

Marion County Middle School Addition & Renovation

Marion County Board of Education Lebanon, Kentucky

> RTA 1928 BG 19-363

Project Manual

October 2019



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SECTION 001115 - ADVERTISEMENT FOR BIDS

Sealed proposals for the following work will be received by the Marion County Board of Education in the manner and on the date hereinafter specified for the furnishing of all labor, materials, supplies, tools, equipment, services, etc., necessary for the construction of Marion County Middle School Addition & Renovation as set forth in the specifications and as shown on the drawings prepared by RossTarrant Architects, Inc., 101 Old Lafayette Avenue, Lexington, Kentucky 40502.

Bid Submittal: Contractors must submit their bids to the Marion County Board of Education, 755 East Main Street, Lebanon, Kentucky 40033 until: December 5, 2019, 2:00 p.m., local time.

Each Proposal shall be submitted on forms contained in the Project Manual. Proposals shall be enclosed in a sealed envelope with the following information on the outside:

Sealed Bid for the:

Marion County Middle School Addition & Renovation

No proposal shall be withdrawn for a period of sixty (60) days after the date of bid opening.

Pre-Bid Conference: A pre-bid conference will be held on November 14, 2019 at 10 am local time, at the Marion County Board of Education building. Each bidder is encouraged to visit the site to review field conditions prior to submitting a bid.

Addenda: The last date for the Architect to receive items to be addressed in any addenda is November 26, 2019 by 12:00 p.m. EST. All requests must be submitted to the Architect in writing.

Method of Receiving Bids: Bids will be received from Contractors for a Total Lump Sum Amount. All phases of the work shall be bid to and through the Contractor submitting the proposal. Bid Security in the amount of five (5) percent of each proposal submitted must accompany each Proposal in accordance with the Form of Proposal.

It is the Owner's intent to purchase significant quantities of materials through direct purchase orders. After review of bids, the Owner will issue purchase orders for major material items. Refer to the Supplemental Instructions to Bidders, General Conditions, Supplementary Conditions, and Division 1 sections for additional information.

Right to Reject and Waiver: The Owner reserves the right to accept any bid, to reject any or all bids, to waive any informalities in bids received where such acceptance, rejection, or waiver is considered to be in the best interest of the Owner or to reject any bid where evidence or information submitted by the bidder does not satisfy the Owner that the bidder is qualified to carry out the details of the Contract Documents. The Owner's desire to waive irregularities and informalities as to a bid shall be reviewed and final judgment made by the Kentucky Department of Education, Division of Facilities Management, prior to approval of the contract and financing plan.

 Plans and Specifications Reviewed: Contract Documents may be examined at the following places: Marion County Board of Education, 755 East Main Street, Lebanon, Kentucky 40033 CMTA, Inc., 2429 Members Way, Lexington, Kentucky 40504 Structural Design Group, Inc., 220 Great Circle Road, Suite 106, Nashville, Tennessee 37228

Obtaining Plans and Specifications: Bidders may obtain contract documents from Lynn Imaging, 328 Old East Vine Street, Lexington, Kentucky 40507 (telephone (859) 255-1021), in accordance with the following deposit and charge schedule.

First and Second Set \$150.00 Per Set Refundable

Additional Sets \$150.00 Per Set Non-Refundable

Postage and handling fees shall be paid directly to Lynn Imaging. Deposit checks shall be made payable to RossTarrant Architects, Inc. It is most important that requesting firm identify the position of the firm as to prime bidder, miscellaneous Contractor, material supplier, or other. Please give name, address, telephone number and email address of person responsible for receiving Addenda material and general communication concerning this bidding.

Plans and Specifications must be returned directly to Lynn Imaging within thirty (30) calendar days after the closing date for the receipt of bids, in good condition, otherwise no refund will be made.

General Information: State Wage Rates are not applicable. Conflicts of interest, gratuities and kickbacks are defined in KRS 45A.445 and as provided for in KRS 45A.455 are absolutely prohibited. Preference for resident bidders shall be given as outlined in KRS 45A.90 to 45A.94. The successful bidder must supply a 100% Performance and Payment Bond as outlined in the Project Manual.

Project Location: 1155 State Highway 327, Lebanon, Kentucky 40033

Project Description: The project scope consists primarily of the addition to the south end of the classroom wing to add three standard classrooms and a science classroom. Construction will consist of shallow spread footings, CMU load-bearing and partition walls, steel joists and decking at the floor and roof, and masonry veneer. Site work will include all disturbed areas, building pad preparation and storm drainage. HVAC system will include geothermal wellfield, terminal space units, and energy recovery unit.

END OF SECTION

SECTION 002100 - INSTRUCTIONS TO BIDDERS

PART 1 GENERAL

1.01 Refer to the Kentucky Department of Education Version of AIA Document A701-1997. END OF SECTION

Kentucky Department of Education Version of $\widehat{\mathbb{A}}$ Document A701TM – 1997

Instructions to Bidders



This version of AIA Document A701[™]–1997 is modified by the Kentucky Department of Education. Publication of this version of AIA Document A701–1997 does not imply the American Institute of Architects' endorsement of any modification by the Kentucky Department of Education. A comparative version of AIA Document A701–1997 showing additions and deletions by the Kentucky Department of Education is available for review on the Kentucky Department of Education Web site.

Cite this document as "AIA Document A701[™]– 1997, Instructions to Bidders – KDE Version," or "AIA Document A701[™]–1997 – KDE Version."

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Kentucky Department of Education Version of @AIA Document A701 $^{\rm TM}$ – 1997

Instructions to Bidders

for the following PROJECT:

(Name and location or address)

THE OWNER: (Name, legal status and address)

THE ARCHITECT:

(Name, legal status and address)

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- 2 BIDDER'S REPRESENTATIONS
- 3 BIDDING DOCUMENTS
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- 8 FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR
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KENTUCKY DEPARTMENT OF

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This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

ARTICLE 1 DEFINITIONS

§ 1.1 Bidding Documents include the Bidding Requirements and the proposed Contract Documents. The Bidding Requirements consist of the Advertisement or Invitation to Bid, Instructions to Bidders, Supplementary Instructions to Bidders, the bid form, and other sample bidding and contract forms. The proposed Contract Documents consist of the form of Agreement between the Owner and Contractor, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications and all Addenda issued prior to execution of the Contract.

§ 1.2 Definitions set forth in the General Conditions of the Contract for Construction, AIA Document A201[™], or in other Contract Documents are applicable to the Bidding Documents.

§ 1.3 Addenda are written or graphic instruments issued by the Architect prior to the execution of the Contract which modify or interpret the Bidding Documents by additions, deletions, clarifications or corrections.

§ 1.4 A Bid is a complete and properly executed proposal to do the Work for the sums stipulated therein, submitted in accordance with the Bidding Documents.

§ 1.5 The Base Bid is the sum stated in the Form of Proposal for which the Bidder offers to perform the Work described in the Bidding Documents as the base, to which Work may be added or from which Work may be deleted for sums stated in Alternate Bids. The Base Bid shall include all labor, material, bonds, and the cost of all direct purchase orders for material to be purchased by the Owner

§ 1.6 An Alternate Bid (or Alternate) is an amount stated in the Bid to be added to or deducted from the amount of the Base Bid if the corresponding change in the Work, as described in the Bidding Documents, is accepted.

§ 1.7 A Unit Price is an amount stated in the Bid as a price per unit of measurement for materials, equipment or services or a portion of the Work as described in the Bidding Documents.

§ 1.8 A Bidder is a person or entity who submits a Bid and who meets the requirements set forth in the Bidding Documents.

§ 1.9 A Sub-bidder is a person or entity who submits a bid to a Bidder for materials, equipment or labor for a portion of the Work.

ARTICLE 2 BIDDER'S REPRESENTATIONS

§ 2.1 The Bidder by making a Bid represents that:

§ 2.1.1 The Bidder has read and understands the Bidding Documents or Contract Documents, to the extent that such documentation relates to the Work for which the Bid is submitted, and for other portions of the Project, if any, being bid concurrently or presently under construction.

§ 2.1.2 The Bid is made in compliance with the Bidding Documents.

§ 2.1.3 The Bidder has visited the site, become familiar with local conditions under which the Work is to be performed and has correlated the Bidder's personal observations with the requirements of the proposed Contract Documents.

 The submission of a Bid will be construed as evidence that a site visit and examination of local conditions have been made. Later claims for labor, equipment, or materials required or difficulties encountered which could have been foreseen had such an examination been made will not be recognized.

§ 2.1.4 The Bid is based upon the materials, equipment and systems required by the Bidding Documents without exception.

ARTICLE 3 BIDDING DOCUMENTS

§ 3.1 Copies

§ 3.1.1 Bidders may obtain complete sets of the Bidding Documents from the issuing office designated in the Advertisement or Invitation to Bid in the number and for the deposit sum, if any, stated therein. The deposit will be refunded to Bidders who submit a bona fide Bid and return the Bidding Documents in good condition within ten days after receipt of Bids. The cost of replacement of missing or damaged documents will be deducted from the deposit. A Bidder receiving a Contract award may retain the Bidding Documents and the Bidder's deposit will be refunded.

§ 3.1.2 (Not Used)

§ 3.1.3 Bidders shall use complete sets of Bidding Documents in preparing Bids; neither the Owner nor Architect assumes responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.

§ 3.1.4 The Owner and Architect may make copies of the Bidding Documents available on the above terms for the purpose of obtaining Bids on the Work. No license or grant of use is conferred by issuance of copies of the Bidding Documents.

§ 3.2 Interpretation or Correction of Bidding Documents

§ 3.2.1 The Bidder shall carefully study and compare the Bidding Documents with each other, and with other work being bid concurrently or presently under construction to the extent that it relates to the Work for which the Bid is submitted, shall examine the site and local conditions, and shall at once report to the Architect and Construction Manager (if utilized) errors, inconsistencies or ambiguities discovered.

§ 3.2.2 Bidders and Sub-bidders requiring clarification or interpretation of the Bidding Documents shall make a written request which shall reach the Architect and Construction Manager (if utilized) at least seven days prior to the date for receipt of Bids.

§ 3.2.3 Interpretations, corrections and changes of the Bidding Documents will be made by Addendum. Interpretations, corrections and changes of the Bidding Documents made in any other manner will not be binding, and Bidders shall not rely upon them.

§ 3.3 Substitutions

§ 3.3.1 The materials, products and equipment described in the Bidding Documents establish a standard of required function, dimension, appearance and quality to be met by any proposed substitution.

§ 3.3.2 No substitution will be considered prior to receipt of Bids unless written request for approval has been received by the Architect at least ten days prior to the date for receipt of Bids. Such requests shall include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitution including drawings, performance and test data, and other information necessary for an evaluation. A statement setting forth changes in other materials, equipment or other portions of the Work, including changes in the work of other contracts that incorporation of the proposed substitution would require, shall be included. The burden of proof of the merit of the proposed substitution is upon the proposer. The Architect's decision of approval or disapproval of a proposed substitution shall be final.

§ 3.3.3 If the Architect approves a proposed substitution prior to receipt of Bids, such approval will be set forth in an Addendum. Bidders shall not rely upon approvals made in any other manner.

§ 3.3.4 No substitutions will be considered after the Contract award unless specifically provided for in the Contract Documents.

§ 3.4 Addenda

§ 3.4.1 Addenda will be transmitted to all who are known by the Architect and Construction Manager (if utilized) to have received a complete set of Bidding Documents.

§ 3.4.2 Copies of Addenda will be made available for inspection wherever Bidding Documents are on file for that purpose.

§ 3.4.3 Addenda will be issued no later than four days prior to the date for receipt of Bids except an Addendum withdrawing the request for Bids or one which includes postponement of the date for receipt of Bids.

§ 3.4.4 Each Bidder shall ascertain prior to submitting a Bid that the Bidder has received all Addenda issued, and the Bidder shall acknowledge their receipt in the Bid.

ARTICLE 4 BIDDING PROCEDURES

§ 4.1 Preparation of Bids

§ 4.1.1 Bids shall be submitted on the forms included with the Bidding Documents.

§ 4.1.2 All blanks on the Form of Proposal shall be legibly executed in a non-erasable medium.

§ 4.1.3 Sums shall be expressed in both words and figures. In case of discrepancy, the amount written in words shall govern.

§ 4.1.4 Interlineations, alterations and erasures must be initialed by the signer of the Bid.

§ 4.1.5 All requested Alternates shall be bid. If no change in the Base Bid is required, enter "No Change."

§ 4.1.6 Where two or more Bids for designated portions of the Work have been requested, the Bidder may, without forfeiture of the bid security, state the Bidder's refusal to accept award of less than the combination of Bids stipulated by the Bidder. The Bidder shall make no additional stipulations on the Form of Proposal nor qualify the Bid in any other manner.

