of 150 percent of nominal capacity of day tank.
 - a. Leak Detector: Locate in rupture basin and connect to provide audible and visual alarm in the event of day-tank leak.

2.9 ENGINE EXHAUST SYSTEM

- A. Muffler: Residential type, sized as recommended by engine manufacturer. Measured sound level, according to the Diesel Engine Manufacturers Association's "DEMA Test Code for the Measurement of Sound from Heavy-Duty Reciprocating Engines" at a distance of 10 feet from the exhaust discharge, is 95 dBA or less.

- B. Condensate Drain for Muffler: Schedule 40, black steel pipe connected to muffler drain outlet through a petcock.
- C. Connections from Engine to Exhaust System: Flexible section of corrugated stainless-steel pipe.
- D. Connection from Exhaust Pipe to Muffler: Stainless-steel expansion joint with liners.

2.10 STARTING SYSTEM

- A. Description: 12-V electric, with negative ground and including the following items:
 1. Components: Sized so they will not be damaged during a full engine-cranking cycle with ambient temperature at maximum specified in "Environmental Conditions" Paragraph above.
 2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
 3. Cranking Cycle: 60 seconds.
 4. Battery complies with SAE J537 and has adequate capacity within ambient temperature range specified in "Environmental Conditions" Paragraph above to provide specified cranking cycle at least twice without recharging.
 5. Battery Cable: Size as recommended by generator set manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.
 6. Battery Compartment: Factory fabricated of metal with acid-resistant finish and thermal insulation. Thermostatically controlled heater is arranged to maintain battery above 10 deg C regardless of external ambient temperature within range specified in "Environmental Conditions" Paragraph above. Include accessories required to support and fasten batteries in place.
 7. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage-regulation and 35-A minimum continuous rating.
 8. Battery Charger: Current-limiting, automatic-equalizing and float-charging type. Unit complies with UL 508 and includes the following features:
 - a. Operation: Equalizing-charging rate of 10 A is initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit then automatically switches to a lower float-charging mode and continues operating in that mode until battery is discharged again.
 - b. Automatic Temperature Compensation: Adjusts float and equalizes voltages for variations in ambient temperature from minus 40 deg C to plus 60 deg C to prevent overcharging at high temperatures and undercharging at low temperatures.
 - c. Automatic Voltage Regulation: Maintains output voltage constant regardless of input voltage variations up to plus or minus 10 percent.
 - d. Ammeter and Voltmeter: Flush mounted in door. Meters indicate charging rates.
 - e. Safety Functions: Include sensing of abnormally low battery voltage arranged to close contacts providing low battery voltage indication on control and monitoring panel. Also include sensing of high battery voltage and loss of ac input or dc output of battery charger. Either of these conditions closes contacts that provide a battery charger malfunction indication at system control and monitoring panel.
 - f. Enclosure and Mounting: NEMA 250, Type 1, wall-mounted cabinet.

2.11 CONTROL AND MONITORING

- A. Functional Description: Switching on-off switch on the generator control panel to the on position starts the generator set. The off position of the same switch initiates generator-set shutdown. When the generator set is running, specified system or equipment failures or derangements automatically shut down the generator set and initiate alarms. Operation of a remote emergency-stop switch also shuts down the generator set.
- B. Configuration: Operating and safety indications, protective devices, basic system controls, and engine gages are grouped on a common control and monitoring panel mounted on the generator set. Mounting method isolates the control panel from generator-set vibration.
- C. Indicating and Protective Devices, and Controls: Include the following:
1. Ac voltmeter.
 2. Ac ammeter.
 3. Ac frequency meter.
 4. Dc voltmeter (alternator battery charging).
 5. Engine-coolant temperature gage.
 6. Engine lubricating-oil pressure gage.
 7. Running-time meter.
 8. Ammeter-voltmeter, phase-selector switch or switches.
 9. Generator-voltage adjusting rheostat.
 10. Start-stop switch.
 11. Overspeed shutdown device.
 12. Coolant high-temperature shutdown device.
 13. Coolant low-level shutdown device.
 14. Oil low-pressure shutdown device.
 15. Fuel tank high-level shutdown of fuel supply alarm.
- D. Supporting Items: Include sensors, transducers, terminals, relays, and other devices, and wiring required to support specified items. Locate sensors and other supporting items on engine, generator, or elsewhere as indicated. Where not indicated, locate to suit manufacturer's standard.
- E. Connection to Data Link: A separate terminal block, factory wired to Form C dry contacts, for each alarm and status indication is reserved for connections for data link transmission of indications to remote data terminals. Data system connections to terminals are covered in another Section.
- F. Common Remote Audible Alarm: Signal the occurrence of any of the events listed below without differentiating between different event types. Locate audible device and silencing means where indicated. Connect so that after an alarm is silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset.
1. Engine high-temperature shutdown.
 2. Lube-oil low-pressure shutdown.
 3. Overspeed shutdown.
 4. Remote emergency-stop shutdown.
 5. Engine high-temperature prealarm.
 6. Lube-oil low-pressure prealarm.
 7. Fuel tank low level.
 8. Overcrank shutdown.
 9. Coolant low-temperature alarm.
 10. Control switch not in auto position.
 11. Battery-charger malfunction alarm.

12. Battery low-voltage alarm.

- G. Remote Alarm Annunciator: Comply with NFPA 99. Labeled LEDs identify each alarm event. Common audible signal sounds for alarm conditions. Silencing switch in face of panel silences signal without altering visual indication. Connect so that after an alarm is silenced, clearing initiating condition will reactivate alarm until silencing switch is reset. Cabinet and faceplate are surface- or flush-mounting type to suit mounting conditions indicated.
- H. Remote Emergency-Stop Switch: Flush wall-mounted, unless otherwise indicated and prominently labeled. Push button is protected from accidental operation.

2.12 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

- A. Comply with NEMA MG 1 and specified performance requirements.
- B. Drive: Generator shaft is directly connected to engine shaft. Exciter is rotated integrally with generator rotor.
- C. Electrical Insulation: Class H or Class F.
- D. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required.
- E. Construction prevents mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.
- F. Excitation uses no slip or collector rings, or brushes, and is arranged to sustain generator output under short-circuit conditions as specified.
- G. Enclosure: Drip-proof.
- H. Instrument Transformers: Mounted within generator enclosure.
- I. Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified.
 - 1. Adjusting rheostat on control and monitoring panel provides plus or minus 5 percent adjustment of output voltage operating band.
- J. Strip Heater: Thermostatically controlled unit arranged to maintain stator windings above dew point.
- K. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.
- L. Subtransient Reactance: 12 percent, maximum.

2.13 OUTDOOR GENERATOR-SET ENCLOSURE

- A. Description: Vandal-resistant, weatherproof steel housing, wind resistant up to 100 mph. Multiple panels are lockable and provide adequate access to components requiring maintenance. Panels are removable by one person without tools. Instruments and control are mounted within enclosure.
- B. Description: Prefabricated enclosure with the following features:

1. Construction: Galvanized steel, metal-clad on concrete pad.
 2. Louvers: Equipped with insect/rodent screen and filter arranged to permit air circulation when engine is not running while excluding exterior dust and rodents.
 3. Hinged Doors: With padlocking provisions.
 4. Ventilation: Louvers equipped with insect/rodent screen and filter arranged to permit air circulation while excluding exterior dust and rodents.
 5. Finish: 2-coat enamel finish over cleaned and primed surfaces.
- C. Muffler Location: Within enclosure.
- D. Louvers: Fixed-engine cooling air inlet and discharge. Louvers prevent entry of rain and snow.
- E. Automatic Dampers: At engine cooling air inlet and discharge. Dampers are closed to reduce enclosure heat loss in cold weather when unit is not operating.
- F. Convenience Outlets: Factory wired. Arrange for external circuit supply.

2.14 FINISHES

- A. Outdoor Enclosures: Manufacturer's standard enamel over corrosion-resistant pretreatment and compatible standard primer.

2.15 SOURCE QUALITY CONTROL

- A. Factory Tests: Include prototype testing and Project-specific equipment testing (testing of equipment manufactured specifically for this Project).
- B. Prototype Testing: Performed on a separate engine generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.
1. Tests: Conform to those required for Level 1 energy converters in paragraphs 3.2.1, 3.2.1.1, and 3.2.1.2 of NFPA 110.
 2. Components and Accessories: Items furnished with installed unit that are not identical to those on tested prototype have been tested to demonstrate compatibility and reliability.

2.16 GENERAL TRANSFER-SWITCH PRODUCT REQUIREMENTS

- A. Units Smaller than 600 A: Listed without derating for all classes and all mixtures of classes of loads, including 100 percent tungsten filament lamp or 100 percent inductive load.
- B. Tested Fault-Current Closing and Withstand Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated based on testing according to UL 1008.
1. Where External Circuit Breaker or Fuses Protect Transfer Switch: Products are listed for use with the actual devices providing the fault-current protection at each location for Project. Rated fault-current, withstand-duration times include the following:
 - a. Units Protected by Molded-Case Circuit Breakers 150 A and Less: 1.5 cycles.
 - b. Units Protected by Molded-Case Circuit Breakers Larger than 150 A: 3

- c. Units Protected by Power and Insulated-Case Circuit Breakers: 10 cycles.
 - d. Units Protected by Current-Limiting Fuses: 0.5 cycles (nominal).
- 2. Where Transfer Switch Includes Internal Protection: Rating of switch and trip unit combination exceeds indicated fault-current value at installation location.
- C. Annunciation and Control Interface Components: Devices at transfer switches for communicating with remote annunciators or annunciator and control panels have communications capability matched with the remote device.
- D. Solid-State Controls: Repetitive accuracy of all settings is plus or minus 2 percent or better over an operating temperature range of minus 68 deg F to 158 deg F.
- E. Resistance to Damage by Voltage Transients: Components meet or exceed voltage-surge withstand capability requirements when tested according to ANSI C37.90.1. Components meet or exceed voltage-impulse withstand test of NEMA ICS 1.
- F. Neutral Terminal: Where 2- or 3-pole switches are indicated, provide fully rated, solid, unswitched neutral terminal, unless otherwise indicated.
- G. Four-Pole Switches: Where 4-pole switches are indicated, provide neutral switching.
- H. Oversize Neutral: Ampacity and switch rating of neutral path through units indicated for oversize neutral shall be double the nominal rating of the circuit in which the switch is installed.
- I. Enclosures: General-purpose NEMA 250, Type 1, complying with NEMA ICS 6; UL 508, unless otherwise indicated.
- J. Heater: Equip switches exposed to outdoor temperature and humidity conditions, and other units indicated, with an internal heater. Provide thermostat within enclosure to control heater.
- K. Factory Wiring: Train and bundle factory wiring and label consistent with Shop Drawings, either by color code or by numbered or lettered wire and cable tape markers at terminations.
 - 1. Designated Terminals: Pressure type suitable for types and sizes of field wiring indicated.
 - 2. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.
 - 3. Control Wiring: Equipped with lugs suitable for connection to terminal strips.
- L. Electrical Operation: Accomplish by a nonfused, momentarily energized solenoid or electric motor-operated mechanism, mechanically and electrically interlocked in both directions.
- M. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.
 - 1. Limitation: Switches using molded-case switch or insulated-case circuit-breaker components and switches using contactors not designed for continuous-duty repetitive switching between active power sources are not acceptable.
 - 2. Switch Action: Double throw; mechanically held in both directions.