§ 4.1.7 Each copy of the Bid shall state the legal name of the Bidder and the nature of legal form of the Bidder. The Bidder shall provide evidence of legal authority to perform within the jurisdiction of the Work. Each copy shall be signed by the person or persons legally authorized to bind the Bidder to a contract. A Bid by a corporation shall further give the state of incorporation and have the corporate seal affixed. A Bid submitted by an agent shall have a current power of attorney attached certifying the agent's authority to bind the Bidder.

§ 4.2 Bid Security

§ 4.2.1 Each Bid greater than \$25,000 shall be accompanied by bid security in the form of a Bond provided by a Surety Company authorized to do business in the Commonwealth of Kentucky, or in the form of a certified check, and in an amount equal to at least five percent (5%) of the Base Bid amount, pledging that the Bidder will enter into a contract with the Owner on the terms stated in the Bid and will, if required, furnish bonds covering the faithful performance of the Contract and payments of all obligations arising thereunder. Should the Bidder refuse to enter into such Contract or fail to furnish such bonds if required, the amount of the bid security shall be forfeited to the Owner as liquidated damages, not as a penalty.

§ 4.2.2 If a surety bond is required, it shall be written on AIA Document A310[™], Bid Bond, unless otherwise provided in the Bidding Documents, and the attorney-in-fact who executes the bond on behalf of the surety shall affix to the bond a certified and current copy of the power of attorney.

§ 4.2.3 The Owner will have the right to retain the bid security of Bidders to whom an award is being considered until either (a) the Contract has been executed and bonds, if required, have been furnished, or (b) the specified time has elapsed so that Bids may be withdrawn or (c) all Bids have been rejected.

§ 4.3 Submission of Bids

§ 4.3.1 All copies of the Bid, the bid security, if any, and any other documents required to be submitted with the Bid shall be enclosed in a sealed opaque envelope. The envelope shall be addressed to the party receiving the Bids and shall be identified with the Project name, the Bidder's name and address and, if applicable, the designated portion of the Work for which the Bid is submitted. If the Bid is sent by mail, the sealed envelope shall be enclosed in a separate mailing envelope with the notation "SEALED BID ENCLOSED" on the face thereof.

§ 4.3.2 Bids shall be deposited at the designated location prior to the time and date for receipt of Bids as indicated in the Advertisement or Invitation to Bid or any extensions thereof made by Addendum. Bids received after the closing time and date for receipt and opening of Bids will be rejected and returned to the Bidder unopened.

§ 4.3.3 The Bidder shall assume full responsibility for timely delivery at the location designated for receipt of Bids.

§ 4.3.4 Oral, telephonic, telegraphic, facsimile or other electronically transmitted bids will not be considered.

§ 4.4 Modification or Withdrawal of Bid

§ 4.4.1 A Bid may not be modified, withdrawn or canceled by the Bidder during the stipulated time period following the time and date designated for the receipt of Bids, and each Bidder so agrees in submitting a Bid.

§ 4.4.2 Prior to the time and date designated for receipt of Bids, a Bid submitted may be modified or withdrawn by notice to the party receiving Bids at the place designated for receipt of Bids. Such notice shall be in writing over the signature of the Bidder. Written confirmation over the signature of the Bidder shall be received, and date- and time-stamped by the receiving party on or before the date and time set for receipt of Bids. A change shall be so worded as not to reveal the amount of the original Bid.

§ 4.4.3 Withdrawn Bids may be resubmitted up to the date and time designated for the receipt of Bids provided that they are then fully in conformance with these Instructions to Bidders.

§ 4.4.4 Bid security, if required, shall be in an amount sufficient for the Bid as resubmitted.

ARTICLE 5 CONSIDERATION OF BIDS

§ 5.1 Opening of Bids

At the discretion of the Owner, if stipulated in the Advertisement or Invitation to Bid, the properly identified Bids received on time will be publicly opened and will be read aloud.

§ 5.2 Rejection of Bids

The Owner shall have the right to reject any or all Bids. A Bid not accompanied by a required bid security or by other data required by the Bidding Documents, or a Bid which is in any way incomplete or irregular is subject to rejection.

§ 5.3 Acceptance of Bid (Award) [Reference: KRS 45A.365]

§ 5.3.1 It is the intent of the Owner to award a Contract to the lowest qualified Bidder provided the Bid has been submitted in accordance with the requirements of the Bidding Documents and does not exceed the funds available. The Owner shall have the right to waive informalities and irregularities in a Bid received and to accept the Bid which, in the Owner's judgment, is in the Owner's own best interests.

§ 5.3.2 The Owner shall have the right to accept Alternates in any order or combination, unless otherwise specifically provided in the Bidding Documents, and to determine the low Bidder on the basis of the sum of the Base Bid and Alternates accepted.

ARTICLE 6 POST-BID INFORMATION

§ 6.1 Contractor's Qualification Statement

§ 6.1.1 Bidders to whom award of a Contract is under consideration shall submit to the Architect, upon request, a properly executed AIA Document A305TM, Contractor's Qualification Statement, unless such a Statement has been previously required and submitted as a prerequisite to the issuance of Bidding Documents.

§ 6.1.2 In determining the qualifications and responsibilities of the Bidder, the Owner shall take into consideration the Bidder's skill, experience, facility, previous work standing, financial standing, capacity and ability to handle work in addition to that in progress, and quality and efficiency of construction plant and equipment proposed to be used on the project.

§ 6.2 (Not Used)

§ 6.3 Submittals

§ 6.3.1 Each Bidder shall submit as part of the Form of Proposal a list of subcontractors proposed for each major branch of work itemized and described in the specifications for the Project. The Bidder's listing of a subcontractor for a work category certifies that the subcontractor has in current employment, skilled staff and necessary equipment to complete that category. The Architect and Construction Manager (if utilized) will evaluate the ability of all listed subcontractors to complete the work and notify the Owner. Listing of the Bidder as the subcontractor may invalidate the Bid should the Architect's and Construction Manager's (if utilized) review indicate the bidder does not have skilled staff and equipment to complete the work category at the time the Bid was submitted.

.1 Changing subcontractors from those listed with the Form of Proposal is prohibited unless the bidder provides grounds for such a change that are consistent with provisions of the Instructions to Bidders. Said change shall be accompanied by a written explanation from the Bidder as well as a written release from the listed subcontractor. All letters shall be on original company stationary with original signatures from an officer in the company legally approved to act for the company. An unjustifiable change of subcontractors may invalidate the Bid. Any change to a proposed person or entity shall be addressed as noted in Section 6.3.3 of these Instructions to Bidders

§ 6.3.2 The Bidder will be required to establish to the satisfaction of the Architect and Owner the reliability and responsibility of the persons or entities proposed to furnish and perform the Work described in the Bidding Documents.

§ 6.3.3 Prior to the execution of the Contract, the Architect will notify the Bidder in writing if either the Owner or Architect, after due investigation, has reasonable objection to a person or entity proposed by the Bidder. If the Owner or Architect has reasonable objection to a proposed person or entity, the Bidder may, at the Bidder's option, (1) withdraw the Bid or (2) submit an acceptable substitute person or entity with an adjustment in the Base Bid or Alternate Bid to cover the difference in cost occasioned by such substitution. The Owner may accept the adjusted bid price or disqualify the Bidder. In the event of either withdrawal or disqualification, bid security will not be forfeited. § 6.3.4 Persons and entities proposed by the Bidder and to whom the Owner and Architect have made no reasonable objection must be used on the Work for which they were proposed and shall not be changed except with the written consent of the Owner and Architect.

§ 6.4 List of Materials, Suppliers, and Manufacturers

§ 6.4.1 Each Bidder shall submit a complete list of materials/equipment with supplier's and manufacturer's name in the form and manner indicated on the Form of Proposal and in compliance with materials and equipment specified.

§ 6.4.2 In addition to the list furnished with the Form of Proposal, the successful Bidder thereafter known as the Contractor, may be requested within thirty (30) calendar days after award of contract to furnish to the Architect and Construction Manager (if utilized) a more detailed and complete list of the materials and equipment, together with the manufacturer's or maker's name, brand and/or catalogue number, and product data or illustration thereof.

§ 6.4.3 Prior to the award of contract, the Architect and Construction Manager (if utilized) will make a preliminary check of the lists included with the Form of Proposal and advise the Bidder and the Owner of the acceptance thereof, and of such other actions as may be necessary in order to meet the requirements of the contract specifications. Should it develop that any of the materials or equipment named in the list do not meet the requirements of the project specifications, the Bidder shall be required to offer to the Owner other materials or equipment in compliance with the specifications at no change in contract price. Preliminary review and acceptance of the above list shall not relieve the Contractor of furnishing equipment and materials in accordance with the specifications.

§ 6.4.4 Written approval shall be obtained from the Architect regarding any material/equipment, supplier, and manufacturer substitution. Substitutions are permitted in the following instance:

- .1 Failure to comply with contract requirements;
- .2 Failure of the supplier or manufacturer to meet delivery schedules or other conditions of the contract;
- .3 Written release by the supplier or manufacturer,

§ 6.4.5 The Owner reserves the right to reject the bid of any Bidder who fails to furnish the information required under Sections 6.3 and 6.4.

§ 6.5 Unit Prices

§ 6.5.1 Each Bidder shall submit as part of the Bid a list of unit prices as designated on the Form of Proposal.

§ 6.5.2 Unit prices are for changing or adjusting the scope or quantity of work from that indicated by the contract drawings and specifications.

§ 6.5.3 Unit prices shall include all labor, materials, equipment, appliances, supplies, overhead and profit.

§ 6.5.4 Only a single unit price per item shall be given and it shall apply for either more or less work than indicated or specified in the contract documents. In the event the contract is adjusted by unit prices, a change order shall be issued for the change and for the increased or decreased amount.

§ 6.5.5 Unit prices listed by the Bidder and accepted by the Owner shall apply to all phases of work whether the work is performed by the Bidder or by the Bidder's (Contractor's) subcontractors.

§ 6.5.6 For unit prices that apply to a lump sum Base Bid, the Owner reserves the right, prior to an award of contract, to negotiate, adjust and/or reject any price that is determined by the Architect, Construction Manager, or Owner to be excessive or unreasonable in amount.

§ 6.5.7 On line item total sum bids where Bidders are quoting firm unit prices for estimated quantities of units of work, the unit price is the Bid and is not subject to change, either by the Bidder or Owner. The Owner reserves the right to correct mathematical errors in extensions and additions by the Bidder. The Owner's corrected bid sum total shall take preference over the Bidder's computed bid sum total.

§ 6.6 Bid Division, Material Suppliers, and Purchase Orders

§ 6.6.1 This Section applies to projects with or without Bid Division (Multiple Prime Contracts), and those Projects that provide for direct purchase by the Owner of materials and equipment from Material Suppliers.

§ 6.6.2 For Projects with Bid Division: General Construction and Concrete, Masonry, Plumbing, HVAC and Electrical Contractors shall provide with their Bid a breakdown of major material items (excluding sales tax). This breakdown shall include description of the item, name of the manufacturer, name of the supplier, and the amount of the supplier's quote. The Owner will issue Purchase Orders direct to the suppliers for these materials. The following shall be provided:

- .1 Within four (4) days from the Bid Date, the low Bidder shall furnish to the Owner the list of material suppliers of the items listed on the bid breakdown, with authorization given to the Contractor to quote the materials listed and that the Supplier will furnish the listed materials to the Owner under the Owner's standard Purchase Order for the amount stated on the Contractor's bid breakdown. Failure of any Contractor to provide this written list of material suppliers with authorization will cause forfeiture of the bid security.
- .2 The Contractor shall also guarantee to the Owner that materials listed in the breakdown to be purchased directly by the Owner shall comply with requirements of the Contract Documents and that the quantity of such material is sufficient to complete the Bid Division. The Performance and Payment Bonds required of the Contractor shall be in the combined amount of the materials designated in its bid to be acquired by Purchase Order by the Owner and all remaining items of cost in the respective Bid Division. Contractor shall provide an invoice from the supplier to the Owner with Contractor's Application for Payment.
- .3 Material Suppliers will be paid the full amount of their invoices. Retainage that would otherwise be withheld from invoices submitted by and paid to a material supplier shall be withheld from the approved payment request of the Contractor. Refer to General Conditions for further requirements regarding retainage.
 - .a Lockers, Library, Kitchen, Shop, Technology, Science or other major equipment bid divisions shall provide with their Bid a breakout price for the material portions of the Bid (excluding sales tax). Award of contract will be based on the lump sum price of the accepted Bid that includes labor and materials. The Owner will issue a Purchase Order for the material and a contract for the labor and incidental materials. Retainage will be held on both the Purchase Order and the Contract in accordance with the General Conditions.
 - .b The language of the Bid Divisions is designed to outline and define the work in general to be included in a particular Bid Division and to prevent overlapping and conflicting requirements within other Bid Divisions. No Bidder shall use the omission of any item from this language as a basis for a claim for additional cost when such item is specified or indicated to be part of a complete and workable system.
 - .c It is the responsibility of the Bidder to determine which Bid Division or combination of Bid Divisions the Bidder desires to Bid.

§ 6.6.3 For Projects without Bid Division but with direct purchase by the Owner of materials and equipment from Material Suppliers, Contractors shall comply with paragraph 6.6.2 above as applicable to the Project. The Owner will issue Purchase Orders direct to the suppliers for these materials. Award of contract will be based on the lump sum price of the accepted bid that includes labor and materials. Retainage will be held on both the Purchase Orders and the Contract(s) in accordance with the General Conditions.

ARTICLE 7 PERFORMANCE BOND AND PAYMENT BOND

§ 7.1 Bond Requirements

§ 7.1.1 Unless stipulated otherwise in the Bidding Documents, the Bidder shall furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder. Bonds shall be executed by a surety company authorized to do business in Kentucky.

§ 7.1.2 The cost of such bonds shall be included in the Bid. If the furnishing of such bonds is required after receipt of bids and before execution of the Contract, the cost of such bonds shall be added to the Bid in determining the Contract Sum.

§ 7.2 Time of Delivery and Form of Bonds

§ 7.2.1 The Bidder shall deliver the required bonds to the Owner not later than three days following the date of execution of the Contract. If the Work is to be commenced prior thereto in response to a letter of intent, the Bidder shall, prior to commencement of the Work, submit evidence satisfactory to the Owner that such bonds will be furnished and delivered in accordance with this Section 7.2.1.

§ 7.2.2 Unless otherwise provided, the bonds shall be written on AIA Document A312TM-2010, Performance Bond and Payment Bond — KDE Version. Both bonds shall be written in the amount of the Contract Sum, being the total of the Base Bid, as described in Section 1.5 herein, and all Alternates accepted by the Owner.

§ 7.2.3 The bonds shall be dated on or after the date of the Contract.

§ 7.2.4 The Bidder shall require the attorney-in-fact who executes the required bonds on behalf of the surety to affix thereto a certified and current copy of the power of attorney.

ARTICLE 8 FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR

Unless otherwise required in the Bidding Documents, the Agreement for the Work will be written on AIA Document A101[™]-2007, Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum — KDE Version, except for those Projects utilizing a Construction Manager the Agreement will be written on AIA Document A132[™]-2009, Standard Form of Agreement Between Owner and Contractor, Construction Manager as Advisor Edition — KDE Version. Owner-Contractor Agreements shall be valid only after written notice by the Kentucky Department of Education that the proposed Agreements are approved.

ARTICLE 9 PUBLIC WORKS ACT [Reference: KRS 337.505 to 337.550]

§ 9.1 Labor Regulations

§ 9.1.1 Work shall be performed in compliance with applicable provisions of the Kentucky Prevailing Wage Act on Public Works Projects, KRS 337.505 through KRS 337.550.

§ 9.1.2 Prevailing wage rates, included with the Bidding Documents, shall be paid on this Project if required under Section 10.1.1. The stipulated wage rates represent prevailing minimum wage rates of pay allowable and shall not be construed to mean that higher rates may not have to be paid in order to secure labor.

§ 9.1.3 Any Bidder and/or subcontract bidder in violation of any wage or work act provision (KRS 337.510 to KRS 337.550) and under citation by the Kentucky Department of Labor is prohibited by KRS 337.990 from bidding on or working on any and all public works contracts either in their name or in the name of any other company, firm, or other entity in which there is vested interest. No Bid shall be submitted by a prime Bidder or sub-bidder in violation of KRS Chapter 337. The responsibility of the qualifications of the sub-contract Bidder is solely that of the prime Bidder. The rejection of the subcontract Bidder and resubmitted of a qualified subcontract Bidder shall be addressed per the provisions of these Instructions to Bidders relating to subcontract Bidders (subcontractors) and materials.

§ 9.2 Davis-Bacon Act Provisions

Projects funded with Federal Funds shall comply with the Davis-Bacon Act (Subchapter IV of Chapter 31 of the Title 40 of the United States Code). Where the amount received from federal revenue sharing is less than 25 percent of the estimated total construction cost of a public school project, state law and not the federal applies to the wage rate and the prevailing wage scale to be used for the project (OAG 74-329). Refer to Supplementary Conditions for direction regarding application of federal rates, if included in the bidding documents, to this project. In the event both state and federal wage rates apply, the higher of the two rates shall be used to determine labor costs.

ARTICLE 10 TAXES

§ 10.1 Kentucky Sales and/or Use Tax [Reference KRS 139.495(1)]

Bidders are informed that construction contracts of the Commonwealth of Kentucky and political subdivisions are not exempt from the provisions of the Kentucky Sales and/or Use Tax, unless provisions are clearly noted in the bidding documents for the direct purchase of certain materials and equipment by the Owner. Materials and equipment which are to be submitted for direct purchase are as noted by the Architect or Construction Manager in the Form of Proposal and shall be limited to forty (40) items with a minimum price of \$5,000 each. All other materials and equipment shall be included in the Contract Price and are subject to Kentucky Sales and/or Use Taxes. Current Sales and/or Use Tax shall be provided for and included in the bid amount as no adjustment will be permitted nor made after the receipt of bids.

§ 10.2 Federal Excise Tax

The Commonwealth of Kentucky and its political subdivisions are exempt from Federal Excise Tax.

ARTICLE 11 POST BID REVIEW AND MATERIAL SUBMITTAL

§ 11.1 Representative at Bid Opening

§ 11.1.1 Each prime Bidder shall have an authorized representative at the bid opening for submittal of the list of materials and equipment, and the post bid review which follows immediately after the opening and reading of bids.

§ 11.1.2 Following the opening of bids, the three (3) apparent low Bidders shall remain for a post-bid review, and shall submit a completed list of materials, equipment and suppliers within one (1) hour from the close of the reading of the bids. The list of materials and equipment shall be the listing contained in the Form of Proposal.

§ 11.1.3 The post bid review, open to all bidders, will be conducted jointly with representatives of the Architect and Construction Manager (if utilized), Owner, and apparent low Bidder. Preliminary review will be directed toward Bidder's qualifications, list of subcontractors, list of materials and equipment, and unit prices.

ARTICLE 12 EQUAL EMPLOYMENT AND NONDISCRIMINATION

The Commonwealth of Kentucky and its political subdivisions are committed to equal job opportunities on public contracts and prohibited from discrimination based on race, creed, color, sex, age, religion, or national origin.

ARTICLE 13 CONFLICT OF INTEREST, GRATUITIES AND KICKBACKS, USE OF CONFIDENTIAL INFORMATION [Reference KRS 45A.455]

Conflict of Interest, Gratuities, Kickbacks, and Use of Confidential Information as described in KRS 45A.455 are expressly prohibited. Penalties for any violation under this statute are located in KRS 45A.990.

ARTICLE 14 KENTUCKY FAIRNESS IN CONSTRUCTION ACT OF 2007 [Reference KRS 371.400 to 371.425]

Projects constructed for school districts in the Commonwealth of Kentucky are subject to provisions of the Kentucky Fairness in Construction Act of 2007 as it relates to the right to litigate, the right to delay damages against the Owner, the right to file a mechanic's lien, prompt payment by Owners, amount of retainage that can be withheld and other provisions of the Act.

ARTICLE 15 KENTUCKY PREFERENCE LAW [Reference KRS 45A 490 to 45A 494]

§ 15.1 Projects constructed for school districts in the Commonwealth of Kentucky are subject to provisions of the reciprocal preference for Kentucky Preference for Resident Bidders law, KRS 45A.490 to KRS 45A.494. Reciprocal preference shall be given by public agencies to resident bidders.

§ 15.2 The Kentucky Finance and Administration Cabinet shall maintain a list of states that give to or require a preference for their own resident bidders, including details of the preference given to such bidders, to be used by public agencies in determining resident bidder preferences. The cabinet shall also promulgate administrative regulations in accordance with KRS Chapter 13A establishing the procedure by which the preferences required by this Section shall be given.

§ 15.3 The reciprocal preference as described in KRS 45A.490 to KRS 45A.494 above shall be applied in accordance with Kentucky Administrative Regulation 200 KAR 5:400.

SECTION 002114 - SUPPLEMENTAL INSTRUCTIONS TO BIDDERS

SCOPE

The following Supplemental Instructions to Bidders modify, change, delete from, or add to AIA Document A701-1997 "Instructions to Bidders", Kentucky Department of Education version, which is included herein as a part of the Contract Documents.

ARTICLE 3 - BIDDING DOCUMENTS

Add the following:

3.5 Bids will be received from Contractors for a total lump sum amount. All phases of the work shall be bid to and through the Contractor submitting the proposal.

ARTICLE 4 - BIDDING PROCEDURES

Modify Paragraph 4.2.1 as follows:

"Each Bid greater than \$100,000 shall be accompanied by bid security in the form of a Bond provided by a Surety company authorized to do business in the Commonwealth of Kentucky, or in the form of a certified check, and in an amount equal to at least five percent (5%) of the Base Bid amount, pledging that the Bidder will enter into a contract with the Owner on the terms stated in the Bid and will, if required, furnish bonds covering the faithful performance of the Contract and payments of all obligations arising thereunder. Should the Bidder refuse to enter into such Contract or fail to furnish such bonds, if required, the amount of the bid security shall be forfeited to the Owner as liquidated damages, not as a penalty."

Add to Paragraph 4.3.1:

- 4.3.1.1 The bidder shall submit the following documents at the time of the bid opening: Form of Proposal (KDE Document) - Submit one original. Bid Security - Submit one original. Form of Proposal Pages 2 & 3: List of Proposed Subcontractors - Submit one original.
- 4.3.1.2 The bidder shall submit the following documents within 1 hour of the bid opening: Form of Proposal Pages 4 & 5: List of Proposed Suppliers and Manufacturers. An electronic copy is acceptable. Form of Proposal Pages 6 & 7: Unit Prices. An electronic copy is acceptable.
- 4.3.1.3 The bidder shall submit the following documents within 24 hours of the bid opening: Form of Proposal Section 004122: Modified Bituminous Roofing System Manufacturer's Certification - Submit completed form. A fax copy is acceptable. Form of Proposal Section 004138: Finish Hardware Supplier's Certification - Submit completed form. An electronic copy is acceptable. Form of Proposal Section 004140: Bidder's Qualifications - Submit one completed form within 24 hours of the bid opening. An electronic copy is acceptable.
- 4.3.1.4 The bidder shall submit the following documents within 48 hours of the bid opening: Form of Proposal Section 004145: Identification of Minority and Women Subcontractors and Material Suppliers. An electronic copy is acceptable.

4.3.1.5 The apparent successful bidder shall submit the following documents within 4 days of the bid opening:

Form of Proposal Pages 8-10: Direct Material Purchases. An electronic copy is acceptable. Purchase Orders: Purchase Order Forms should be submitted for each of the vendors listed on the Direct Material Purchases List. These Purchase Orders shall be submitted on the KDE forms provided, and shall be signed by each vendor. Electronic copies are acceptable.

Contractor shall be responsible for verifying that the materials listed on the Bid Form Direct Material Purchases List are in full compliance with the Supplier/Manufacturer List provided within two hours of the bid opening. Should an inconsistency become apparent, the Architect shall be able to select the manufacturer at no additional cost to the Owner.

Kentucky Department of Education Purchase Order Summayr Form Section 004156. An electronic copy is acceptable.

W9 Forms: Submit W9 Forms for each vendor listed on the Direct Material Purchases List. Electronic copies are acceptable.

4.3.1.6 The apparent successful bidder may be asked to submit the following document within 24 hours of the bid opening:

Form of Proposal Section 004142: Bidder's Financial Statement - Submit one completed form within 24 hours of the bid opening if requested. An electronic copy is acceptable.

ARTICLE 6 - POST-BID INFORMATION

Add the following paragraphs:

6.3.5 In determining the qualifications of the bidder with regard to the bidder's experience, the bidder is expected to be able to show experience which reflects a similar or equivalent scale, scope and complexity to the project. Qualifying bidders should expect to be able to provide the following:

6.3.5.1 Project experience of at least five projects with a construction cost of over \$1,000,000 within the last five years;

6.3.5.2 Project experience of at least ten projects with a similar type of construction within the last five years.

ARTICLE 7 - PERFORMANCE BOND AND PAYMENT BOND

Revise the last sentence of Paragraph 7.2.2 to read:

Unless otherwise provided, both bonds shall be written in the amount of the sum of the contract amount plus the total amount of all purchase orders.