3. Switch Contacts: Silver composition for load current switching. Conventional automatic transfer-switch units rated 225 A and greater have separate arcing contacts.

2.17 AUTOMATIC TRANSFER SWITCH

- A. Comply with Level 1 equipment according to NFPA 110.
- B. Comply with NFPA 20 for fire-pump transfer switches.
- C. Switching Arrangement: Double-throw type, incapable of pauses or intermediate position stops during normal functioning, unless otherwise indicated.
- D. Manual Switch Operation: Manually operated under load, with the door closed, and with either or both sources energized. Transfer time is the same as for electrical operation. Control circuit automatically disconnects from electrical operator during manual operation.
- E. Signal-before-Transfer Contacts: A set of normally open/normally closed dry contacts operates in advance of retransfer to normal source. Interval is adjustable from 1 to 30 seconds.
- F. Digital Communications Interface: Full-duplex RS 422 type, matched to capability of remote annunciator or annunciator and control panel.
- G. Transfer Switches Based on Molded-Case Switch Components: Comply with UL 489, UL 869, and NEMA AB 1.
- H. Automatic Transfer Switches for Large-Motor Loads: Where indicated, include factory-wired, internal, in-phase monitor relay. The relay controls transfer to occur when the 2 sources are synchronized in phase. The relay compares phase relationship and frequency difference between the normal and emergency sources and initiates transfer when both sources are within 15 electrical degrees, and only if transfer can be completed within 60 electrical degrees. In-phase transfer is initiated only if both sources are within 2 Hz of nominal frequency and 70 percent or more of nominal voltage.
- I. Automatic Transfer Switches for Large-Motor Loads: Where indicated, include factory-wired, internal, motor-control undervoltage and timing relays. Relays control designated starters to disconnect motors before transfer and reconnect them selectively at adjustable time intervals after transfer. Control connection to motor starters is through wiring external to the automatic transfer switch. Time delay for individual motor loads is adjustable between 1 and 60 seconds, and settings are as indicated. Relay contacts handling motor-control circuit inrush and seal currents are rated for actual currents to be encountered.
- J. Automatic Transfer Switches for Large-Motor Loads: Where indicated, operator has a programmed neutral position arranged to provide a midpoint between the 2 working switch positions, with an intentional, time-controlled pause at the midpoint during transfer. The pause is adjustable from 0.5 to 30 seconds minimum and factory set at 0.5 second, unless otherwise indicated. Time delay occurs for both transfer directions.

2.18 AUTOMATIC TRANSFER-SWITCH FEATURES

- A. Voltage sensing for each phase of normal source. Pickup voltage is adjustable from 85 to 100 percent of nominal, and dropout voltage is adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.

- B. Time delay for override of normal-source voltage sensing delays transfer and engine start signals. Adjustable 0 to 6 seconds and factory set at 1 second.
- C. Voltage/Frequency Lockout Relay: Prevents premature transfer to an emergency generator set. Pickup voltage is adjustable from 85 to 100 percent of nominal. Factory set to pickup at 90 percent. Pickup frequency is adjustable from 90 to 100 percent of nominal. Factory set to pickup at 95 percent.
- D. Time Delay for Retransfer to Normal Source: Adjustable from 0 to 30 minutes and factory set at 10 minutes. Provides automatic defeat of the delay on loss of voltage or sustained undervoltage of the emergency source, provided normal supply has been restored.
- E. Test Switch: Simulates normal-source failure.
- F. Switch-Position Pilot Lights: Indicate source to which load is connected.
- G. Source-Available Indicating Lights: Supervise sources via the transfer-switch, normal- and emergency-source sensing circuits.
 - 1. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
 - 2. Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."
- H. Unassigned Auxiliary Contacts: 2 normally open single-pole, double-throw contacts for each switch position, rated 10 A at 240 V, ac.
- I. Transfer Override Switch: Overrides automatic retransfer control so automatic transfer switch will remain connected to emergency power source regardless of the condition of the normal source. A pilot light indicates override status.
- J. Engine Starting Contacts: 1 isolated, normally closed and 1 isolated, normally open. Contacts are gold flashed or gold plated and rated 10 A at 32 V, dc minimum.
- K. Engine Shutdown Contacts: Time delay adjustable from 0 to 5 minutes; factory set at 5 minutes. Initiates shutdown at remote engine-generator controls after retransfer of load to normal source.
- L. Engine-Generator Exerciser: Solid-state, programmable-time switch starts engine-generator set and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods are adjustable from 10 to 30 minutes. Factory-set periods are for 7 days, 20 minutes, and 5 minutes, respectively. Exerciser features include the following:
 - 1. Exerciser Transfer Selector Switch: Permits selection between exercise with and without load transfer.
 - 2. Push-button programming control with digital display of settings.
 - 3. Integral battery operation of time switch when normal control power is not available.

2.19 FINISHES

- A. Enclosures: Manufacturer's standard enamel over corrosion-resistant pretreatment and primer.

2.20 SOURCE QUALITY CONTROL

- A. Factory Test Components, Assembled Switches, and Associated Equipment: Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Maintain minimum workspace around components according to manufacturer's Shop Drawings and National Electrical Code.

3.2 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Provide services of a factory-authorized service representative to supervise installation and connection of unit and to report results in writing.
- B. Supervised Adjusting and Pretesting: Under supervision of factory-authorized service representative, pretest all system functions, operations, and protective features. Provide all instruments and equipment required for tests. Adjust to ensure operation is according to Specifications. Load system using a variable resistive and reactive load bank simulating kW, and power factor of loads for which unit is rated.
- C. Tests: Engage an independent testing agency to perform tests on completion of installation of system. Use instruments bearing records of calibration within the last 12 months, traceable to National Institute for Standards and Technology standards, and adequate for making positive observation of test results. Include the following:
 - 1. International Electrical Testing Association Tests: Perform each visual and mechanical inspection and electrical and mechanical test stated in International Electrical Testing Association's NETA ATS for emergency engine generator sets. Certify compliance with test parameters.
 - 2. Battery Tests: Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery. Verify acceptance of charge for each element of battery after discharge. Verify measurements are within manufacturer's specifications.
 - 3. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.
 - 4. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine generator system before and during system operation. Check for air, exhaust, and fluid leaks.
 - 5. Exhaust System Back-Pressure Test: Use a manometer with a scale exceeding 40 inches of water. Connect to exhaust line close to engine exhaust manifold. Verify that back pressure at full-rated load is within manufacturer's written allowable limits for the engine.
 - 6. Exhaust Emissions Test: Conform to applicable government test criteria.
 - 7. Voltage and Frequency Transient Stability Tests: Use recording oscilloscope to measure voltage and frequency transients for 50 and 100 percent step-load increases and decreases and verify that performance is as specified.
 - 8. Harmonic-Content Tests: Measure harmonic content of output voltage under 25 percent and at 100 percent of rated linear load. Verify that harmonic content is

within specified limits.

- D. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.

3.3 CLEANING

- A. Upon completion of installation, inspect system components. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish. Clean components internally using methods and materials recommended by manufacturer.

3.4 DEMONSTRATION

- A. Training: Engage a factory-authorized service representative to demonstrate adjustment, operation, and maintenance of system and to train Owner's maintenance personnel as specified below.
 1. Conduct a minimum of 8 hours of training as specified in Division 01 Section "Closeout Procedures."
 2. Schedule training with at least 7 days' advance notice.

3.5 COMMISSIONING

- A. Battery Equalization: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.

3.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Engage a firm experienced in manufacturing equipment of types and capacities similar to those indicated for this Project and with a service center maintained by engine generator set manufacturer capable of providing training, parts, and emergency maintenance and repairs at the Project site with 4 hours' maximum response time.
- B. Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct testing indicated with delaying the Work as evaluated according to criteria contained in ASTM E 699.
- C. Source Limitations: Obtain engine generator set and auxiliary components from a single manufacturer with responsibility for entire system. Furnish a representative product built from components that have proven reliable and compatible with each other and are coordinated to operate as a unit as evidenced by records of prototype testing.
- D. Listing and Labeling: Provide system components of types and ratings for which listing or labeling service is established and components specified in this Section that are listed and labeled.
 1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.
 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.
- E. Comply with NFPA 70.
- F. Comply with NFPA 99.

- G. Engine Exhaust Emissions: Comply with applicable state and local government requirements.
- H. Comply with NFPA 110 requirements for a Level 2 emergency power supply system.
- I. Engine Exhaust Emissions: Comply with applicable state and local government requirements.

3.7 MAINTENANCE SERVICE

- A. Maintenance: Beginning at Substantial Completion, provide 12 months' full maintenance by skilled employees of the manufacturer's designated service organization. Include quarterly exercising to check for proper, starting, load transfer, and running under load. Include routine preventive maintenance as recommended by manufacturer and adjusting as required for proper operation. Provide parts and supplies as used in the manufacture and installation of original equipment.

END OF SECTION 263200

SECTION 264313 - TVSS DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to this Section.

1.2 SUMMARY

- A. These specifications describe the electrical and mechanical requirements for a hybrid, high energy, 200,000 amp or 400,000 amp class suppression filter system that integrates Transient Voltage Surge Suppression (TVSS) with high frequency electrical line noise filtering for high exposure applications.
- B. Operating voltage shall be (480/277, 3 phase) or (120/208, 3 phase).
- C. UL 1449 2nd Edition Rating shall be (800 volts at 480) or (400 volts at 208).

1.3 REFERENCES

- A. The specified unit shall be designed, manufactured, tested and installed in compliance with the following standards:
 - 1. ANSI/IEEE C62.41-1991 and C62.45-1987;
 - 2. ANSI/IEEE C62.1 and C62.11;
 - 3. ANSI/IEE C62.33-1982;
 - 4. Canadian Standards Association (CSA);
 - 5. Federal Information Processing Standards Publication 94 (FIPS PUB 94);
 - 6. National Electrical Manufacturers Association; (NEMA LS1-1992 Guidelines);
 - 7. National Fire Protection Association (NFPA 70 NEC, 75, and 78);
 - 8. Underwriters Laboratories (UL 1449 Second Edition 1283);
 - 9. Underwriters Laboratories (UL 489 and 198).

1.4 SUBMITTALS

- A. Submit the following Shop Drawings and Submittals listed below. Submittals shall indicate conformance with the hereinbefore listed References, or provide certification of meeting those requirements.
 - 1. Product Information.
 - 2. Category C3 Independent Clamp Voltage Test Results.
 - 3. UL 1449 Clamp Voltage Documentation.

PART 2 - PRODUCTS

2.1 SERVICE ENTRANCE

- A. The unit shall include an engineered solid-state high performance suppression system utilizing arrays of non-linear voltage dependent metal oxide varistors with similar operating characteristics. The suppression system shall incorporate field-replaceable fusing and modular replaceable TVSS modules. All internal wiring associated with the suppression filter system and subject to surge currents shall utilize low-impedance copper bus bar and/or #2 AWG copper conductor or larger. The unit shall include redundant long-life, solid state, externally and internally visible LED status indicators that monitor the on-line

status of each phase of the unit. The unit shall include diagnostic switches allowing easy on-line diagnostic testing verifying the operational integrity of the units suppression filter system. Standard surface-mounted units shall be provided in a NEMA 12 type enclosure of 14 gauge steel, painted inside and out. In order to monitor on-line status, the unit shall include Form C dry contacts (N.O. or N.C.), transient surge counter and audible alarm. The unit shall include a high accurate, solid state, six (6) digit, liquid crystal display. Unit shall incorporate an audible alarm with silence switch to indicate failure of any TVSS circuit. The Disturbance Counters shall utilize self-contained lithium batteries with a nominal life of ten (10) years. System shall carry a ten year warranty.