ARTICLE 9 - PUBLIC WORKS ACT (REFERENCE KRS 337.550)

Delete Article 9.1 Labor Regulations in its entirety. Kentucky prevailing wage rates will not apply to this project.

Delete Article 9.2 David-Bacon Act Provisions in its entirety. Federal prevailing wage rates will not apply to this project.

ARTICLE 10 - TAXES

Add the following paragraphs:

10.3. It is the Owner's intention to purchase major material items by direct Purchase Order. Refer to documents included in this Project Manual for information concerning this process.

10.3.1 As provided by KRS 139.310 and the Kentucky Administrative Regulation 103 KAR 26:070 (Contract Construction), each contractor is responsible for Kentucky Sales and Use Tax on all materials purchased and installed by the Contractor or a third party hired by the Contractor.

10.3.2 The sales and use tax is to be excluded on those material items purchased by the Owner directly from the material supplier as indicated on the Direct Material Purchases List. If a contractor lists his own company as the supplier for items listed on this list, the Owner will not issue a Purchase Order and exemption certificate. Accordingly, the sales and use tax on the materials used to fulfill the terms of the contract will be the liability of the contractor.

10.3.3 The material breakout amount indicated by a prospective bidder is considered final. **END OF SECTION**

KENTUCKY DEPARTMENT OF EDUCATION

702 KAR 4:160				KUPUJAL
BG No. <u>19-363</u>				
Date:	То: (Owner) Marion County Board	of Education	
Project Name: <u>Ma</u>	arion County Middle School A	ddition & Renovation Bi	id Package: NA (GC)	
City, County: Leb	anon, Marion County, Kentuc	<u>ky</u>		
Name of Contract	tor:			
Mailing Address:				
Business Address	5:		Telephone:	
Having carefully Conditions, Speci labor, materials, e contract documer	examined the Instructions fications, and Drawings, for tl equipment, tools, supplies, an nts and any addenda listed be	to Bidders, Contract Agree ne above referenced project, th id temporary devices required slow for the price stated herein	ement, General Conditions, S ne undersigned bidder proposes to complete the work in accorda	Supplemental to furnish all ance with the
Addendum BASE BID: For the following lump	(Insert ne construction required to co o sum price of:	the addendum numbers rec received.) omplete the work, in accordance	eived or the word "none" if n	o addendum , I/We submit
		Use Figures		
		Dollars &		Cents
Use	Use Words Use Words			
ALTERNATE BID	<u>S:</u> (If applicable and denoted	in the Bidding Documents)		
For omission from number, the follow	m or addition to those items wing lump sum price will be a	s, services, or construction s dded or deducted from the bas	pecified in Bidding Documents se bid.	by alternate
Alternate Bid No.	Alternate Description	+ (Add to the Base Bid)	- (Deduct from the Base Bid)	No Cost Change from the Base Bid)
Alt. Bid No. 1	Owner-Preferred HVAC Controls Manufacturer			
Alt. Bid No. 2	Owner-Preferred Door Hardware Manufacturers			
Alt. Bid No. 3				
Alt. Bid No. 4				
Alt. Bid No. 5				
Alt. Bid No. 6				
Alt. Bid No. 7				
Alt. Bid No. 9				
Alt. Bid No. 10				

A maximum of 10 Alternate Bids will be acceptable with each Base Bid. Do not add supplemental sheets for Alternate Bids to this document.

LIST OF PROPOSED SUBCONTRACTORS:

List on the lines below each major branch of work and the subcontractor involved with that portion of work. If the branch of work is to be done by the Contractor, so indicate.

The listing of more than one subcontractor in a work category shall invalidate the bid.

The listing of the bidder as the subcontractor for a work category certifies that the bidder has in current employment, skilled staff and necessary equipment to complete that category. The architect/engineer will evaluate the ability of all listed subcontractors to complete the work and notify the owner. Listing of the bidder as the subcontractor may invalidate the bid should the architect's review indicate bidder does not have skilled staff and equipment to complete the work category at the time the bid was submitted.

A maximum of 40 subcontractors will be acceptable with each bid. Do not add supplemental sheets for subcontractors to this document.

The bidder shall submit the list of subcontractors with the bid.

	BRANCH OF WORK (to be filled out by the Architect)	SUBCONTRACTOR (to be filled out by the contractor)
1.	Earthwork	
2.	Storm Drainage	
3.	Site Utilities – Mechanical	
4.	Site Utilities - Electrical	
5.	Structural Concrete (Footings, Stem Walls & Slabs)	
6.	Structural Steel	
7.	Metal Decking	
8.	Masonry	
9.	Roofing	
10.	Doors and Door Hardware	
11.	Window	
12.	Underslab Waterproofing/Vapor Barrier	
13.	Mechanical	
14.	Plumbing	
15.	Controls	
16.	HVAC Insulation	
17.	Fire Protection	

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	BRANCH OF WORK (to be filled out by the Architect)	SUBCONTRACTOR (to be filled out by the contractor)
18.	Electrical	
19.	Fire Alarm	
20.	Communications	
21.	Painting	
22.	Flooring	
23.	Gypsum Board Assemblies	
24.	Acoustical Ceiling Tile	
25.		
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LIST OF PROPOSED SUPPLIERS AND MANUFACTURERS:

List on the lines below each major material category for this project and the suppliers and manufacturers involved with that portion of work. Listing the supplier below means the Contractor is acknowledging authorization from the Supplier to include the Supplier in this bid.

The listing of more than one supplier or manufacturer in a material category shall invalidate the bid.

A maximum of 40 suppliers and manufacturers will be acceptable with each bid. Do not add supplemental sheets for suppliers to this document.

The bidder shall submit the list of suppliers and manufacturers within one (1) hour of the bid.

	MATERIAL DESCRIPTION BY SPECIFICATION DIVISION AND CATEGORY (to be filled out by the Architect or Contractor)	SUPPLIER (to be filled out by the Contractor)	MANUFACTURER (to be filled out by the Contractor)
1.	Concrete		
2.	Concrete Masonry Unit (CMU)		
3.	Brick		
4.	Storm Structures/Piping		
5.	Structural Steel		
6.	Steel Joists		
7.	Steel Decking		
8.	Underslab Waterproofing and Vapor Barrier		
9.	Light Fixtures (Each Type)		
10.	Electrical Distribution		
11.	Wiring Devices		
12.	Heat Pumps		
13.	Outside Air Units		
14.	Plumbing Fixture (Each Type)		
15.	Pumps		
16.	Grilles, Registers and Diffusers		
17.	Ceramic Tile		
18.	Science Casework		

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	MATERIAL DESCRIPTION BY SPECIFICATION DIVISION AND CATEGORY (to be filled out by the Architect or Contractor)	SUPPLIER (to be filled out by the Contractor)	MANUFACTURER (to be filled out by the Contractor)
19.	Paint		
20.	VCT (Vinyl Composition Tile)		
21.	Acoustical Ceiling Tile		
22.	Ceramic Tile		
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UNIT PRICES:

Indicate on the lines below those unit prices to determine any adjustment to the contract price due to changes in work or extra work performed under this contract. The unit prices shall include the furnishing of all labor and materials, cost of all items, and overhead and profit for the Contractor, as well as any subcontractor involved. These unit prices shall be listed in units of work.

A maximum of 40 unit prices will be acceptable with each bid. Do not add supplemental sheets for unit pricing to this document.

The bidder shall submit the list of unit prices within one (1) hour of the bid.

	WORK (to be filled out by the Architect)	PRICE / UNIT (to be filled out by the Contractor)	UNIT (to be filled out by the Contractor)
1	Mass Earth Excavation, On-site disposal		/CY
2	Trench Earth Excavation, On-site disposal		/CY
3	DGA Stone, Placed		/CY
4	#57 Stone, Placed		/CY
5	Fire Alarm pull station w/ 100" of conduit/conductors and connection		/EA
6	Fire Alarm A/V device w/ 100" of conduit/conductors and connection		/EA
7	8" Sanitary Main including excavation and bury		/LF
8	1" DCW Piping w/ hangers and insulation, installed		/LF
9	2" HPS/HPR Piping w/ hangers and insulation, installed		/LF
10	6" GS/GR Piping including excavation and bury		/LF
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	WORK		UNIT
	(to be filled out by the Architect)	(to be filled out by the Contractor)	(to be filled out by the
			Contractor)
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DIRECT MATERIAL PURCHASES:

Indicate on the lines below those materials to be purchased directly by the Owner with a Purchase Order to be issued by the Owner to the individual suppliers. The value of the direct Purchase Order cannot be less than \$5,000. Following the approval of bids, the Contractor shall formalize this list by completing and submitting the electronic Purchase Order Summary Form provided by KDE. Listing the supplier below means the Contractor is acknowledging authorization from the Supplier to include the Supplier in this bid.

A maximum of 50 POs will be acceptable with each bid. Do not add supplemental sheets for additional POs to this document.

The bidder shall submit the list of Purchase Orders within four (4) days of the bid.

	SUPPLIER	PURCHASE ORDER DESCRIPTION	PURCHASE ORDER AMT.
	(to be filled out by the Contractor)	(to be filled out by the Contractor)	(to be filled out by the Contractor)
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
13.			
14.			
15.			
16.			
17.			
18.			
19.			

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	SUPPLIER (to be filled out by the Contractor)	PURCHASE ORDER DESCRIPTION	PURCHASE ORDER AMT.
20.			
21.			
22.			
23.			
24.			
25			
20.			
26.			
27.			
28.			
29.			
30.			
31.			
32.			
33.			
34.			
35.			
36.			
37.			
38.			
39.			
40.			
41.			
42.			
43.			
41			
44.			

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	SUPPLIER (to be filled out by the Contractor)	PURCHASE ORDER DESCRIPTION (to be filled out by the Contractor)	PURCHASE ORDER AMT. (to be filled out by the Contractor)
45.			
46.			
47.			
48.			
49.			
50.			

TIME LIMIT FOR EXECUTION OF CONTRACT DOCUMENTS:

In the event that a bidder's proposal is accepted by the Owner and such bidder should fail to execute the contract within ten (10) consecutive days from the date of notification of the awarding of the contract, the Owner, at his option, may determine that the awardee has abandoned the contract. The bidder's proposal shall then become null and void, and the bid bond or certified check which accompanied it shall be forfeited to and become the property of the Owner as liquidated damages for failure to execute the contract.

The bidder hereby agrees that failure to submit herein above all required information and/or prices can cause disqualification of this proposal.

Submitted by:

NAME OF CONTRACTOR / BIDDER:

AUTHORIZED REPRESENTATIVE'S		E'S	NAME:
	Signature		
AUTHORIZED	REPRESENTATIVE'S	NAME	(printed):
AUTHORIZED REPRESE	NTATIVE'S TITLE:		

NOTICE: Bid security must accompany this proposal if the Base Bid price is greater than of \$25,000.

This form shall not be modified.

SECTION 004122 - MODIFIED BITUMINOUS ROOFING SYSTEM MANUFACTURER'S CERTIFICATION

PART 1 GENERAL

1.01 MODIFIED BITUMINOUS ROOFING SYSTEM MANUFACTURER'S CERTIFICATION

This certification must be completed and submitted as outlined in the Supplemental Instructions to Bidders. Failure to submit this completed certification may be cause for rejection of the bidder's proposal.

Date Submitted:

Name & Address of Roofing Systems Manufacturer:

Name & Address of Roofing Systems Installer:

I certify that ______ (Name of Roofing Installer) is an approved applicator of our roofing systems, and upon completion of this project, providing all terms and conditions for the manufacturer's guarantee are met, we will provide a no-dollar-limit 20-year manufacturer's guarantee for the roof.

Signed. I file:

(Roofing Systems Manufacturer)

END OF SECTION

SECTION 004129 - SPRAYED-IN-PLACE THERMAL INSULATION (072100) INSTALLER'S CERTIFICATION

PART 1 GENERAL

1.01 SPRAYED-IN-PLACE THERMAL INSULATION (072100) INSTALLER'S CERTIFICATION

This certification must be completed and submitted as outlined in the Supplemental Instructions to Bidders. Failure to submit this completed certification may be cause for rejection of the bidder's proposal. Upon submittal of this form RossTarrant will verify from the ABAA website (www.airbarrier.org) the listed installers current and valid certification, at the time of bid, with the ABAA. Installers listed without current and valid ABAA certification will be rejected.

Date Submitted:_____

Name & Address of Sprayed-In-Place Thermal Insulation Installer:

I certify that ______ (Name of Sprayed-In-Place Thermal Insulation Installer) has achieved ABAA Accreditation for sprayed-in-place thermal insulation installation, and is a member with current and valid ABAA Certification.

ABAA Accreditation Number_____

I certify that ______ (Name of Sprayed-In-Place Thermal Insulation Subcontractor) installers have achieved ABAA Certification for sprayed-in-place thermal insulation installation, and is a member with current and valid ABAA Certification.