1. Single Pulse Surge Current Capacity Testing:
 - a. Line to Ground 200 Ka
 - b. Line to Neutral 200 Ka
 - c. Neutral to Ground 200 Ka
 - d. Certified documentation of the units Single Pulse Surge Current Capacity Testing shall be available upon request.
2. Surge Current Fuse Testing: This unit shall be surge tested with fusing in series to verify that a surge of maximum surge current is fully suppressed. This testing shall also verify that, in the event of fuse failure, the full magnitude of the event shall be suppressed prior to this failure.

B. Each suppression element shall be individually fused such that the failure of a single component or the operation of a single fuse element remains isolated and does not render the entire mode or product deficient by more than 10%.

C. The device shall be capable of withstanding the full single pulse surge current capacity for every mode without the operation or failure of overcurrent/fault current protection of fuses.

2.2 SECONDARY PANELBOARD

A. The unit shall include an engineered solid-state high performance suppression system utilizing arrays of non-linear voltage dependent metal oxide varistors with similar operating characteristics. The suppression system shall incorporate internal fusing. The unit shall include long-life, solid state externally visible LED status indicators that monitor the on-line status of each phase of the unit. Standard surface-mounted units shall be provided in NEMA 1 Type enclosure. In order to monitor on-line status, the unit shall include Form C dry contacts (N.O. or N.C.) and audible alarm. System shall carry a ten (10) year warranty.

1. Single Pulse Surge Current Capacity Testing:
 - a. Line to Ground 100 Ka
 - b. Line to Neutral 100 Ka
 - c. Neutral to Ground 100 Ka
 - d. Certified documentation of the units Single Pulse Surge Current Capacity Testing shall be available upon request.
2. Surge Current Fuse Testing: This unit shall be surge tested with fusing in series to verify that a surge of maximum surge current is fully suppressed. This testing shall also verify that, in the event of fuse failure, the full magnitude of the event shall be suppressed prior to this failure.

B. Each suppression element shall be individually fused such that the failure of a single component or the operation of a single fuse element remains isolated and does not render the entire mode or product deficient by more than 10%.

C. The device shall be capable of withstanding the full single pulse surge current capacity for every mode without the operation or failure of overcurrent/fault current protection of fuses.

PART 3 - EXECUTION

3.1 INSTALLATION OF SUPPRESSORS

- A. Install suppressors as close as practical to the Electrical panel or electronic equipment to be protected, consistent with available space. Suppressors shall be close nipped to the device being protected in a position near the neutral bus which will minimize lead length between suppressor and the buses or control breaker to which the suppressor connects. Suppressor leads shall not extend beyond the suppressor Manufacturer's recommended maximum lead length without specific approval of the Engineer.
- B. Install suppressors in a neat, workmanlike manner that allows simple replacement. Lead dress shall be as short and as straight as possible and be consistent with recommended industry practices for the system on which these devices are installed.
- C. Provide a supplemental ground at the bonding connections between the bonding bus or ground plane for each equipment cluster and other locations as indicated herein shall be accomplished using #6 AWG core copper conductor and approved connections referenced to a common earth ground.
- D. Install suppressor with a means of disconnecting the suppressor at the panel. At the main service entrance location, provide a dedicated 30 amp, 3 pole circuit breaker, minimum 100,000 A.I.C. for the TVSS device. At distribution secondary and/or subpanels location, provide dedicated 20 amp or 30 amp, 3 pole circuit breaker for the TVSS device. Label disconnect or circuit breaker "surge protector". Fused disconnects may be substituted for the circuit breaker with the approval of the Engineer.

END OF SECTION 264313

SECTION 265000- LIGHTING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to this Section.

1.2 SUMMARY

- A. Lighting fixtures shall be provided complete with lamps, mounting hardware, accessories, etc., and shall be approved before installation. Lamps shall meet the requirements of the Energy Policy Act of 1992.

1.3 REFERENCES

- A. Lighting fixtures, ballasts and lamps shall conform to the following:
 1. Fluorescent Lighting Fixtures - UL 1570, NEMA LE 4
 2. Lampholders for Fluorescent Lamps - UL 542
 3. Electronic Ballasts for Fluorescent Lamps - ANSI C82.11, ANSI C62.41, FCC Part 18 (Class A) for EMI and RFI, UL listed (Class P, Type 1, Outdoor)
 4. Ballasts for Fluorescent Lamps - ANSI C82.1, UL 935
 5. HID Lighting Fixtures - UL 1572, NEMA LE 4
 6. Ballasts for HID Lamps - ANSI C82.4, UL 1029

1.4 SUBMITTALS

- A. Submit the following Shop Drawings and Submittals listed below. Submittals shall indicate conformance with the hereinbefore listed References, or provide certification of meeting those requirements.
 1. Lighting Fixtures
 2. Photometric reports based on I.E.S. testing procedures
 3. Coefficient of Utilization Tables
 4. Lamps
 5. Ballasts and Warranty Information
- B. Furnish written warranties and manufacturer's wiring diagrams for the electronic ballasts, which shall carry a minimum three-year warranty, including labor allowance for the entire three year warranty period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Fixtures indicated shall be UL approved for the particular installation. Fixture types shown on the drawings are indicative of the general type desired and are not intended to restrict selection to fixtures of any particular manufacturer. Fixtures of similar designs and equivalent energy efficiency, light-distribution and brightness characteristics, and of equal finish and quality will be acceptable if approved.
- B. Shop Drawings shall clearly indicate lighting fixture Manufacturer, catalog numbers, type and number of lamps, operating voltage, type of mounting and any required options as indicated on the drawings and in the schedules.

- C. Lamps shall be as manufactured by General Electric, type as indicated on the schedules. Lamps manufactured by OSRAM-Sylvania or Phillips shall be considered equal.
- D. Electronic ballasts shall be Triad Octic type as manufactured by MagneTek. Ballasts manufactured by Advance, Motorola or Valmont shall be considered equal.
- E. Electromagnetic ballasts shall be as manufactured by MagneTek Triad. Ballasts manufactured by Advance, Motorola or Valmont shall be considered equal.

2.2 FLUORESCENT FIXTURES

- A. Fluorescent fixtures shall be constructed so as to limit the ballast case temperature to 90 degrees Celsius, when installed in an ambient temperature of 104 degrees Fahrenheit.
- B. For fluorescent fixtures on the exterior of the building or in unheated spaces, provide zero degree low temperature ballasts.

2.3 HID FIXTURES

- A. Recessed HID fixtures shall be thermally protected and shall be so identified. Where fixtures, whether recessed or otherwise, are operated by remote ballasts, the ballasts shall also be thermally protected.

2.4 LAMPS

- A. T8 fluorescent lamps shall be operational on either rapid start, instant start or cathode cutout types of ballasts rated for T8 lamps. T8 lamps shall have a color temperature of 3500 degrees Kelvin.
- B. T5 fluorescent biax lamps shall be instant start type with a color temperature of 3500 degrees Kelvin.
- C. T4 fluorescent lamps shall be double biax type with 4-pin base and shall be operational on electronic or dimming ballasts. T4 lamps shall have a color temperature of 3500 degrees Kelvin.

2.5 FLUORESCENT BALLASTS

- A. Electromagnetic ballasts shall be CBM approved, energy-saving with a power factor above 90%. Lamp current crest factor shall be less than 1.7 and total harmonic distortion shall be less than 32%. Ballast shall be UL listed Class "P" with a Class "A" sound rating.
- B. Electronic ballasts shall operate lamps at a frequency of 20 kHz or higher with no detectable flicker. Ballasts shall be instant start with a power factor above 95%, a ballast factor below 92%, and a ballast efficacy of 1.7, or less. Lamp current crest factor shall be less than 1.6, and total harmonic distortion shall be less than 10%. Ballast circuit shall be parallel operation, such that if one lamp becomes inoperative in the fixture, it shall not affect operation of the remaining lamps.
- C. Electronic dimming ballasts shall operate lamps at a frequency of 20 kHz or higher with no detectable flicker. Ballasts shall have power factor above 98%, a lamp current crest factor of less than 1.5 and total harmonic distortion of less than 10%. Ballasts shall have Class "A" sound rating and provide continuous dimming from 100-10% light output. Control wiring and interface for the dimming ballast shall be per manufacturers requirements.

2.6 HID BALLASTS

- A. HID ballasts shall be of the core and coil type, with a constant wattage autotransformer circuit type. Where this circuit type is not available, circuit type shall be high reactance-high power factor. Where HID fixtures are located in interior spaces, ballasts shall be encapsulated.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to the Architectural reflected ceiling plans for exact locations of fixtures in the ceiling. The Contractor's attention is also directed to coordination with sprinkler heads and mechanical equipment. Where recessed lighting fixtures are indicated, this Contractor shall be responsible for coordinating the type fixtures with the actual ceiling being installed. This shall include changes resulting from alternate bid items, change orders, etc.
- B. Install surface mounted fluorescent lighting fixtures independent of ceiling construction. Fluorescent lighting fixtures mounted in or on a plaster ceiling shall also be mounted independent of ceiling construction. When recessed fluorescent lighting fixtures occur in lay-in tile or concealed spline ceilings, the Electrical Contractor shall install a support hanger at each of the four corners of the fixture and fasten these hangers to the structure above the ceiling, so as to support fixtures independently of ceiling. Hanger wires shall be galvanized carbon steel wire, 12 gauge minimum. Do not support fixtures from the steel roof deck, the ceiling, or the ceiling support wires.
- C. Do not place insulation within three inches of recessed lighting fixtures, unless fixtures are listed as suitable for direct contact with insulation.
- D. Provide a minimum of visual comfort probability (VCP) in accordance with IES LM-42 method in media centers and instructional spaces. The brightness ratio shall not exceed 3 to 1 in any area.

END OF SECTION 265000

SECTION 283000 - FIRE ALARM SYSTEM

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to this Section.

1.2 SUMMARY

- A. Furnish all labor, material, tools, and equipment necessary for and incidental to the installation and test of a fully supervised manual and automatic addressable fire alarm system as described herein. All equipment shall be listed by Underwriters Laboratories for fire alarm use and approved by Factory Mutual.
- B. The fire alarm system shall be the standard design of a single supplier. All components used shall be cross-listed for use with the system as selected by the Owner. All components shall be supplied by the same Manufacturer, and shall be compatible with the existing fire alarm system, as required.

1.3 REFERENCES

- A. Fire alarm system and components shall conform to the following:
 - 1. NFPA 70
 - 2. NFPA 72
 - 3. NFPA 72E
 - 4. NFPA 72G
 - 5. NFPA 72H
 - 6. NFPA 241
 - 7. UL 164
 - 8. UL 268
- B. All equipment shall be listed as power limited by Underwriters Laboratories, Inc. or approved by Factory Mutual. The fire alarm system in its entirety shall be in compliance with all applicable fire and electrical codes. Accessory components as required shall be catalogued by the Manufacturer and UL listed to operate with the Manufacturer's control panel and other fire alarm equipment. All equipment shall be approved prior to installation by the local fire inspection official and by the Local Authority Having Jurisdiction (LAHJ).

1.4 SUBMITTALS

- A. Submit the following Shop Drawings and Submittals listed below. Submittals shall indicate conformance with the hereinbefore listed References, or provide certification of meeting those requirements.
 - 1. Control Panel / Cabinet
 - 2. Peripheral Devices-Initiating
 - 3. Peripheral Devices-Signaling
 - 4. Peripheral Devices-Auxiliary
 - 5. Batteries with Calculations
 - 6. Point-to-point CAD drawings
 - 7. Graphic Annunciator
 - 8. Narrative of the Construction Process

- B. Submit fire alarm equipment supplier qualifications indicating years in business, service policies, warranty definitions, and a list of similar installations. No system shall be considered unless there is a locally staffed office offering parts and service within a 50 mile radius of the job site.
- C. Submit installer qualifications indicating years in business and prior experience with installations that include the type of equipment that is to be supplied.

1.5 RELATED WORK SPECIFIED ELSEWHERE

- A. Sprinkler water flow switches, tamper switches, post indicator valve, and bell shall be furnished and installed by the Plumbing Contractor, but wired and connected by the Electrical Contractor. The Electrical Contractor shall review the Plumbing and/or Sprinkler documents for requirements.
- B. Duct smoke detectors shall be installed by the Mechanical Contractor, but furnished, wired and connected to the fire alarm system by the Electrical Contractor.

1.6 WARRANTY

- A. The Contractor shall warrant the completed fire alarm system wiring and equipment to be free from inherent mechanical and electrical defects for a period of one (1) year from the date of the complete and certified test or from the date of first beneficial use.
- B. The Equipment Manufacturer shall make available to the Owner a maintenance contract proposal to provide a minimum of two (2) inspections and tests per year in compliance with NFPA-72H guidelines.

PART 2 - PRODUCTS

2.1 SYSTEM DESIGN

- A. Furnish and install a fully operational and functional addressable fire detection system. The system shall be electrically supervised against opens and grounds on both station and signal wiring. Opens and grounds shall cause a trouble bell to sound at the control panel until manually silenced by the trouble bell silencing switch and shall not cause a false alarm to be sounded. Basic power supply for the system shall be 120 volts AC supplied from the emergency power system. Operation of all system components shall be 25 volts DC furnished by step down transformers and rectifiers within the control panel. The system shall allow for loading or editing special instructions and operation sequences as required. Software operations shall be stored in non-volatile programmable memory. Loss of primary and secondary power shall not erase the instructions stored in memory.
- B. The sequence of operation shall be that actuation of any manual or automatic sensors shall cause:
 - 1. All building alarm devices to sound.
 - 2. Appropriate zone annunciators to annunciate.
 - 3. Operate outputs to release magnetically held smoke doors.
 - 4. Operate outputs to signal the elevator recall functions.
 - 5. Operate outputs to signal shut-down of ventilation equipment.
- C. Pressing the appropriate acknowledge button shall acknowledge any alarm or trouble condition. After the points have been acknowledged, the LED's shall glow steady and the panel audible signal will be silenced.

- D. The System Reset button shall be used to return the system to its normal state after an alarm condition has been remedied. Should the alarm condition continue to exist, the system will remain in an abnormal state.

2.2 CONTROL PANEL

- A. The control panel shall be of the fully modular type with all necessary control modules for system operation. The cabinet shall be constructed of code gauge steel with latch and cylinder type lock, and shall be semi-recessed mounted.
- B. Provide control modules, device alarm modules, signal modules, power supply module, automatic dual-rate battery charger and sealed, rechargeable type, electrolyte battery within the control panel.

2.3 PERIPHERAL DEVICES - INITIATING

- A. Manual stations shall be non-code type, located as shown on the drawings. Stations shall be semi-flush and remain mechanically locked until manually reset. Mount stations with the base at four feet above finished floor and no more than five feet from any door, measured horizontally.
- B. Smoke detectors shall be photoelectric type, operating on the photodiode, light scattering principle, and listed to UL 268. The sensor shall contain a flashing red LED for visual supervision which goes steady in alarm conditions, and a functional test switch. Provide detector bases as required to operate on 24 volts DC and allow complete functioning of the detector with the selected fire alarm system.
- C. Detectors in ducts shall be photoelectric type and listed by UL for duct installation. Duct detectors shall be provided with approved duct housing, mounted exterior to the duct, and shall be provided with perforated sampling tubes extending across the width of the duct. Activation of duct detectors shall cause actuation of the fire alarm control panel in the same manner as other alarm initiating devices and in addition, cause all air handling units to be deactivated. The detector shall operate with a nominal line voltage of 24 volts DC and shall be provided with indicating lamp and test switch.
- D. Heat detectors shall be of the combination rate-of-rise and fixed temperature type. Sensors shall be listed to UL 268 and shall be suitable for ceiling installations. The sensor shall contain a flashing red LED for visual supervision which goes steady in alarm conditions. Provide detector bases as required to operate on 24 volts DC and allow complete functioning of the detector with the selected fire alarm system.

2.4 PERIPHERAL DEVICES - SIGNALING

- A. Audio/visual devices shall be combination electronic horn and xenon flash tube strobe indicator. Sound levels shall be between 96 db and 103 db, and lamps shall produce a minimum of 15 candela at a flash rate of one flash per second with higher candela ratings as required. The unit shall be self rimmed and not require trim kit for semi-flush mount. The device shall be semi-flush mounted on a 4 inch square back box.
- B. Visual devices shall be a xenon flash tube strobe indicator. The lamp shall produce a minimum of 15 candela at a flash rate of one flash per second with higher candela ratings as required. The unit shall be self rimmed and not require trim kit for semi-flush mount. The device shall be semi-flush mounted on a 4 inch square back box.
- C. Exterior horns shall be flush mounted and UL listed for use in wet locations. Sound levels shall be between 96 db and 103 db.

2.5 PERIPHERAL DEVICES, AUXILIARY

- A. Door magnets shall be wall mounted, semi-flush, electro-magnetic device, 24 volts DC.

2.6 FIRE CONTROL COMMUNICATOR

- A. The Fire Control Communicator shall be Silent Knight Model 5104 and shall provide the following functional criteria:
 - 1. The digital communicator shall transmit the fire alarm and supervisory signals to a central station. The digital communicator shall be UL or FM listed for fire reporting to a central station and shall conform to the requirements of NFPA 71.
 - 2. The digital communicator shall be installed in a slave configuration and receive 24 volt DC power from the UL listed fire alarm control panel. The communicator shall have provisions for connecting an N.O. alarm contact signal and an N.C. trouble contact signal.
 - 3. The control/communicator shall have the capacity to supervise two telephone lines, seize the phone line and send the alarm signal on one or both lines without the addition of any more equipment. It shall sound a local trouble signal if the telephone service is interrupted for longer than 45 seconds and it shall transmit a signal indicating the loss of phone line service to the central station over the remaining phone line. A signal shall also be transmitted indicating the restoration of phone service. The control/communicator shall be able to report the loss of either phone line without regard to which phone line failed first. If both lines fail, a local signal shall sound.
 - 4. The control/communicator shall have the ability to send a test signal to the central station every 24 hours. The test signal shall be able to be transmitted at a specific time of day or night by setting a program within the panel.
 - 5. The communicator shall be able to transmit all signals in the Standard SIA format (Security Industry Association).
- B. Field Programming: Provide the Silent Knight Model 5230 remote alphanumeric annunciator in order to perform field programming of the Model 5104 Communicator. System programming is stored in a non-volatile EEPROM chip which shall be reprogrammable hundreds of times.

2.7 SPARE PARTS

- A. Provide each of the following listed devices as spare parts to the Owner:
 - 1. Two of each manual station
 - 2. Two of each smoke detector base
 - 3. Two of each smoke detector head
 - 4. Two of each heat detector
 - 5. Three spare keys to the fire alarm panel

2.8 WIRING

- A. The Contractor shall furnish and install in accordance with NEC (Section 70 of NFPA) and Manufacturer's instructions, all wiring, raceways, conduit and outlet boxes required for the erection of a complete system as described herein and as shown on the drawings. All wiring shall be installed in metallic conduit and of the approved type for fire alarm use. Wire and cable shall be UL listed and a minimum of 18 AWG or as required by local codes and the LAHJ. A consistent color code shall be used throughout and all wires shall be tagged at all junction points between conductors. Final connections between control

equipment and the wiring system shall be made under direct supervision of a representative of the Manufacturer. Raceways containing conductors identified as "Fire Protective Alarm System" conductors shall not contain any other conductors and no AC or audio current carrying conductors shall be allowed in the same raceway with the D.C. fire alarm detection and signaling conductors.

2.9 FIRE ALARM REMOTE ANNUNCIATOR

- A. Remote annunciator shall be flush mounted. Remote annunciators shall have identical functionality and operation as the built-in annunciator. The annunciator must have an 80-character LCD display and must feature five LEDs for: General Alarm, Supervisory, System Trouble, System Silence, and System Power.
- B. All controls and programming keys are silicone Mechanical type with tactile and audible feedback. Keys have a travel of .404 inches. No membrane style buttons will be permissible.
- C. The annunciator must be able to silence and reset alarms through the use of a code entered on the annunciator keypad or by using a firefighter's key. The annunciator must have two levels of user codes that will limit the operating system programming to authorized individuals. The control panel must allow all annunciators to accommodate multiple user input simultaneously.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. All wires shall be tagged at all junction points and at connections to equipment. Wire markers shall be of the taped band type of permanent material and shall be suitable and permanently stamped with the proper identification. The markers shall be attached in a manner that will not permit accidental detachment. Wiring shall test free from opens, grounds, and short circuits. Final connections between equipment and the wiring system shall be made under the supervision of a representative of the Manufacturer.
- B. Installation of the Fire Control Communicator shall be in strict compliance with Manufacturer's recommendations. Consult Manufacturer for all wiring diagrams, schematics, sizes, outlets, etc. before installing conduits and pulling wire.
- C. Wiring for the fire alarm system shall be laid out in the most convenient form for this installation, and all such wiring shall be shown on the as-built drawings which are required under this Division of the specifications. A wiring diagram shall be mounted inside the door of the fire alarm control panel.
- D. Provide two copies of completed instructions covering the operation and maintenance of the installed system, including circuit drawings and wiring diagrams of the system as actually installed, including as-built building alarm wiring. A complete list of part numbers and names, together with the name of the Manufacturer, shall be included in each manual.
- E. All equipment shall be held firmly in place. Fastening and supports shall be adequate to support the loads with a safety factor of five.
- F. Addressable devices connected to the fire alarm system shall be identified at the control panel by the room numbers assigned by the Owner. The room numbers shown on the drawings are for reference only.

3.2 TESTS AND REPORTS

- A. Final Acceptance: The system will be accepted only after a satisfactory test of the entire system has been accomplished by a factory-trained distributor in the presence of a representative of the Authority Having Jurisdiction and Owner's Representative.
- B. Provide 3 sets of Owner's Operation and Maintenance manuals to the Architect.
- C. On-Site Services: Provide the on-site services of an authorized technical representative of the Manufacturer to supervise all connections and fully test all devices and components of the system as installed. Instruct Owner's representative in the proper use and testing of the system.