ABAA Certification Numbers

Signed:______Title: _____

END OF SECTION 004129

SPRAYED-IN-PLACE THERMAL INSULATION (072100) INSTALLER'S CERTIFICATION

SECTION 004138 - FINISH HARDWARE SUPPLIER'S CERTIFICATION

PART 1 GENERAL

1.01 FINISH HARDWARE SUPPLIER'S CERTIFICATION

This certification must be completed and submitted as outlined in the Supplemental Instructions to Bidders. Failure to submit this completed certification may be cause for rejection of the bidder's proposal.

Date Submitted:

Name & Address of Finish Hardware Supplier:

I certify that ______ (print or type name of employee) is a current member of the Door and Hardware Institute (DHI), certified by DHI as an Architectural Hardware Consultant. I further certify that this person has fulfilled the educational experience requirements of the DHI's Continuing Education Program for Consultants and is authorized by DHI to use the Official Seal.

All hardware for this project shall be scheduled and furnished by or under direct supervision of the person listed above, who is also a full-time employee of the firm listed above.

DHI Membership Number

DHI Official Seal Valid Through_____(Date)

Signed:______Title: _____

END OF SECTION

SECTION 004140 - BIDDER'S QUALIFICATION

PART 1 GENERAL

1.01 BIDDER'S QUALIFICATION

Company Name:		
Mailing Address:		
Shipping Address:		
Telephone:		
Fax Number:		
Email (if applicable):		
Projects completed within the las	st five years with a construction cost of \$1,	,000,000 or greater:
	\$	
Owner:	Telephone:	
	\$ T-l	
Owner:	1 elephone:	
Owner	v Telenhone:	
Owner	1 elephone	
Owner:	v Telephone:	
	i \$	
Owner:	Telephone:	

Projects completed within the last five (5) years with a similar type of construction:

	\$	
Owner:	Telephone:	
	\$	
Owner:	Telephone:	
	\$	
Owner:	Telephone:	
	\$	
Owner:	Telephone:	
	\$	
Owner:	Telephone:	

We now have the following jobs under contract and bonded:

 \$
 \$
\$
\$

Personnel: The superintendent on site for the project is scheduled to be:

_.

The project manager in the office for the project is scheduled to be:

END OF SECTION
SECTION 004142 - BIDDER'S FINANCIAL STATEMENT

PART 1 GENERAL

1.01 BIDDER'S QUALIFICATIONS

The Bidder's Qualifications together with the attached affidavit are required by the conditions of the Invitation to be executed and submitted within 24 hours as part of the Proposal if requested.

А.	A permanent place of business is maintained at:				
B.	The following construction Plant and Equipment will be made available for use of this Contract:				
C.	Adequate finances are possessed as indicated: (Note: A prestatement may be substituted in lieu of the following.)	pared Company certified financial			
Co	nditions at close of business	, 20			
1.02 AS	SETS				
А.	Cash in bank and on hand	\$			
B.	Receivable Notes, Accounts, Money Earned, Interest, Guara	ntee Loan \$			
C.	Stocks and Bonds	\$			
D.	Real Estate, Furniture and Fixtures, and Materials	\$			
E.	Equipment (After depreciation)	\$			
F.	Other Assets (Name)	\$			
	Total Assets:	\$			
1.03 LL	ABILITIES				
А.	Payable Notes, Accounts, Interest, Loans	\$			
B.	Real Estate Encumbrances	\$			
C.	Other Encumbrances (Name)	\$			
D.	Reserves	\$			
E.	Capital Stock Paid Up (All Classes)	\$			
F.	Surplus - Net Worth	\$			

In addition to the foregoing, a complete and detailed certified financial statement will be furnished if required.

In the event the Contract is awarded the undersigned, surety bonds will be furnished by:

(Surety Company)

Signed:_____

(Representative of Surety Company)

Agent:_____

Address:_____

SECTION 004145 - IDENTIFICATION OF MINORITY AND WOMEN SUBCONTRACTORS AND MATERIAL SUPPLIERS

PART 1 GENERAL

1.01 SUBMITTAL DATA

- A. The utilization of minority and women subcontractors and material suppliers is encouraged and supported, whenever possible, on public school projects. The bidder and contractor should make full efforts to locate minority- and women-owned business persons.
- B. The apparent successful bidder shall submit this form, along with required attachments, within 48 hours of the Bid Opening.
- C. For assistance in identifying subcontractors and material suppliers, bidders may contact the Kentucky Office for Minority Business Enterprises, mwbe.ky.gov, Phone (502) 564-8099 or the Office of Equal Opportunity, Contract Compliance, finance.ky.gov, Phone (502) 564-2874.
- D. Minority and women subcontractors and material suppliers to hold subcontracts on this project:

Company Name	City/State	Certified MWBE
		Veg/Ne
		I es/Ino
		Yes/No

E. Bidder must attach to this Form of Proposal a list of all minority and women subcontractors and material suppliers contacted in order to prepare a bid.

SECTION 004155 - PURCHASE ORDER

PART 1 GENERAL

1.01 OWNER'S PURCHASE ORDER

- A. Following approval of the Bid Breakout List on the Form of Proposal, the Contractor shall provide copies of Purchase Orders on the attached Kentucky Department of Education Purchase Order Form, or may also provide the same complete information in another format agreed to by the Architect. This Purchase Order shall be governed by the Terms and Conditions of the Purchase Order, also attached.
 - 1. An electronic copy of this form may be requested from the Architect.
 - 2. Once the Architect has received complete information, the data will be entered into the Kentucky Department of Education FACPAC system, and an actual Purchase Order form will be generated for the Contractor to use in getting vendor signatures. This KDE Purchase Order form includes the same information on the form attached to this section.

KENTUCKY DEPARTMENT OF EDUCATION 702 KAR 4:160

PURCHASE ORDER

Board of Education:	BG#
	District PO Number:
	(THIS PURCHASE ORDER NUMBER MUST APPEAR ON ALL PACKAGES, INVOICES AND SHIPPING PAPERS)
	Project Name:
Kentucky Sales Tax Exemption Number:	Bid Package No.:
Date of Order:	
Vendor Name:	Material Description / Category:
Vendor Address:	Facility Name:
	Requested By:
Vendor Phone:	AUTHORIZATION
Vendor Email:	THE ATTACHED TERMS & CONDITIONS ARE HEREBY ACKNOWLEDGED AND MADE PART OF THIS ORDER.
Bill To:	Owner Authorized Name:
Bill to Address:	Owner Authorized Signature:
	Owner Authorization Date:
Ship To:	
Ship to Address:	Vendor Authorized Name:
	Vendor Authorized Signature:
Attention of:	Vendor Authorization Date:

The following project contacts must be notified 48 hours in advance of delivery to jobsite.

Contact Name	Phone Number	Contact Name	Phone Number

Furnish the necessary materials to complete the following bid package(s) / specification section(s) in its entirety. All materials shall be in accordance with the requirements of the Contract.

ITEM NO.	QUANTITY	ITEM DESCRIPTION	UNIT PRICE	TOTAL
		Bid Package(s):	L. S.	
		Specification Section(s):	L. S.	
		SPECIMEN COPY ONLY		

TERMS & CONDITIONS OF PURCHASE ORDER

- 1. Drawings, catalogs, cut sheets, or samples shall be submitted for approval.
- 2. All invoices shall be sent to the contractor/subcontractor designated on the purchase order for approval. No invoices shall be sent directly to the Board of Education (Owner) for payment.
- 3. All invoices shall reference the purchase order number.
- 4. No change in, modification of, or revision of this order shall be valid unless in writing and signed by the Owner.
- 5. Vendor agrees to observe and comply with all applicable federal, state and locals laws, rules, ordinances and regulations in performance of this order.
- 6. Vendor shall not assign this order or any right hereunder without first having obtained the written consent of the Owner.
- 7. Deliveries are to be made in accordance with the Owner's schedule, as directed by the General Contractor (GC), Construction Manager (CM) or Qualified Provider (QP).
- 8. The Owner may cancel this purchase order in whole or in part in the event that the vendor fails or refuses to deliver any of the items purchased, within the time provided, or otherwise violates any of the conditions of this purchase order, or if it becomes evident that the vendor is not providing materials in accordance with the specifications or with such diligence as to permit delivery on or before the delivery date.
- 9. The vendor agrees to deliver the items to the supplied hereunder free and clear of all liens, encumbrances and claims.
- 10. If any of the goods covered under this purchase order are found to be defective in material or workmanship, or otherwise not in conformity with the requirements of this order, the Owner, in addition to the other rights which it may have under warranty or otherwise, shall have the right to reject the same or require that such articles or materials be corrected or replaced promptly with satisfactory materials or workmanship.
- 11. By acknowledging receipt of this order, by performing the designated work or any portion thereof, or by shipping the designated goods, the vendor agrees to the terms and conditions outlined.
- 12. This purchase order shall be governed in all respects by the laws of the Commonwealth of Kentucky.
- 13. In the event the quantities of materials supplied via this purchase order are insufficient to complete the work, the GC, CM or QP shall, at no expense to the Owner, provide such materials as necessary to complete the work.
- 14. In the event that at the completion of the work the vendor has not submitted invoices totaling the value of this purchase order, this purchase order shall be considered complete and closed.

SECTION 004156 - KENTUCKY DEPARTMENT OF EDUCATION PURCHASE ORDER SUMMARY

PART 1 GENERAL

1.01 KENTUCKY DEPARTMENT OF EDUCATION PURCHASE ORDER SUMMARY FORM

- A. The Contractor shall provide a signed Kentucky Department of Education Purchase Order Summary Form within four (4) calendar days from the date of the bid opening.
 - 1. An electronic copy of this form may be requested from the Architect in Excel format.

Kentucky Department of Education District Facilities Branch

Purchase Orde	r Summary Form
	702 KAR 4:160
	February 8, 2012

BG#		19-363					x Initial Statement	
District N	ame	Marion	County Board of Education	District Code		_	Chang Order Stmt.	Date Submitted
Facility N	ame	Marion Co	unty MS Addition & Renovation	Facility Code		_	Final Statement	
PO Number	Bid. Div.	Specification Section No.	Purchase Order Description	Vendor Name	Initial PO Amount	Change Order Amt. To Date	Reason For Change	Final PO Amount
1928-01								
					1			

Kentucky Department of Education District Facilities Branch

Purchase Order	Summary Form
	702 KAR 4:160
	February 8, 2012

BG#		19-363					x Initial Statement	1 cordary 0, 2012
District N	lame	Marion	County Board of Education	District Code		_	Chang Order Stmt.	Date Submitted
Facility N	lame	Marion Cou	nty MS Addition & Renovation	Facility Code		_	Final Statement	
PO Number	Bid. Div.	Specification Section No.	Purchase Order Description	Vendor Name	Initial PO Amount	Change Order Amt. To Date	Reason For Change	Final PO Amount
						_		
All signature	es belov	w are required base	ed upon the appropriate PO certification	Initial PO Total	<u>s</u> -	\$ -	Final PO Total	- \$-
statement pl	nase. (I	nitial / Final)			Ψ –	Ŷ		Ψ –

BG#		19-363					x Initial Statement	
District N	ame	Marion	County Board of Education	District Cod	e	_	Chang Order Stmt.	Date Submitted
Facility N	ame	Marion Cou	inty MS Addition & Renovation	Facility Cod	e	_	Final Statement	
PO Number	Bid. Div.	Specification Section No.	Purchase Order Description	Vendor Name	Initial PO Amount	Change Order Amt. To Date	Reason For Change	Final PO Amount
I certify that materials li with 103 K	at to the sted with AR 26	e best of my kno ithin this docum :070.	wledge, information and belief, all ent will be purchased in accordance		I certify that to the listed within this of KAR 26:070.	e best of my knowl document have bee	edge, information and be n purchased in accordanc	lief, all materials we with KRS 103
Owner's S	ignatu	ire	Date		Owner's Signatu	ire	Date	e
General C	ontrac	ctor's Signature	Date		General Contrac	ctor's Signature	Date	2
Architect's	s Sign	ature	Date		Architect's Sign	ature	Date	e

SECTION 005200 - CONTRACT AGREEMENT FORM

FORM OF GENERAL CONDITIONS

1.01 Refer to Kentucky Department of Education Version of AIA Document A101-2007, Standard Form of Agreement Between Owner and Contractor.
 END OF SECTION

Kentucky Department of Education Version of @AIA` Document A101 $^{\rm IM}$ – 2007

Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum



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Cite this document as "AIA Document A101[™]–2007, Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum — KDE Version," or "AIA Document A101[™]–2007 — KDE Version."

Kentucky Department of Education Version of $@AIA \\ Document A101 - 2007 \\ \label{eq:AIA}$

Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum

day of

AGREEMENT made as of the in the year (In words, indicate day, month and year.)