END OF SECTION 283000

SECTION 312000 - EARTHWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes, but is not limited to, the following:
 - 1. Preparing subgrades for slabs-on-grade, walks, pavements, lawns, and plantings.
 - 2. Excavating and backfilling for buildings and structures.
 - 3. Drainage course for slabs-on-grade.
 - 4. Subbase course for concrete walks and pavements.
 - 5. Excavating and backfilling trenches within building lines.
 - 6. Excavating and backfilling trenches for buried mechanical and electrical utilities and pits for buried utility structures.
- B. Related Sections include, but are not limited to, the following:
 - 1. Division 01 Section "Temporary Facilities and Controls."
 - 2. Division 03 Section "Cast-in-Place Concrete" for granular course over vapor retarder.
 - 3. Division 22, 23 and 26 Sections for excavating and backfilling buried mechanical and electrical utilities and buried utility structures.
 - 4. Division 32 Section "Turf and Grasses" for finish grading, including placing and preparing topsoil for lawns and plantings.

1.3 DEFINITIONS

- A. Backfill: Soil materials used to fill an excavation.
 - 1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
 - 2. Final Backfill: Backfill placed over initial backfill to fill a trench.
- B. Base Course: Layer placed between the subbase course and asphalt paving.
- C. Bedding Course: Layer placed over the excavated subgrade in a trench before laying pipe.
- D. Borrow: Satisfactory soil imported from off-site for use as fill or backfill.
- E. Drainage Course: Layer supporting slab-on-grade used to minimize capillary flow of pore water.
- F. Excavation: Removal of material encountered above subgrade elevations.
 - 1. Additional Excavation: Excavation below subgrade elevations as directed by Architect. Additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
 - 2. Bulk Excavation: Excavations more than 10 feet in width and pits more than 30 feet in either length or width.
 - 3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

- G. Fill: Soil materials used to raise existing grades.
- H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- I. Subbase Course: Layer placed between the subgrade and base course for asphalt paving, or layer placed between the subgrade and a concrete pavement or walk.
- J. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.
- K. Utilities include on-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.4 SUBMITTALS

- A. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:
 - 1. Classification according to ASTM D 2487 of each on-site or borrow soil material proposed for fill and backfill.
 - 2. Laboratory compaction curve according to ASTM D 698 for each on-site or borrow soil material proposed for fill and backfill.

1.5 QUALITY ASSURANCE

- A. Geotechnical Testing Agency Qualifications: An independent testing agency qualified according to ASTM E 329 to conduct soil materials and rock-definition testing, as documented according to ASTM D 3740 and ASTM E 548.

1.6 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Architect and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify Architect not less than two days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Architect's written permission.
 - 3. Contact utility-locator service for area where Project is located before excavating.
- B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

- B. Satisfactory Soils: ASTM D 2487 soil classification groups GW, GP, GM, SW, SP, and SM, or a combination of these group symbols; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
- C. Unsatisfactory Soils: ASTM D 2487 soil classification groups GC, SC, ML, MH, CL, CH, OL, OH, and PT, or a combination of these group symbols.
 - 1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
- D. Backfill and Fill: Satisfactory soil materials.
- E. Subbase: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2- inch sieve and not more than 12 percent passing a No. 200 sieve.
- F. Base: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.
- G. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
- H. Bedding: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.
- I. Drainage Fill: Washed, narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2- inch sieve and 0 to 5 percent passing a No. 8 sieve.
- J. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1- inch sieve and 0 to 5 percent passing a No. 4 sieve.
- K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. Protect subgrades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.
- C. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.2 DEWATERING

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

- B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
 - 1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
 - 2. Install a dewatering system to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

3.3 EXPLOSIVES

- A. Explosives: Do not use explosives.

3.4 EXCAVATION, GENERAL

- A. Unclassified Excavation: Excavation to subgrade elevations regardless of the character of surface and subsurface conditions encountered, including rock, soil materials, and obstructions.
 - 1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
- B. Classified Excavation: Excavation to subgrade elevations classified as earth and rock. Rock excavation will be paid for by adjusting the Contract Sum according to unit prices included in the Contract Documents.
 - 1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation.

3.5 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. Extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
 - 1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated cross sections, elevations, and grades.

3.7 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
 - 1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.
- B. Excavate trenches to uniform widths to provide a working clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.
 - 1. Clearance: 12 inches on each side of pipe or conduit.
- C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels

of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

1. For pipes and conduit less than 6 inches in nominal diameter and flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
2. For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tamped sand backfill.
3. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

D. Trench Bottoms: Excavate trenches 4 inches deeper than bottom of pipe elevation to allow for bedding course. Hand excavate for bell of pipe.

1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

3.8 APPROVAL OF SUBGRADE

A. Notify Architect when excavations have reached required subgrade.

B. If Architect determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

1. Additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

C. Proof roll subgrade with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof roll wet or saturated subgrades.

D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect.

3.9 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill may be used when approved by Architect.

1. Fill unauthorized excavations under other construction or utility pipe as directed by Architect.

3.10 STORAGE OF SOIL MATERIALS

A. Stockpile borrow materials and satisfactory excavated soil materials. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.11 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, dampproofing, waterproofing, and perimeter insulation.
2. Surveying locations of underground utilities for record documents.
3. Inspecting and testing underground utilities.
4. Removing concrete formwork.

5. Removing trash and debris.
6. Removing temporary shoring and bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

3.12 UTILITY TRENCH BACKFILL

- A. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- B. Backfill trenches excavated under footings and within 18 inches of bottom of footings; fill with concrete to elevation of bottom of footings.
- C. Provide 4-inch thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase.
- D. Place and compact initial backfill of subbase material, free of particles larger than 1 inch, to a height of 12 inches over the utility pipe or conduit.
 1. Carefully compact material under pipe haunches and bring backfill evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of utility system.
- E. Coordinate backfilling with utilities testing.
- F. Fill voids with approved backfill materials while shoring and bracing, and as sheeting is removed.
- G. Place and compact final backfill of satisfactory soil material to final subgrade.
- H. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.13 FILL

- A. Preparation: Remove vegetation, topsoil, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface before placing fills.
- B. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- C. Place and compact fill material in layers to required elevations as follows:
 1. Under grass and planted areas, use satisfactory soil material.
 2. Under walks and pavements, use satisfactory soil material.
 3. Under steps and ramps, use engineered fill.
 4. Under building slabs, use engineered fill.
 5. Under footings and foundations, use engineered fill.

3.14 MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill layer before compaction to within 2 percent of optimum moisture content.
 1. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

2. Remove and replace, or scarify and air-dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.15 COMPACTION OF BACKFILLS AND FILLS

- A. Place backfill and fill materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- C. Compact soil to not less than the following percentages of maximum dry unit weight according to ASTM D 698:
 1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill material at 95 percent.
 2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill material at 92 percent.
 3. Under lawn or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill material at 85 percent.

3.16 GRADING

- A. General: Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
 1. Provide a smooth transition between adjacent existing grades and new grades.
 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
 1. Lawn or Unpaved Areas: Plus or minus 1 inch.
 2. Walks: Plus or minus 1 inch.
 3. Pavements: Plus or minus 1/2 inch.
- C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.17 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.
- B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.
- C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.

- D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
 - 1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. or less of paved area or building slab, but in no case fewer than three tests.
 - 2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for each 100 feet or less of wall length, but no fewer than two tests.
 - 3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for each 150 feet or less of trench length, but no fewer than two tests.
- E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

3.18 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
 - 1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
 - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.

3.19 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.
- B. Disposal: Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Architect.
 - 1. Remove waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION 312000

SECTION 313116 - TERMITE CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes, but is not limited to, soil treatment with termiticide.
- B. Related Sections include, but are not limited to:
 - 1. Division 06 Section "Rough Carpentry" for wood preservative treatment by pressure process.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of termite control product. Include the EPA-Registered Label for termiticide products.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For termite control products, from manufacturer.
- B. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner's records and include the following:
 - 1. Date and time of application.
 - 2. Moisture content of soil before application.
 - 3. Termiticide brand name and manufacturer.
 - 4. Quantity of undiluted termiticide used.
 - 5. Dilutions, methods, volumes used, and rates of application.
 - 6. Areas of application.
 - 7. Water source for application.
- C. Warranties: Sample of special warranty.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A specialist who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment and products in jurisdiction where Project is located.
- B. Regulatory Requirements: Formulate and apply termiticides and termiticide devices according to the EPA-Registered Label.
- C. Source Limitations: Obtain termite control products from single source from single manufacturer.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with requirements of the EPA-Registered Label and requirements of authorities having jurisdiction.

- B. Coordinate soil treatment application with excavating, filling, grading, and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs before construction.

1.7 WARRANTY

- A. Soil Treatment Special Warranty: Manufacturer's standard form, signed by Applicator and Contractor, certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOIL TREATMENT

- A. Termiticide: Provide an EPA-Registered termiticide, complying with requirements of authorities having jurisdiction, in an aqueous solution formulated to prevent termite infestation. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to product's EPA-Registered Label.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. BASF Corporation, Agricultural Products; Termidor.
 - b. Bayer Environmental Science; Premise 75.
 - c. FMC Corporation, Agricultural Products Group; Dragnet FT, Talstar, or Prevail.
 - d. Syngenta; Demon TC, Prelude, or Probuild TC.
 - 2. Service Life of Treatment: Soil treatment termiticide that is effective for not less than five years against infestation of subterranean termites.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of soil per termiticide label requirements, interfaces with earthwork, slab and foundation work, landscaping, utility installation, and other conditions affecting performance of termite control.
- B. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparation before beginning application of termite control treatment. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations.
- B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended in writing by termiticide manufacturer.
 - 1. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.

3.3 APPLICATION, GENERAL

- A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.

3.4 APPLYING SOIL TREATMENT

- A. Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute treatment evenly.
 - 1. Slabs-on-Grade: Underground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
 - 2. Foundations: Adjacent soil, including soil along the entire inside perimeter of foundation walls; around plumbing pipes and electric conduit penetrating the slab; around interior column footers and piers; and along the entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.
 - 3. Masonry: Treat voids.
 - 4. Penetrations: At expansion joints, control joints, and areas where slabs will be penetrated.
- B. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.
- C. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.
- D. Post warning signs in areas of application.
- E. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

END OF SECTION 313116

SECTION 321400 - UNIT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes, but is not limited to:
 1. Brick pavers set in aggregate setting beds.
 2. Aluminum edge restraints.
 3. Cast-in-place concrete edge restraints.

1.3 PRECONSTRUCTION TESTING

- A. Preconstruction Adhesion and Compatibility Testing: Submit to latex-additive manufacturer, for testing as indicated below, samples of paving materials that will contact or affect mortar and grout that contain latex additives.
 1. Use manufacturer's standard test methods to determine whether mortar and grout materials will obtain optimum adhesion with, and will be nonstaining to, installed pavers and other materials constituting paver installation.

1.4 ACTION SUBMITTALS

- A. Product Data: For materials other than water and aggregates.
- B. Product Data: For the following:
 1. Pavers.
 2. Edge restraints.
- C. Adhesion and Compatibility Test Reports: From latex-additive manufacturer for mortar and grout containing latex additives.
- D. Sieve Analyses: For aggregate setting-bed materials, according to ASTM C 136.
- E. Samples for Verification:
 1. Full-size units of each type of unit paver indicated.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of unit paver, joint material, and setting material from single source with resources to provide materials and products of consistent quality in appearance and physical properties.
- B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- C. Preinstallation Conference: Conduct conference at Project site.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store pavers on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Store liquids in tightly closed containers protected from freezing.
- E. Store asphalt cement and other bituminous materials in tightly closed containers.

1.7 PROJECT CONDITIONS

- A. Cold-Weather Protection: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace unit paver work damaged by frost or freezing.

PART 2 - PRODUCTS

2.1 BRICK PAVERS

- A. Regional Materials: Provide brick pavers that have been manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.
- B. Brick Pavers: Heavy vehicular paving brick; ASTM C 1272. Provide brick without frogs or cores in surfaces exposed to view in the completed Work.
 - 1. Basis of Design Manufacturer: Pine Hall Brick.
 - 2. Thickness: 2-3/4".
 - 3. Face Size: 4 by 8 inches.
 - 4. Color: English Edge Red.
- C. Efflorescence: Brick shall be rated "not effloresced" when tested according to ASTM C 67.
- D. Temporary Protective Coating: Precoat exposed surfaces of brick pavers with a continuous film of a temporary protective coating that is compatible with brick, mortar, and grout products and can be removed without damaging grout or brick. Do not coat unexposed brick surfaces; handle brick to prevent coated surfaces from contacting backs or edges of other units. If, despite these precautions, coating does contact bonding surfaces of brick, remove coating from bonding surfaces before setting brick.

2.2 CURBS AND EDGE RESTRAINTS

- A. Aluminum Edge Restraints: Manufacturer's standard L-Shaped 1/8" thick x 1-5/8" high, extruded-aluminum edging with loops pressed from face to receive stakes at 12 inches o.c., and aluminum stakes 12 inches long for each loop.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brickstop Corporation.
 - b. Curv-Rite, Inc.
 - c. Permaloc Corporation.

d. Sure-loc Edging Corporation.

- B. Job-Built Concrete Edge Restraints: Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mixed concrete with minimum 28-day compressive strength of 3000 psi.

2.3 AGGREGATE SETTING-BED MATERIALS

- A. Graded Aggregate for Subbase: Sound, crushed stone or gravel complying with ASTM D 448 for Size No. 57.
- B. Sand for Leveling Course: Sound, sharp, washed, natural sand or crushed stone complying with gradation requirements in ASTM C 33 for fine aggregate.
- C. Stone Screenings for Leveling Course: Sound stone screenings complying with ASTM D 448 for Size No. 10.
- D. Sand for Joints: Fine, sharp, washed, natural sand or crushed stone with 100 percent passing No. 16 sieve and no more than 10 percent passing No. 200 sieve.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas indicated to receive paving, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Where pavers are to be installed over waterproofing, examine waterproofing installation, with waterproofing Installer present, for protection from paving operations, including areas where waterproofing system is turned up or flashed against vertical surfaces.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove substances from concrete substrates that could impair mortar bond, including curing and sealing compounds, form oil, and laitance.
- B. Sweep concrete substrates to remove dirt, dust, debris, and loose particles.
- C. Proof-roll prepared subgrade according to requirements in Division 31 Section "Earthwork" to identify soft pockets and areas of excess yielding. Proceed with unit paver installation only after deficient subgrades have been corrected and are ready to receive base course for unit pavers.

3.3 INSTALLATION, GENERAL

- A. Do not use unit pavers with chips, cracks, voids, discolorations, or other defects that might be visible or cause staining in finished work.
- B. Mix pavers from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures.
- C. Cut unit pavers with motor-driven masonry saw equipment to provide clean, sharp, unchipped edges. Cut units to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible. Hammer cutting is not acceptable.

1. For concrete pavers, a block splitter may be used.
- D. Handle protective-coated brick pavers to prevent coated surfaces from contacting backs or edges of other units. If, despite these precautions, coating does contact bonding surfaces of brick, remove coating from bonding surfaces before setting brick.
- E. Joint Pattern: As indicated on drawings.
- F. Tolerances: Do not exceed 1/4 inch in 10 feet from level, or indicated slope, for finished surface of paving.
- G. Provide edge restraints as indicated. Install edge restraints before placing unit pavers.
 1. Install edge restraints to comply with manufacturer's written instructions. Install stakes at intervals required to hold edge restraints in place during and after unit paver installation.
 2. For metal edge restraints with top edge exposed, drive stakes at least 1 inch below top edge.
 3. Install job-built concrete edge restraints to comply with requirements in Division 03 Section "Cast-in-Place Concrete."

3.4 AGGREGATE SETTING-BED APPLICATIONS

- A. Compact soil subgrade uniformly to at least 95 percent of ASTM D 1557 laboratory density.
- B. Proof-roll prepared subgrade to identify soft pockets and areas of excess yielding. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.
- C. Place separation geotextile over prepared subgrade, overlapping ends and edges at least 12 inches.
- D. Place aggregate subbase and base, compact to 100 percent of ASTM D 1557 maximum laboratory density, and screed to depth indicated.
- E. Place drainage geotextile over compacted base course, overlapping ends and edges at least 12 inches.
- F. Place leveling course and screed to a thickness of 1 to 1-1/2 inches, taking care that moisture content remains constant and density is loose and uniform until pavers are set and compacted.
- G. Treat leveling course with herbicide to inhibit growth of grass and weeds.
- H. Set pavers with a minimum joint width of 1/16 inch and a maximum of 1/8 inch, being careful not to disturb leveling base. If pavers have spacer bars, place pavers hand tight against spacer bars. Use string lines to keep straight lines. Fill gaps between units that exceed 3/8 inch with pieces cut to fit from full-size unit pavers.
 1. When installation is performed with mechanical equipment, use only unit pavers with spacer bars on sides of each unit.
- I. Vibrate pavers into leveling course with a low-amplitude plate vibrator capable of a 3500- to 5000-lbf compaction force at 80 to 90 Hz. Use vibrator with neoprene mat on face of plate or other means as needed to prevent cracking and chipping of pavers. Perform at least three passes across paving with vibrator.
 1. Compact pavers when there is sufficient surface to accommodate operation of vibrator, leaving at least 36 inches of uncompacted pavers adjacent to temporary edges.

2. Before ending each day's work, compact installed concrete pavers except for 36-inch width of uncompacted pavers adjacent to temporary edges (laying faces).
 3. As work progresses to perimeter of installation, compact installed pavers that are adjacent to permanent edges unless they are within 36 inches of laying face.
 4. Before ending each day's work and when rain interrupts work, cover pavers that have not been compacted and cover leveling course on which pavers have not been placed with nonstaining plastic sheets to protect them from rain.
- J. Spread dry sand and fill joints immediately after vibrating pavers into leveling course. Vibrate pavers and add sand until joints are completely filled, then remove excess sand. Leave a slight surplus of sand on the surface for joint filling.
- K. Do not allow traffic on installed pavers until sand has been vibrated into joints.
- L. Repeat joint-filling process 30 days later.
- 3.5 REPAIRING, POINTING, AND CLEANING
- A. Remove and replace unit pavers that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment and with no evidence of replacement.
- B. Pointing: During tooling of joints, enlarge voids or holes and completely fill with grout. Point joints at sealant joints to provide a neat, uniform appearance, properly prepared for sealant application.
- C. Cleaning: Remove excess grout from exposed paver surfaces; wash and scrub clean.
1. Remove temporary protective coating as recommended by coating manufacturer and as acceptable to paver and grout manufacturers.
 2. Do not allow protective coating to enter floor drains. Trap, collect, and remove coating material.

END OF SECTION 321400

SECTION 321443 - POROUS UNIT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes, but is not limited to:
 - 1. Solid concrete pavers with openings between pavers filled with aggregate.
 - 2. Aggregate setting bed for pavers.
- B. Related Requirements include, but are not limited to:
 - 1. City of Lynchburg Specification sections relating to excavation, compacted subgrade, and cast-in-place concrete.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For materials other than aggregates:
 - 1. Pavers.
 - 2. Geotextiles.
- B. Sieve Analyses: For aggregate materials, according to ASTM C 136.
- C. Samples:
 - 1. Full-size units of each type of unit paver indicated.
 - 2. Aggregate fill.
 - 3. Aggregate setting bed materials.

1.5 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For unit pavers. Include statements of material properties indicating compliance with requirements, including compliance with standards. Provide for each type and size of unit.
- B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for unit pavers, indicating compliance with requirements.

1. For solid interlocking paving units, include test data for freezing and thawing according to ASTM C 67.

1.6 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store pavers on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied.
- B. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

PART 2 - PRODUCTS

2.1 CONCRETE UNIT PAVERS

- A. Source Limitations: Obtain each type of paver from single source that has resources to provide materials and products of consistent quality in appearance and physical properties.
- B. Solid Concrete Pavers for Porous Paving: Solid interlocking paving units of shapes that provide openings between units, complying with ASTM C 936/C 936M, resistant to freezing and thawing when tested according to ASTM C 67, and made from normal-weight aggregates.
 1. Basis of Design Product: SF-RIMA, Manufactured by Eagle Bay Hardscape Products
 2. Thickness: 3-1/8 inches.
 3. Face Size and Shape: 7-3/4 inches by 7-3/4 inches.
 4. Color: As selected by Architect from manufacturer's full range of available colors.

2.2 AGGREGATE SETTING-BED MATERIALS

- A. Graded Aggregate for Subbase: Sound crushed stone or gravel complying with ASTM D 448 for Size No. 2.
- B. Graded Aggregate for Base Course: Sound crushed stone or gravel complying with ASTM D 448 for Size No. 57.
- C. Graded Aggregate for Leveling Course: Sound crushed stone or gravel complying with ASTM D 448 for Size No. 8.

- D. Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured according to test methods referenced:
1. Survivability: Class 2; AASHTO M 288.
 2. Apparent Opening Size: No. 40 sieve, maximum; ASTM D 4751.
 3. Permittivity: 0.5 per second, minimum; ASTM D 4491.
 4. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

2.3 FILL MATERIALS

- A. Aggregate Fill for Porous Paving: Graded, sound crushed stone or gravel complying with ASTM D 448 for Size No. 8.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Proof-roll prepared subgrade to identify soft pockets and areas of excess yielding. Proceed with porous paver installation only after deficient subgrades have been corrected and are ready to receive subbase and base course for porous paving.

3.2 INSTALLATION, GENERAL

- A. Do not use unit pavers with chips, cracks, voids, discolorations, and other defects that might be structurally unsound or visible in finished work.
- B. Mix pavers from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures.
- C. Cut unit pavers with motor-driven masonry saw equipment to provide clean, sharp, unchipped edges. Cut units to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible. Hammer cutting is not acceptable.
- D. Tolerances:
1. Variation in Plane between Adjacent Units (Lipping): Do not exceed 1/16-inch unit-to-unit offset from flush.
 2. Variation from Level or Indicated Slope: Do not exceed 1/8 inch in 24 inches and 1/4 inch in 10 feet or a maximum of 1/2 inch.
- E. Provide edge restraints as indicated. Install edge restraints before placing unit pavers.
1. Install edge restraints to comply with manufacturer's written instructions. Install stakes at intervals required to hold edge restraints in place during and after porous paver installation.
 2. For metal edge restraints with top edge exposed, drive stakes at least 1 inch below top edge.
- F. Provide curbs as indicated. Install curbs before placing unit pavers.