BETWEEN the Owner: *(Name, legal status, address and other information)*

and the Contractor: (Name, legal status, address and other information)

for the following Project: (Name, location and detailed description)



This version of AIA Document A101–2007 is modified by the Kentucky Department of Education. Publication of this version of AIA Document A101 does not imply the American Institute of Architects' endorsement of any modification by the Kentucky Department of Education. A comparative version of AIA Document A101–2007 showing additions and deletions by the Kentucky Department of Education is available for review on the Kentucky Department of Education Web site.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

The Architect: (Name, legal status, address and other information)

The Owner and Contractor agree as follows.

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TABLE OF ARTICLES

- 1 THE CONTRACT DOCUMENTS
- 2 THE WORK OF THIS CONTRACT
- 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION
- 4 CONTRACT SUM
- 5 PAYMENTS
- 6 DISPUTE RESOLUTION
- 7 TERMINATION OR SUSPENSION
- 8 MISCELLANEOUS PROVISIONS
- 9 ENUMERATION OF CONTRACT DOCUMENTS
- 10 INSURANCE AND BONDS

ARTICLE 1 THE CONTRACT DOCUMENTS

The Contract Documents consist of this Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Owner direct Purchase Orders, Drawings, Specifications, Addenda issued prior to execution of this Agreement, other documents listed in this Agreement and Modifications issued after execution of this Agreement, all of which form the Contract, and are as fully a part of the Contract as if attached to this Agreement or repeated herein. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. An enumeration of the Contract Documents, other than a Modification, appears in Article 9.

ARTICLE 2 THE WORK OF THIS CONTRACT

The Contractor shall fully execute the Work described in the Contract Documents, except as specifically indicated in the Contract Documents to be the responsibility of others.

ARTICLE 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

§ 3.1 The date of commencement of the Work shall be the date of this Agreement unless a different date is stated below or provision is made for the date to be fixed in a notice to proceed issued by the Owner. (Insert the date of commencement if it differs from the date of this Agreement or, if applicable, state that the date will be fixed in a notice to proceed.)

If, prior to the commencement of the Work, the Owner requires time to file mortgages and other security interests, the Owner's time requirement shall be as follows:

§ 3.2 The Contract Time shall be measured from the date of commencement.

Init.

1

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§ 3.3 The Contractor shall achieve Substantial Completion of the entire Work not later than

() days from the date of commencement, or as follows: (Insert number of calendar days. Alternatively, a calendar date may be used when coordinated with the date of commencement. If appropriate, insert requirements for earlier Substantial Completion of certain portions of the Work. Either list requirements for earlier Substantial Completion here or refer to an exhibit attached to this Agreement.)

Portion of Work

Substantial Completion Date

, subject to adjustments of this Contract Time as provided in the Contract Documents.

Liquidated Damages: As actual damages for delay in completion of Work are impossible to determine, the Contractor and his Surety shall be liable for and shall pay to the Owner the sum of

(\$), not as a penalty, but as fixed, agreed and liquidated damages for each calendar day of delay until the Contract Work is substantially completed as defined in the General Conditions of the Contract for Construction. The Owner shall have the right to deduct liquidated damages from money in hand otherwise due, or to become due, to the Contractor, or to sue and recover compensation for damages for failure to substantially complete the Work within the time stipulated herein. Said liquidated damages shall cease to accrue from the date of Substantial Completion.

ARTICLE 4 CONTRACT SUM

§ 4.1 The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's performance of the Contract. The Contract Sum shall be

(\$

), subject to additions and deductions as provided in the Contract Documents.

(List the base bid amount, sum of accepted alternates, total construction cost (the sum of base bid amount plus sum of accepted alternates), sum of Owner's direct Purchase Orders. The Contract Sum shall equal the sum of Total Construction Cost, less Owner direct Purchase Orders. Either list this information here or refer to an exhibit attached to this Agreement.)

		Amount
Base Bid		\$
Sum of Accepted Alternates		\$
Total Construction Cost (the s	um of base bid amount plus sum	of
accepted alternates)		\$
Sum of Owner's direct Purcha	ise Orders	\$
Contract Sum (total construction	n cost less Owner direct Purchase (Orders) \$

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§ 4.2 The Contract Sum is based upon the following alternates, if any, which are described in the Contract Documents and are hereby accepted by the Owner:

(State the numbers or other identification of accepted alternates. If the bidding or proposal documents permit the Owner to accept other alternates subsequent to the execution of this Agreement, attach a schedule of such other alternates showing the amount for each and the date when that amount expires. Either list alternates here or refer to an exhibit attached to this Agreement.)

Number	Item Description	Amount
	Total of Alternates	

§ 4.3 Unit prices, if any:

Item

(Identify and state the unit price; state quantity limitations, if any, to which the unit price will be applicable. Either list unit prices here or refer to an exhibit attached to this Agreement.)



(Identify allowance and state exclusions, if any, from the allowance price. Either list allowances here or refer to an exhibit attached to this Agreement.)

Price

Init.

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ARTICLE 5 PAYMENTS § 5.1 PROGRESS PAYMENTS

§ 5.1.1 Based upon Applications for Payment submitted to the Architect by the Contractor and Certificates for Payment issued by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

§ 5.1.2 The period covered by each Application for Payment shall be one calendar month ending on the last day of the month, or as follows:

§ 5.1.3 Provided that an Application for Payment is received by the Architect not later than the day of a month, the Owner shall make payment of the certified amount to the Contractor not later than the day of the month. If an Application for Payment is received by the Architect after the application date fixed above, payment shall be made by the Owner not later than () days after the Architect receives the Application for Payment.

State law (KRS 371.405) requires the Owner to pay undisputed Applications for Payment within forty-five (45) business days following receipt of the invoices. If the Owner fails to pay the Contractor within forty-five (45) business days following receipt of an undisputed Application for Payment, state law requires the Owner shall pay interest to the Contractor beginning on the forty-sixth business day after receipt of the Application for Payment, computed at the rate required by state law.

§ 5.1.4 Each Application for Payment shall be based on the most recent schedule of values submitted by the Contractor in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum among the various portions of the Work. The schedule of values shall be prepared in such form and supported by such data to substantiate its accuracy as the Architect may require. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 5.1.5 Applications for Payment shall show the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment.

§ 5.1.6 Subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

.1 Take that portion of the Contract Sum properly allocable to completed Work as determined by multiplying the percentage completion of each portion of the Work by the share of the Contract Sum allocated to that portion of the Work in the schedule of values, less retainage of

percent (%). Pending final determination of cost to the Owner of changes in the Work, amounts not in dispute shall be included as provided in Section 7.3.9 of AIA Document A201[™]-2007, General Conditions of the Contract for Construction — KDE Version;

- .2 Add that portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction (or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing), less retainage of percent (%);
- .3 Subtract the aggregate of previous payments made by the Owner; and
- .4 Subtract amounts, if any, for which the Architect has withheld or nullified a Certificate for Payment as provided in Section 9.5 of AIA Document A201–2007 KDE Version.

§ 5.1.7 The progress payment amount determined in accordance with Section 5.1.6 shall be further modified under the following circumstances:

- Add, upon Substantial Completion of the Work, a sum sufficient to increase the total payments to the full amount of the Contract Sum, less such amounts as the Architect shall determine for incomplete Work,
- retainage applicable to such work and unsettled claims; and

(Section 9.8.5 of AIA Document A201–2007 — KDE Version requires release of applicable retainage upon Substantial Completion of Work with consent of surety, if any.)

Init.

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.2 Add, if final completion of the Work is thereafter materially delayed through no fault of the Contractor, any additional amounts payable in accordance with Section 9.10.3 of AIA Document A201–2007 — KDE Version.

§ 5.1.8 Reduction or limitation of retainage, if any, shall be as follows:

When Owner direct Purchase Orders are used, retainage that would otherwise be held on materials and equipment shall transfer to the Contractor, and the material suppliers will be paid the full amount of their invoices. The Owner shall retain ten percent (10%) from each Application for Payment, and an amount equal to ten percent (10%) of approved Purchase Order payments, up to fifty percent (50%) completion of the Work, then provided the Work is on schedule and satisfactory, and upon written request of the Contractor together with consent of surety and the recommendation of the Architect, the Owner shall approve a reduction in Retainage to five percent (5%) of the current Contract Sum plus Purchase Orders. No part of the five percent (5%) retainage shall be paid until after Substantial Completion of the Work, as defined in the General Conditions of the Contract for Construction. After Substantial Completion, if reasons for reduction in retainage may be approved by the Owner when deemed reasonable. The minimum lump sum retainage shall be twice the estimated cost to correct deficient or incomplete work.

§ 5.1.9 Except with the Owner's prior approval, the Contractor shall not make advance payments to suppliers for materials or equipment which have not been delivered and stored at the site.

§ 5.2 FINAL PAYMENT

§ 5.2.1 Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor when

- .1 the Contractor has fully performed the Contract except for the Contractor's responsibility to correct Work as provided in Section 12.2.2 of AIA Document A201-2007 — KDE Version, and to satisfy other requirements, if any, which extend beyond final payment;
- .2 a final Certificate for Payment has been issued by the Architect; and
- .3 the Contractor provides the Owner with affidavits that all payrolls, bills for materials, supplies and equipment, and other indebtedness connected with the Work have been paid or otherwise satisfied, and with Consent of Surety for final payment.

ARTICLE 6 DISPUTE RESOLUTION

§ 6.1 INITIAL DECISION MAKER

The Architect will serve as Initial Decision Maker pursuant to Section 15.2 of AIA Document A201–2007 — KDE Version, unless the parties appoint below another individual, not a party to this Agreement, to serve as Initial Decision Maker.

(If the parties mutually agree, insert the name, address and other contact information of the Initial Decision Maker, if other than the Architect.)



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§ 6.2 BINDING DISPUTE RESOLUTION

For any Claim subject to, but not resolved by, mediation pursuant to Section 15.3 of AIA Document A201–2007 — KDE Version, the method of binding dispute resolution shall be as follows:

(Check the appropriate box. If the Owner and Contractor do not select a method of binding dispute resolution below, or do not subsequently agree in writing to a binding dispute resolution method other than litigation, Claims will be resolved by litigation in a court of competent jurisdiction.)

Arbitration pursuant to Section 15.4 of AIA Document A201–2007 — KDE Version

Litigation in a court of competent jurisdiction where the Project is located

Other: (Specify)

ARTICLE 7 TERMINATION OR SUSPENSION

§ 7.1 The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A201-2007 — KDE Version.

§ 7.2 The Work may be suspended by the Owner as provided in Article 14 of AIA Document A201–2007 — KDE Version.

ARTICLE 8 MISCELLANEOUS PROVISIONS

§ 8.1 Where reference is made in this Agreement to a provision of AIA Document A201-2007 — KDE Version or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

§ 8.2 Payments due and unpaid under the Contract shall bear interest from the date payment is due at such rate required by state law, or in the absence of law, at the legal rate prevailing at the time and place where the Project is located. (Insert rate of interest agreed upon, if any.)

§ 8.3 The Owner's representative: (*Name, address and other information*)

§ 8.4 The Contractor's representative: (Name, address and other information)



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§ 8.5 Neither the Owner's nor the Contractor's representative shall be changed without ten days written notice to the other party.

§ 8.6 Other provisions:

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 The Contract Documents, except for Modifications issued after execution of this Agreement, are enumerated in the sections below.

§ 9.1.1 The Agreement is this executed AIA Document A101–2007, Standard Form of Agreement Between Owner and Contractor — KDE Version.

§ 9.1.2 The General Conditions are AIA Document A201–2007, General Conditions of the Contract for Construction — KDE Version.

§ 9.1.3 The Supplementary and other Conditions of the Contract: (Either list Supplementary and other Conditions of the Contract here or refer to an exhibit attached to this Agreement.)



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(Either list the Drawings here or refer to an exhibit attached to this Agreement.)



AIA Document E201TM-2007, Digital Data Protocol Exhibit, if completed by the parties, or the following

.2 Other documents, if any, listed below:

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(List here any additional documents that are intended to form part of the Contract Documents. AIA Document A201–2007 — KDE Version provides that bidding requirements such as advertisement or invitation to bid, Instructions to Bidders, sample forms and the Contractor's bid are not part of the Contract Documents unless enumerated in this Agreement. They should be listed here only if intended to be part of the Contract Documents.)

- A. AIA Document A701-1997, Instructions to Bidders --- KDE Version
- B. Contractor's Form of Proposal
- C. KDE Purchase Order Summary Form

ARTICLE 10 INSURANCE AND BONDS

The Contractor shall purchase and maintain insurance and provide bonds as set forth in Article 11 of AIA Document A201–2007 – KDE Version.