3.3 SETTING-BED INSTALLATION

- A. Compact subgrade uniformly to at least 95 percent of ASTM D 698 laboratory density.
- B. Proof-roll prepared subgrade to identify soft pockets and areas of excess yielding. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.
- C. Place drainage geotextile over prepared subgrade, overlapping ends and edges at least 12 inches.
- D. Place aggregate subbase and base, compact by tamping with plate vibrator, and screed to depth indicated.
- E. Place leveling course and screed to depth indicated, taking care that moisture content remains constant and density is loose and constant until pavers are set and compacted.

3.4 PAVER INSTALLATION

- A. Set unit pavers on leveling course, being careful not to disturb leveling base. If pavers have lugs or spacer bars to control spacing, place pavers hand tight against lugs or spacer bars. If pavers do not have lugs or spacer bars, place pavers with a 1/16-inch- minimum and 1/8-inch- maximum joint width. Use string lines to keep straight lines. Fill gaps between units that exceed 3/8 inch with pieces cut to fit from full-size pavers.
 - 1. When installation is performed with mechanical equipment, use only unit pavers with lugs or spacer bars on sides of each unit.
- B. Compact pavers into leveling course with a low-amplitude plate vibrator capable of a 3500- to 5000-lbf compaction force at 80 to 90 Hz. Use vibrator with neoprene mat on face of plate or other means as needed to prevent cracking and chipping of pavers. Perform at least three passes across paving with vibrator.
 - 1. Compact pavers when there is sufficient surface to accommodate operation of vibrator, leaving at least 36 inches of uncompacted pavers adjacent to temporary edges.
 - 2. Before ending each day's work, compact installed concrete pavers except for 36-inch width of uncompacted pavers adjacent to temporary edges (laying faces).
 - 3. As work progresses to perimeter of installation, compact installed pavers that are adjacent to permanent edges unless they are within 36 inches of laying face.
 - 4. Before ending each day's work and when rain interrupts work, cover pavers that have not been compacted and leveling course on which pavers have not been placed with nonstaining plastic sheets to protect them from rain.
- C. Place graded aggregate fill immediately after vibrating pavers into leveling course. Spread and screed aggregate fill level with tops of pavers.
 - 1. Before ending each day's work, place aggregate fill in installed porous paving except for 42-inch width of unfilled paving adjacent to temporary edges (laying faces).
 - 2. As work progresses to perimeter of installation, place aggregate fill in installed paving that is adjacent to permanent edges unless it is within 42 inches of laying face.
 - 3. Before ending each day's work and when rain interrupts work, cover paving that has not been filled with nonstaining plastic sheets to protect it from rain.

- D. As work progresses, remove and replace pavers that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment and with no evidence of replacement.

END OF SECTION 321443

SECTION 323119 - ALUMINUM FENCES AND GATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes, but is not limited to:
 - 1. Decorative aluminum fences.
 - 2. Swing gates.
- B. Related Requirements include, but are not limited to:
 - 1. Division 03 Section "Cast-in-Place Concrete" for concrete.
 - 2. Division 03 Section "Architectural Precast Concrete."
 - 3. Division 04 Section "Unit Masonry."

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For gates. Include plans, elevations, sections, details, and attachments to other work.
- C. Samples: For each fence material and for each color specified.
 - 1. Provide Samples 12 inches in length for linear materials.
 - 2. Provide Samples 12 inches square for bar grating and sheet or plate materials.

1.4 INFORMATIONAL SUBMITTALS

- A. Warranty: Copy of manufacturer's warranty

1.5 WARRANTY

- A. Provide manufacturer's 20-year warranty for factory finish against cracking, peeling, and blistering under normal use.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Basis of Design Manufacturer: Ametco® Manufacturing Corp.
 - 1. Address: 4326 Hamann Parkway, P.O. Box 1210, Willoughby, Ohio 44096.
 - 2. Phone: 800-362-1360
 - 3. Website: www.ametco.com
- B. Refer to Division 01 Section "Product Requirements" for requests to use equivalent products of other manufacturers.

2.2 ALUMINUM FENCE SYSTEM

- A. Aluminum Fences: Fences consisting of vertical, fixed louver, modular fence panels fabricated with extruded aluminum framing bars and supported by extruded aluminum fence posts.

- B. Posts: Square extruded tubes, 2-1/2" square by 5/16-inch thick.
- C. Rails: Extruded-aluminum channels or bars, 2-1/2 inches wide.
- D. Pickets, Fence Type AF-1: Extruded-aluminum tubes, 1/2-inch by 2 inches.
 - 1. Terminate tops of pickets at top rail for flush top appearance.
 - 2. Picket Spacing: 3-1/2 inches on center.
 - 3. Open Area: 85%.
- E. Pickets, Fence Type AF-2: Extruded-aluminum tubes, 1/2-inch by 4 inches.
 - 1. Terminate tops of pickets at top rail for flush top appearance.
 - 2. Picket Spacing: 5 inches on center.
 - 3. Open Area: 20%.
- F. Fasteners: Stainless steel bolts of type, size, and spacing as recommended by fence manufacturer for specific condition.
- G. Fabrication: Assemble fences into sections by welding pickets to rails.
 - 1. Fabricate sections with clips welded to rails for field fastening to posts.
 - 2. Drill clips for fasteners before finishing.
- H. Finish: Powder coating.
- I. Basis of Design Products:
 - 1. Fence Type AF-1: Ametco® Galaxy Design.
 - 2. Fence Type AF-2: Ametco® Saturn Design.

2.3 SWING GATES

- A. Gate Configuration: Double leaf.
 - 1. Gate Frame Height: 100 inches.
 - 2. Gate Opening Width: 72 inches.
- B. Aluminum Frames and Bracing: Fabricate members from square extruded-aluminum tubes 2-1/2 by 2-1/2 inches with 5/16 inch wall thickness.
- C. Picket Size, Configuration, and Spacing: Fence Type AF-2.
- D. Hardware: Latches permitting operation from both sides of gate, hinges, and keepers. Provide cane bolts for pairs of gates. Fabricate latches with integral eye openings for padlocking; padlock accessible from both sides of gate.
 - 1. Hinges: Size and type as determined by manufacturer. Provide minimum of two (2) hinges for each leaf up to 6 feet high and one (1) additional hinge for each 24 inches in height or fraction thereof.
 - 2. Latch: 3/4-inch diameter slide bolt to accommodate padlock.
 - 3. Material: Malleable iron; galvanized.
- E. Provide galvanized-steel pipe strikes to receive cane bolts in closed position.
- F. Galvanizing: For hardware items, hot-dip galvanize to comply with ASTM A 153/A 153M.
- G. Aluminum Finish: Powder coating.

2.4 ALUMINUM

- A. Aluminum, General: Provide alloys and tempers with not less than the strength and durability properties of alloy and temper designated in paragraphs below for each aluminum form required.
 - 1. Extrusions: ASTM B 221, Alloy 6063-T5.
 - 2. Tubing: ASTM B 429/B 429M, Alloy 6063-T6.
 - 3. Plate and Sheet: ASTM B 209, Alloy 6061-T6.
 - 4. Die and Hand Forgings: ASTM B 247, Alloy 6061-T6.
 - 5. Castings: ASTM B 26/B 26M, Alloy A356.0-T6.

2.5 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
 - 1. For aluminum, provide type and alloy as recommended by producer of metal to be welded and as required for strength and compatibility in fabricated items.
- B. Concrete: One of the following:
 - 1. Normal-weight, air-entrained, ready-mix concrete complying with requirements in Division 03 Section "Cast-in-Place Concrete" with a minimum 28-day compressive strength of 3000 psi, 3-inch slump, and 1-inch maximum aggregate size
 - 2. Dry, packaged, normal-weight concrete mix complying with ASTM C 387/C 387M mixed with potable water according to manufacturer's written instructions.
- C. Nonshrink Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M and specifically recommended by manufacturer for exterior applications.

2.6 ALUMINUM FINISH

- A. Polyester Powder-Coat Finish: Electrostatically applied colored polyester powder coating heat cured to chemically bond finish to metal substrate.
 - 1. Minimum hardness measured in accordance with ASTM D3363: 2H.
 - 2. Direct impact resistance tested in accordance with ASTM D2794: Withstand 160 inch-pounds.
 - 3. Salt spray resistance tested in accordance with ASTM B117: No undercutting, rusting, or blistering after 500 hours in 5 percent salt spray at 95 degrees F and 95 percent relative humidity and after 1000 hours less than 3/16 inches undercutting.
 - 4. Weatherability tested in accordance with ASTM D822: No film failure and 88 percent gloss retention after 1 year exposure in South Florida with test panels tilted at 45 degrees.
 - 5. Color and Gloss: As selected by Architect from manufacturer's full range of available colors.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, construction layout, and other conditions affecting performance of the Work.
- B. Do not begin installation before final grading is completed unless otherwise permitted by Architect.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Stake locations of fence lines, gates, and terminal posts. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.3 FENCE INSTALLATION

- A. Install fences according to manufacturer's written instructions.
- B. Install fences by setting posts and fastening infill panels to posts.
- C. Post Excavation: Drill or hand-excavate holes for posts in firm, undisturbed soil. Excavate holes to a diameter of not less than 4 times post size and a depth of not less than 24 inches.
- D. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.
 - 1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
 - 2. Concrete Fill: Place concrete around posts and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
 - a. Minimum Footing Diameter: 12 inches.
 - b. Concealed Concrete: Top 2 inches below grade to allow covering with surface material. Slope top surface of concrete to drain water away from post.
 - 3. Posts Set in Concrete: Extend post to within 6 inches of specified excavation depth, but not closer than 3 inches to bottom of concrete.
 - 4. Space posts uniformly at 6 feet o.c. nominal.

3.4 GATE INSTALLATION

- A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.5 ADJUSTING

- A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.
- B. Lubricate hardware and other moving parts.
- C. Touch-up damaged finish with paint supplied by manufacturer and matching original coating.

END OF SECTION 323119

SECTION 329200 – TURF AND GRASSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes, but is not limited to:
 - 1. Seeding.
 - 2. Sodding.

1.3 DEFINITIONS

- A. Finish Grade: Elevation of finished surface of planting soil.
- B. Manufactured Soil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
- C. Planting Soil: Native or imported topsoil, manufactured topsoil, or surface soil modified to become topsoil; mixed with soil amendments.
- D. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill immediately beneath planting soil.
- E. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Certification of Grass Seed and Sod: From seed vendor for each grass-seed monostand or mixture stating the botanical and common name and percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.
 - 1. Certification of each seed mixture for turfgrass and sod identifying source, including name and telephone number of supplier.
- C. Qualification Data: For qualified landscape Installer and Contractor
 - 1. Certifications may include the American Nursery and Landscape Association, Certified Landscape Technician, and Certified Turfgrass Professional.
- D. Product Certificates: For soil amendments and fertilizers, from manufacturer.
- E. Material Test Reports: For existing surface soil and imported topsoil.
- F. Planting Schedule: Indicating anticipated planting dates for each type of planting.
- G. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of lawns during a calendar year. Submit before expiration of required initial maintenance periods.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful lawn establishment.
 - 1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when planting is in progress.
 - 2. Maintenance Proximity: Not more than 1-1/2 hours' normal travel time from Installer's place of business to Project site.
 - 3. Experience: Three (3) years minimum experience in turf installation in addition to requirements in Division 01 Section "Quality Requirements."
- B. Soil-Testing Laboratory Qualifications: An independent laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.
- C. Topsoil Analysis: Furnish soil analysis by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity; deleterious material; pH; and mineral and plant-nutrient content of topsoil.
 - 1. Report suitability of topsoil for lawn growth. State-recommended quantities of nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory topsoil.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Sod: Harvest, deliver, store, and handle sod according to requirements in TPI's "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" in its "Guideline Specifications to Turfgrass Sodding." Deliver sod in time for planting within 24 hours of harvesting. Protect sod from breakage and drying.

1.7 PROJECT CONDITIONS

- A. Bidders shall personally examine the site and fully acquaint themselves with all of the existing conditions in order that no misunderstanding may afterwards arise as to the characteristics of the site or the extent of the work to be performed. Submission of a quotation shall be considered evidence that the site has been examined. No additional compensation will be granted because of any difficulties which may be encountered in the performance of any portion of the work.
- B. Schedule and coordinate with work of other sections and local seasons.
 - 1. Utilities: Locate all existing utilities. Any damage to the utilities shall be repaired at the Contractor's expense.
- C. Excavation: Notify the Landscape Architect immediately of any unforeseen conditions affecting plant growth (buried debris, etc.). Contact the Landscape Architect immediately if there is any doubt about the sub-soil's suitability to maintain healthy plant life. If no notification is given it shall be understood that the sub-soil is acceptable.
- D. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit.
- E. Planting Time: Seeding and sodding shall only be allowed as follows unless approved in writing by the Architect:
 - 1. Spring: March 15 to June 15.
 - 2. Fall: September 15 to November 30.

1.8 MAINTENANCE

- A. Lawns: Maintain lawns immediately after planting until final acceptance by the Landscape Architect.
1. Watering: Water regularly and at such times and rates as necessary for optimum growth and to avoid wilting, puddling, runoff, or erosion.
 2. Mow grass at regular intervals to maintain a maximum height of 2 inches; do not cut more than 1/3 of grass blade at any one mowing.
 - a. Use only sharp equipment on dry grass and firm soil. Trim edges and clip by hand where necessary.
 - b. Immediately remove clippings after mowing and trimming.
 3. Fertilizing: After one month of growth, apply fertilizer at the rate of one pound of available nitrogen per 1000 square feet of turf area.
 4. Control growth of weeds. Apply herbicides in accordance with manufacturer's instructions. Remedy any damage resulting from use of herbicides.
 5. Do not allow foot or vehicular traffic over new lawn areas. Provide effective barricades or warning signs, or both if necessary.
 6. Regrade and resod areas if necessary to correct rutted, damaged, or improperly graded areas.
- B. Basis of Lawn Acceptance: At the end of the maintenance period, lawns shall be uniform in texture, density, and color; substantially weed-free; without gaps or bare spots; and with vigorous growth of proper species and variety. For the purpose of establishing an acceptable standard, scattered bare spots, none of which are larger than one square foot, will be allowed up to a maximum of three percent (3%) of the entire lawn area. If planting is done after lawn preparation, proper protection to lawn areas shall be provided and any damage resulting from planting operations shall be repaired promptly at no additional cost to the Owner.

1.9 WARRANTIES

- A. General: Warranties shall be in addition to, and not a limitation of, other rights the Owner may have against the Contractor under the Contract Documents.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Sod: Provide Kentucky Bluegrass Variety, Category I.
- B. Seed: Provide Blend of 70% Tall Fescue, 20% Perennial Rye, and 10% Kentucky Blue Grass.

2.2 TOPSOIL

- A. Topsoil: ASTM D 5268, pH range of 5.5 to 7, a minimum of four percent (4%) organic material content; free of stones 1 inch or larger in any dimension and other extraneous materials harmful to plant growth.
1. Topsoil Source: Amend existing in-place surface soil to produce topsoil. Verify suitability of surface soil to produce topsoil. Clean surface soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.
 2. Surface soil may be supplemented with imported or manufactured topsoil from off-site sources. Obtain topsoil displaced from naturally well-drained construction where topsoil occurs at least 4 inches deep. Do not obtain from agricultural land, bogs or marshes.

2.3 INORGANIC SOIL AMENDMENTS

- A. Lime: ASTM C 602, agricultural limestone containing a minimum of 80 percent calcium carbonate equivalent and as follows:
 - 1. Composition: In amounts recommended in soil reports from a qualified soil-testing agency.
 - 2. Provide lime in form of dolomitic limestone.
- B. Sulfur: Granular, biodegradable, containing a minimum of 90 percent sulfur, with a minimum of 99 percent passing through No. 6 sieve and a maximum of 10 percent passing through No. 40 sieve.
- C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.
- D. Aluminum Sulfate: Commercial grade, unadulterated.
- E. Perlite: Horticultural perlite, soil amendment grade.
- F. Agricultural Gypsum: Finely ground, containing a minimum of 90 percent calcium sulfate.
- G. Sand: Clean, washed, natural or manufactured, free of toxic materials.
- H. Diatomaceous Earth: Calcined, diatomaceous earth, 90 percent silica, with approximately 140 percent water absorption capacity by weight.
- I. Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.

2.4 ORGANIC SOIL AMENDMENTS

- A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:
 - 1. Organic Matter Content: 50 to 60 percent of dry weight.
 - 2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.
- B. Peat: One of the following:
 - 1. Sphagnum peat moss, partially decomposed, finely divided or granular texture, with a pH range of 3.4 to 4.8.
 - 2. Peat: Finely divided or granular texture, with a pH range of 6 to 7.5, containing partially decomposed moss peat, native peat, or reed-sedge peat and having a water-absorbing capacity of 1100 to 2000 percent.
- C. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, and material harmful to plant growth.

2.5 PLANTING ACCESSORIES

- A. Selective Herbicides: EPA registered and approved, of type recommended by manufacturer for application.

2.6 FERTILIZER

- A. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of one percent (1%) nitrogen and 10 percent phosphoric acid.
- B. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.
- C. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
 - 1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.
- D. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
 - 1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.

2.7 PLANTING SOIL MIX

- A. Planting Soil Mix: Topsoil mixed with the following soil amendments and fertilizers in the following quantities:
 - 1. Ratio of Loose Compost to Topsoil by Volume: 1:3.
 - 2. Ratio of Loose Peat to Topsoil by Volume: 1:3.
 - 3. Weight of Lime per 1000 Sq. Ft.: 50 lbs.
 - 4. Weight of Bonemeal per 1000 Sq. Ft.: 50 lbs.
 - 5. Weight of Superphosphate per 1000 Sq. Ft.: 10 lbs.
 - 6. Weight of Slow-Release Fertilizer per 1000 Sq. Ft.: 10 lbs.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive lawn seed and/or sod for compliance with requirements and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.
 - 1. Protect grade stakes set by others until directed to remove them.
- B. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.3 LAWN PREPARATION

- A. Limit lawn subgrade preparation to areas to be planted.
- B. Newly Graded Subgrades: Loosen subgrade to a minimum depth of 8 inches. Remove stones larger than 1 inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

1. Apply superphosphate fertilizer directly to subgrade before loosening.
 2. Thoroughly blend planting soil mix off-site before spreading or spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil mix.
 - a. Delay mixing fertilizer with planting soil if planting will not proceed within a few days.
 - b. Mix lime with dry soil before mixing fertilizer.
 3. Spread planting soil mix to a depth of 4 inches but not less than required to meet finish grades after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.
 - a. Spread approximately 1/2 the thickness of planting soil mix over loosened subgrade. Mix thoroughly into top 4 inches of subgrade. Spread any remainder of planting soil mix over areas to be planted and mix thoroughly.
 - b. Reduce elevation of planting soil to allow for soil thickness of sod.
- C. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in the immediate future.
- D. Moisten prepared lawn areas before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
- E. Before planting, restore areas if eroded or otherwise disturbed after finish grading.

3.4 PLANTING SEED

- A. Planting Seed: Initial seeding work shall be done between March 15 and June 15 unless otherwise directed by the Landscape Architect. When delays in operation carry the seeding work beyond the specified planting season, or when conditions are such by reason of drought, high winds, excessive moisture or other factors that satisfactory results are not likely to be obtained, the work will be stopped and shall be resumed only when directed. Sow additional seed on any areas that have been skipped as directed by the Landscape Architect at no additional cost to the Owner.
1. Seed indicated areas within the limits of construction as a result of construction operations.
 2. Perform seeding operations when the soil is dry and when winds do not exceed 5 miles per hour velocity.
 3. Apply seed with a rotary or drop type distributor. Install seed evenly by sowing equal quantities in two directions, at right angles to each other.
 4. Initial seeding shall be applied at the rate of 7 lbs. of Rebel or Falcon Fall Fescue per 1000 square foot.
- B. Mulching:
1. Place straw mulch on seeded areas within 24 hours after seeding.
 2. Place straw mulch uniformly in a continuous blanket at the rate of 2 1/2 tons per acre, or two 50 lb. bales per 1,000 sq. ft. of area.
- C. Provide straw bale checking in ditches or problem swales at intervals required to adequately slow water velocity and impede soil loss.

3.5 RECONDITIONING LAWNS

- A. Recondition lawns where damaged by construction operations including, but not limited to, storage of materials or equipment and movement of construction vehicles, etc. across existing lawns as indicated.

- B. Removals: Strip any unsatisfactory lawn areas as indicated on drawings, and dispose of vegetation off site.
 - 1. Where the construction operations have introduced deleterious materials including oil drippings, sand, stone, gravel or other contaminants into topsoil, remove and dispose of topsoil off site and replace with new planting soil.
 - 2. Provide fertilizer, seed and soil amendments as specified for new lawns and as required to provide a satisfactorily reconditioned lawn. Provide topsoil as required to fill low areas and meet new finish grades.
 - 3. Cultivate bare and compacted areas thoroughly.
 - 4. Remove diseased or unsatisfactory lawn areas, and recondition in accordance with specifications. Do not bury into soil.
 - 5. Where substantial but thin lawn remains, rake, serrate if compacted, and cultivate soil; fertilize and seed.
 - 6. Water newly seeded areas. Maintain adequate soil moisture until new grass established.
 - 7. Reseed in accordance with specifications.

3.6 LAWN MAINTENANCE

- A. Maintain and establish lawn by watering, fertilizing, weeding, mowing, trimming, replanting, and other operations. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth lawn. Provide materials and installation methods the same as those used in the original installation.
 - 1. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
- B. Watering: Provide and maintain temporary piping, hoses, and lawn-watering equipment to convey water from sources and to keep lawn uniformly moist to a depth of 4 inches.
 - 1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
 - 2. Water lawn with fine spray at a minimum rate of 1 inch per week unless rainfall precipitation is adequate.
- C. Mow lawn as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than 1/3 of grass height. Remove no more than 1/3 of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:
 - 1. Mow grass to a height of 1-1/2 to 2 inches.
- D. Lawn Postfertilization: Apply fertilizer after initial mowing and when grass is dry.
 - 1. Use fertilizer that will provide actual nitrogen of at least 1 lb/1000 sq. ft. to lawn area.

3.7 SATISFACTORY LAWNS

- A. Lawn installations shall meet the following criteria as determined by Landscape Architect:
 - 1. Satisfactory Seeded and Sodded Lawn: At end of maintenance period, a healthy, well-rooted, even-colored, viable lawn has been established, free of weeds, open joints, bare areas, and surface irregularities.

3.8 CLEANUP AND PROTECTION

- A. Promptly remove soil and debris, created by lawn work, from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

- B. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after lawn is established.
- C. Remove nondegradable erosion-control measures after grass establishment period.

END OF SECTION 329200