(State bonding requirements, if any, and limits of liability for insurance required in Article 11 of AIA Document A201–2007 – KDE Version. Either list insurance and bond information here or refer to an exhibit attached to this Agreement.)

Type of Insurance or Bond	Limit of Liability or Bond Amount (\$0.00)
This Agreement entered into as of the day and ye	ar first written above.
OWNER (Signature)	CONTRACTOR (Signature)
(Printed name and title)	(Printed name and title)
ALA Document A101, 2007 Conversity @ 1015, 1018, 1025, 1	027 1051 1058 1061 1063 1067 1074 1077 1087 1001 1007 and 2007 by The



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SECTION 005410 - PERFORMANCE & PAYMENT BOND

FORM OF GENERAL CONDITIONS

1.01 Refer to the AIA Document A312, Performance & Payment Bond, 2010 END OF SECTION

Kentucky Department of Education Version of $@AIA \end{tabular}$ Document A312 $^{\rm TM}$ – 2010

Performance Bond

CONTRACTOR:

(Name, legal status and address)

SURETY:

(Name, legal status and principal place of business)

OWNER:

(Name, legal status and address)

CONSTRUCTION CONTRACT Date:

Amount:

Description: (Name and location)

BOND

Date: (Not earlier than Construction Contract Date)

Amount:

Signature:

Name and Title:

Modifications to this Bond: 🛛 🗆 None

□ See Section 16

SURETY

Company:

Signature: Name

and Title:

CONTRACTOR AS PRINCIPAL

Company: (Corporate Seal)

(Corporate Seal)



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This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

AlA Document A312–2010 combines two separate bonds, a Performance Bond and a Payment Bond, into one form. This is not a single combined Performance and Payment Bond.

(FOR INFORMATION ONLY – Name, address and telephone) AGENT or BROKER: OWNER'S REPRESEN

(Any additional signatures appear on the last page of this Performance Bond.)

OWNER'S REPRESENTATIVE: (Architect, Engineer or other party:)

AIA Document A312™-2010 and Kentucky Department of Education Version of AIA Document A312™-2010. The American Institute of Architects. This document was created on under license number , and is not for resale. This document is ticensed by The American Institute of Architects for one-time use only, and may not be reproduced prior to its completion. § 1 The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.

§ 2 If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except when applicable to participate in a conference as provided in Section 3.

§ 3 If there is no Owner Default under the Construction Contract, the Surety's obligation under this Bond shall arise after

- .1 the Owner first provides notice to the Contractor and the Surety that the Owner is considering declaring a Contractor Default. Such notice shall indicate whether the Owner is requesting a conference among the Owner, Contractor and Surety to discuss the Contractor's performance. If the Owner does not request a conference, the Surety may, within five (5) business days after receipt of the Owner's notice, request such a conference. If the Surety timely requests a conference, the Owner shall attend. Unless the Owner agrees otherwise, any conference requested under this Section 3.1 shall be held within ten (10) business days of the Surety's receipt of the Owner's notice. If the Owner's notice. If the Owner, the Contractor and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement shall not waive the Owner's right, if any, subsequently to declare a Contractor Default;
- .2 the Owner declares a Contractor Default, terminates the Construction Contract and notifies the Surety; and
- .3 the Owner has agreed to pay the Balance of the Contract Price in accordance with the terms of the Construction Contract to the Surety or to a contractor selected to perform the Construction Contract.

§ 4 Failure on the part of the Owner to comply with the notice requirement in Section 3.1 shall not constitute a failure to comply with a condition precedent to the Surety's obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.

§ 5 When the Owner has satisfied the conditions of Section 3, the Surety shall promptly and at the Surety's expense take one of the following actions:

§ 5.1 Arrange for the Contractor, with the consent of the Owner, to perform and complete the Construction Contract;

§ 5.2 Undertake to perform and complete the Construction Contract itself, through its agents or independent contractors;

§ 5.3 Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and a contractor selected with the Owner's concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Section 7 in excess of the Balance of the Contract Price incurred by the Owner as a result of the Contractor Default; or

§ 5.4 Waive its right to perform and complete, arrange for completion, or obtain a new contractor and with reasonable promptness under the circumstances:

- .1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as
 - practicable after the amount is determined, make payment to the Owner; or
- .2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.

§ 6 If the Surety does not proceed as provided in Section 5 with reasonable promptness, the Surety shall be deemed to be in default on this Bond seven days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Section 5.4, and the Owner refuses the payment or the Surety has denied liability, in whole or in part, without further notice the Owner shall be entitled to enforce any remedy available to the Owner.

§7 If the Surety elects to act under Section 5.1, 5.2 or 5.3, then the responsibilities of the Surety to the Owner shall not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety shall not be greater than those of the Owner under the Construction Contract. Subject to the commitment by the Owner to pay the Balance of the Contract Price, the Surety is obligated, without duplication, for

- .1 the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;
- .2 additional legal, design professional and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Section 5; and
- .3 liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.

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§8 If the Surety elects to act under Section 5.1, 5.3 or 5.4, the Surety's liability is limited to the amount of this Bond.

§ 9 The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price shall not be reduced or set off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than the Owner or its heirs, executors, administrators, successors and assigns.

§ 10 The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.

§ 11 Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and shall be instituted within two years after a declaration of Contractor Default or within two years after the Contractor ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

§ 12 Notice to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears.

§ 13 When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

§ 14 Definitions

§ 14.1 Balance of the Contract Price. The total amount payable by the Owner to the Contractor under the Construction Contract after all proper adjustments have been made, including allowance to the Contractor of any amounts received or to be received by the Owner in settlement of insurance or other claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Construction Contract.

§ 14.2 Construction Contract. The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and changes made to the agreement and the Contract Documents.

§ 14.3 Contractor Default. Failure of the Contractor, which has not been remedied or waived, to perform or otherwise to comply with a material term of the Construction Contract.

§ 14.4 Owner Default. Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

§ 14.5 Contract Documents. All the documents that comprise the agreement between the Owner and Contractor.

§ 15 If this Bond is issued for an agreement between a Contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

§ 16 Modifications to this bond are as follows:

§ 16.1 Surety Company shall be licensed to conduct business in the Commonwealth of Kentucky.

§ 16.2 Insurance Agency and Agents issuing bond shall be registered and licensed to conduct business in the Commonwealth of Kentucky with the appropriate Power of Attorney included.

§ 16.3 Bond shall comply with all statutory requirements of the Commonwealth of Kentucky including the Kentucky Unemployment Insurance Law.

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§ 16.4 No suit, action or proceeding by reason or any default whatever shall be brought on this bond after two (2) years from the date on which final payment of the contract fall due and provided further that if any alterations or additions which may be made under the contract or in the work to be done under it, or the giving by the Owner of any extension of time for the performance of the contract or any other forbearance on the part of either the Owner or the Principal shall not, in any way, release the Principal and Surety, or either of them, their heirs, executors, administrators, successors, or assigns for their liability hereunder. Notice to the Surety of any such alterations, extensions, or forbearance being expressly waived.

This obligation shall remain in force and effect until the performance of all covenants, terms and conditions herein stipulated and after such performance, it shall become null and void.

(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)CONTRACTOR AS PRINCIPALSURETYCompany:(Corporate Seal)Company:(Corporate Seal)

Signature:	Signature:
Name and Title:	Name and Title:
Address	Address

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Kentucky Department of Education Version of ATA Document A312™ – 2010

Payment Bond

CONTRACTOR:

(Name, legal status and address)

SURETY:

(Name, legal status and principal place of business)

OWNER:

(Name, legal status and address)

CONSTRUCTION CONTRACT Date:

Amount:

Description: (Name and location)

BOND

Date: (Not earlier than Construction Contract Date)

Amount:

Signature:

Name

Modifications to this Bond: □ None See Section 18

CONTRACTOR AS PRINCIPAL (Corporate Seal)

Company:

(Corporate Seal)



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This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

AIA Document A312-2010 combines two separate bonds, a Performance Bond and a Payment Bond, into one form. This is not a single combined Performance and Payment Bond.

and Title: (Any additional signatures appear on the last page of this Payment Bond.)

AGENT or BROKER:

(FOR INFORMATION ONLY - Name, address and telephone) **OWNER'S REPRESENTATIVE:** (Architect, Engineer or other party:)

SURETY

Company:

Signature:

Name and Title:

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§ 1 The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner to pay for labor, materials and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference, subject to the following terms.

§ 2 If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies and holds harmless the Owner from claims, demands, liens or suits by any person or entity seeking payment for labor, materials or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.

§ 3 If there is no Owner Default under the Construction Contract, the Surety's obligation to the Owner under this Bond shall arise after the Owner has promptly notified the Contractor and the Surety (at the address described in Section 13) of claims, demands, liens or suits against the Owner or the Owner's property by any person or entity seeking payment for labor, materials or equipment furnished for use in the performance of the Construction Contract and tendered defense of such claims, demands, liens or suits to the Contractor and the Surety.

§ 4 When the Owner has satisfied the conditions in Section 3, the Surety shall promptly and at the Surety's expense defend, indemnify and hold harmless the Owner against a duly tendered claim, demand, lien or suit.

§ 5 The Surety's obligations to a Claimant under this Bond shall arise after the following:

§ 5.1 Claimants, who do not have a direct contract with the Contractor,

- .1 have furnished a written notice of non-payment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and
- .2 have sent a Claim to the Surety (at the address described in Section 13).

§ 5.2 Claimants, who are employed by or have a direct contract with the Contractor, have sent a Claim to the Surety (at the address described in Section 13).

§ 6 If a notice of non-payment required by Section 5.1.1 is given by the Owner to the Contractor, that is sufficient to satisfy a Claimant's obligation to furnish a written notice of non-payment under Section 5.1.1.

§7 When a Claimant has satisfied the conditions of Sections 5.1 or 5.2, whichever is applicable, the Surety shall promptly and at the Surety's expense take the following actions:

§ 7.1 Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and

§ 7.2 Pay or arrange for payment of any undisputed amounts.

§ 7.3 The Surety's failure to discharge its obligations under Section 7.1 or Section 7.2 shall not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to discharge its obligations under Section 7.1 or Section 7.2, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.

§ 8 The Surety's total obligation shall not exceed the amount of this Bond, plus the amount of reasonable attorney's fees provided under Section 7.3, and the amount of this Bond shall be credited for any payments made in good faith by the Surety.

§ 9 Amounts owed by the Owner to the Contractor under the Construction Contract shall be used for the performance of the Construction Contract and to satisfy claims, if any, under any construction performance bond. By the Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfy obligations of the Contractor and Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.

§ 10 The Surety shall not be liable to the Owner, Claimants or others for obligations of the Contractor that are unrelated to the Construction Contract. The Owner shall not be liable for the payment of any costs or expenses of any

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Claimant under this Bond, and shall have under this Bond no obligation to make payments to, or give notice on behalf of, Claimants or otherwise have any obligations to Claimants under this Bond.

§ 11 The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.

§ 12 No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the state in which the project that is the subject of the Construction Contract is located or after the expiration of one year from the date (1) on which the Claimant sent a Claim to the Surety pursuant to Section 5.1.2 or 5.2, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

§ 13 Notice and Claims to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, shall be sufficient compliance as of the date received.

§ 14 When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

§ 15 Upon request by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor and Owner shall promptly furnish a copy of this Bond or shall permit a copy to be made.

§ 16 Definitions

§ 16.1 Claim. A written statement by the Claimant including at a minimum

- .1 the name of the Claimant;
- .2 the name of the person for whom the labor was done, or materials or equipment furnished;
- .3 a copy of the agreement or purchase order pursuant to which labor, materials or equipment was furnished for use in the performance of the Construction Contract;
- .4 a brief description of the labor, materials or equipment furnished;
- .5 the date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;
- .6 the total amount earned by the Claimant for labor, materials or equipment furnished as of the date of the Claim;
- .7 the total amount of previous payments received by the Claimant; and
- .8 the total amount due and unpaid to the Claimant for labor, materials or equipment furnished as of the date of the Claim.

§ 16.2 Claimant. An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials or equipment for use in the performance of the Construction Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic's lien or similar statute against the real property upon which the Project is located. The intent of this Bond shall be to include without limitation in the terms "labor, materials or equipment" that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor's subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials or equipment were furnished.

§ 16.3 Construction Contract. The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and all changes made to the agreement and the Contract Documents.

§ 16.4 Owner Default. Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

§ 16.5 Contract Documents. All the documents that comprise the agreement between the Owner and Contractor.

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§ 17 If this Bond is issued for an agreement between a Contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

§ 18 Modifications to this bond are as follows:

§ 18.1 Surety Company shall be licensed to conduct business in the Commonwealth of Kentucky.

§ 18.2 Insurance Agency and Agents issuing bond shall be registered and licensed to conduct business in the Commonwealth of Kentucky with the appropriate Power of Attorney included.

§ 18.3 Bond shall comply with all statutory requirements of the Commonwealth of Kentucky including the Kentucky Unemployment Insurance Law.

§ 18.4 No suit, action or proceeding by reason or any default whatever shall be brought on this bond after two (2) years from the date on which final payment of the contract fall due and provided further that if any alterations or additions which may be made under the contract or in the work to be done under it, or the giving by the Owner of any extension of time for the performance of the contract or any other forbearance on the part of either the Owner or the Principal shall not, in any way, release the Principal and Surety, or either of them, their heirs, executors, administrators, successors, or assigns for their liability hereunder. Notice to the Surety of any such alterations, extensions, or forbearance being expressly waived.

This obligation shall remain in force and effect until the performance of all covenants, terms and conditions herein stipulated and after such performance, it shall become null and void.

 (Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)

 CONTRACTOR AS PRINCIPAL
 SURETY

 Company:
 (Corporate Seal)
 Company:
 (Corporate Seal)

Signature:	Signature:
Name and Title:	Name and Title:
Address	Address

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SECTION 007200 - GENERAL CONDITIONS

FORM OF GENERAL CONDITIONS

1.01 Refer to the Kentucky Department of Education Version of AIA Document A201, General Conditions of the Contract for Construction, 2007 Edition.

Kentucky Department of Education Version of MAIA Document A201™ – 2007

General Conditions of the Contract for Construction

for the following PROJECT:

(Name and location or address)

THE OWNER: (Name, legal status and address)

THE ARCHITECT: (*Name, legal status and address*)

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This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

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ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

§ 1.1.1 The Contract Documents

The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Owner direct Purchase Orders, Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive or (4) a written order for a minor change in the Work issued by the Architect. Unless specifically enumerated in the Agreement, the Contract Documents do not include the advertisement or invitation to bid, Instructions to Bidders, sample forms, other information furnished by the Owner in anticipation of receiving bids or proposals, the Contractor's bid or proposal, or portions of Addenda relating to bidding requirements.

§ 1.1.2 The Contract

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and a Subcontractor or a Sub-subcontractor, (3) between the Owner and the Architect or the Architect's consultants or (4) between any persons or entities other than the Owner and the Contractor. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect's duties.

§ 1.1.3 The Work

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

§ 1.1.4 The Project

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner and by separate contractors.

§ 1.1.5 The Drawings

The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules and diagrams.

§ 1.1.6 The Specifications

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

§ 1.1.7 Instruments of Service

Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Architect and the Architect's consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

§ 1.1.8 Initial Decision Maker

The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2 and certify termination of the Agreement under Section 14.2.2.

§ 1.2 Correlation and Intent of the Contract Documents

§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

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§ 1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

§ 1.2.3 Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

§ 1.3 Capitalization

Terms capitalized in these General Conditions include those that are (1) specifically defined, (2) the titles of numbered articles or (3) the titles of other documents published by the American Institute of Architects.

§ 1.4 Interpretation

In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

§ 1.5 Ownership and Use of Drawings, Specifications and Other Instruments of Service

§ 1.5.1 The Architect and the Architect's consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications, and will retain all common law, statutory and other reserved rights, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and material or equipment suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with this Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' reserved rights.

§ 1.5.2 The Contractor, Subcontractors, Sub-subcontractors and material or equipment suppliers are authorized to use and reproduce the Instruments of Service provided to them solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and material or equipment suppliers may not use the Instruments of Service on other projects or for additions to this Project outside the scope of the Work without the specific written consent of the Owner, Architect and the Architect's consultants.

§ 1.6 Transmission of Data in Digital Form

If the parties intend to transmit Instruments of Service or any other information or documentation in digital form, they shall endeavor to establish necessary protocols governing such transmissions, unless otherwise already provided in the Agreement or the Contract Documents.

ARTICLE 2 OWNER

§ 2.1 General

§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.

§ 2.1.2 The Owner shall furnish to the Contractor within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of or enforce mechanic's lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner's interest therein.

§ 2.2 Information and Services Required of the Owner § 2.2.1 (Not Used)

§ 2.2.2 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

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§ 2.2.3 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.

§ 2.2.4 The Owner shall furnish information or services required of the Owner by the Contract Documents with reasonable promptness. The Owner shall also furnish any other information or services under the Owner's control and relevant to the Contractor's performance of the Work with reasonable promptness after receiving the Contractor's written request for such information or services.

§ 2.2.5 Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor one copy of the Contract Documents for purposes of making reproductions pursuant to Section 1.5.2.

§ 2.3 Owner's Right to Stop the Work

If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or repeatedly fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3.

§ 2.4 Owner's Right to Carry Out the Work

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of written notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such deficiencies. In such case an appropriate Change Order shall be issued deducting from payments then or thereafter due the Contractor the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect or failure. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner.

ARTICLE 3 CONTRACTOR

§ 3.1 General

§ 3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the jurisdiction where the Project is located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative.

§ 3.1.2 The Contractor shall perform the Work in accordance with the Contract Documents.

§ 3.1.3 The Contractor shall not be relieved of obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

§ 3.2 Review of Contract Documents and Field Conditions by Contractor

§ 3.2.1 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed and correlated personal observations with requirements of the Contract Documents.

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.2.3, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for

information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

§ 3.2.3 The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Architect any nonconformity discovered by or made known to the Contractor as a request for information in such form as the Architect may require.

§ 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall make Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities.

§ 3.3 Supervision and Construction Procedures

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract, unless the Contract Documents give other specific instructions concerning these matters. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences or procedures, the Contractor shall evaluate the jobsite safety thereof and, except as stated below, shall be fully and solely responsible for the jobsite safety of such means, methods, techniques, sequences or procedures that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely written notice to the Owner and Architect and shall not proceed with that portion of the Work without further written instructions from the Architect. If the Contractor is then instructed to proceed with the required means, methods, techniques, sequences or procedures shall be solely responsible for any loss or damage arising solely from those Owner-required means, methods, techniques, sequences or procedures without acceptance of changes proposed by the Contractor, the Owner shall be solely responsible for any loss or damage arising solely from those Owner-required means, methods, techniques, sequences or procedures.

§ 3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors.

§ 3.3.3 The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.

§ 3.4 Labor and Materials

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

§ 3.4.2 Except in the case of minor changes in the Work authorized by the Architect in accordance with Sections 3.12.8 or 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect and in accordance with a Change Order or Construction Change Directive.

§ 3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them.

§ 3.5 Warranty

The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further

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warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

§ 3.6 Taxes

The Contractor shall pay sales, consumer, use and similar taxes for the Work provided by the Contractor that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

§ 3.7 Permits, Fees, Notices and Compliance with Laws

§ 3.7.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit as well as for other permits, fees, licenses, and inspections by government agencies necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.

§ 3.7.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work.

§ 3.7.3 If the Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

§ 3.7.4 Concealed or Unknown Conditions

If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 21 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend an equitable adjustment in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor in writing, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may proceed as provided in Article 15.

§ 3.7.5 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner and Architect. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15.

§ 3.8 Allowances

§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

- § 3.8.2 Unless otherwise provided in the Contract Documents,
 - .1 allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;
 - .2 Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and
 - .3 whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

§ 3.8.3 Materials and equipment under an allowance shall be selected by the Owner with reasonable promptness.

§ 3.9 Superintendent

§ 3.9.1 The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor.

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner through the Architect the name and qualifications of a proposed superintendent. The Architect may reply within 14 days to the Contractor in writing stating (1) whether the Owner or the Architect has reasonable objection to the proposed superintendent or (2) that the Architect requires additional time to review. Failure of the Architect to reply within the 14 day period shall constitute notice of no reasonable objection.

§ 3.9.3 The Contractor shall not employ a proposed superintendent to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not change the superintendent without the Owner's consent, which shall not unreasonably be withheld or delayed.

§ 3.10 Contractor's Construction Schedules

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall prepare and submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall not exceed time limits current under the Contract Documents, shall be revised at appropriate intervals as required by the conditions of the Work and Project, shall be related to the entire Project to the extent required by the Contract Documents, and shall provide for expeditious and practicable execution of the Work.

§ 3.10.2 The Contractor shall prepare a submittal schedule, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, and shall submit the schedule(s) for the Architect's approval. The Architect's approval shall not unreasonably be delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

§ 3.10.3 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect.

§ 3.11 Documents and Samples at the Site

The Contractor shall maintain at the site for the Owner one copy of the Drawings, Specifications, Addenda, Change Orders and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and one copy of approved Shop Drawings, Product Data, Samples and similar required submittals. These shall be available to the Architect and shall be delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

§ 3.12 Shop Drawings, Product Data and Samples

§ 3.12.1 Shop Drawings are drawings, diagrams, schedules and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier or distributor to illustrate some portion of the Work.

§ 3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

§ 3.12.3 Samples are physical examples that illustrate materials, equipment or workmanship and establish standards by which the Work will be judged.

§ 3.12.4 Shop Drawings, Product Data, Samples and similar submittals are not Contract Documents. Their purpose is to demonstrate the way by which the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect is subject to the limitations of Section 4.2.7. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Architect without action.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve and submit to the Architect Shop Drawings, Product Data, Samples and similar submittals required by the Contract Documents in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of separate contractors.

§ 3.12.6 By submitting Shop Drawings, Product Data, Samples and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

§ 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples or similar submittals until the respective submittal has been approved by the Architect.

§ 3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples or similar submittals unless the Contractor has specifically informed the Architect in writing of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples or similar submittals by the Architect's approval thereof.

§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such written notice, the Architect's approval of a resubmission shall not apply to such revisions.

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. The Contractor shall not be required to provide professional services in violation of applicable law. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall cause such services or certifications to be provided by a properly licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor all performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review, approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design

concept expressed in the Contract Documents. The Contractor shall not be responsible for the adequacy of the performance and design criteria specified in the Contract Documents.

§ 3.13 Use of Site

The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

§ 3.14 Cutting and Patching

§ 3.14.1 The Contractor shall be responsible for cutting, fitting or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting and patching shall be restored to the condition existing prior to the cutting, fitting and patching, unless otherwise required by the Contract Documents.

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or separate contractors by cutting, patching or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter such construction by the Owner or a separate contractor except with written consent of the Owner and of such separate contractor; such consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold from the Owner or a separate contractor the Contractor's consent to cutting or otherwise altering the Work.

§ 3.15 Cleaning Up

§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials or rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery and surplus materials from and about the Project.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and Owner shall be entitled to reimbursement from the Contractor.

§ 3.16 Access to Work

The Contractor shall provide the Owner and Architect access to the Work in preparation and progress wherever located.

§ 3.17 Royalties, Patents and Copyrights

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for such defense or loss when a particular design, process or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications or other documents prepared by the Owner or Architect. However, if the Contractor has reason to believe that the required design, process or product is an infringement of a copyright or a patent, the Contractor shall be responsible for such loss unless such information is promptly furnished to the Architect.

§ 3.18 Indemnification

§ 3.18.1 To the fullest extent permitted by law the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18.

§ 3.18.2 In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts or other employee benefit acts.

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ARTICLE 4 ARCHITECT

§ 4.1 General

§ 4.1.1 The Owner shall retain an architect lawfully licensed to practice architecture or an entity lawfully practicing architecture in the jurisdiction where the Project is located. That person or entity is identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number.

§ 4.1.2 Duties, responsibilities and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted, modified or extended without written consent of the Owner, Contractor and Architect. Consent shall not be unreasonably withheld.

§ 4.1.3 If the employment of the Architect is terminated, the Owner shall employ a successor architect as to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Architect.

§ 4.2 Administration of the Contract

§ 4.2.1 The Architect will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction until the date the Architect issues the final Certificate for Payment, and, at the discretion of the Owner may be the Owner's representative during the one-year period for correction of Work described in Section 12.2. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for, the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents, except as provided in Section 3.3.1.

§ 4.2.3 On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and report to the Owner (1) known deviations from the Contract Documents and from the most recent construction schedule submitted by the Contractor, and (2) defects and deficiencies observed in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of and will not be responsible for acts or omissions of the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

§ 4.2.4 Communications Facilitating Contract Administration

Except as otherwise provided in the Contract Documents or when direct communications have been specially authorized, the Owner and Contractor shall endeavor to communicate with each other through the Architect about matters arising out of or relating to the Contract. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and material suppliers shall be through the Contractor. Communications by and with separate contractors shall be through the Owner.

§ 4.2.5 Based on the Architect's evaluations of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

§ 4.2.6 The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the Work in accordance with Sections 13.5.2 and 13.5.3, whether or not such Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, material and equipment suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 4.2.7 The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data and Samples, but only for the limited purpose of checking for conformance

with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5 and 3.12. The Architect's review shall not constitute approval of safety precautions or, unless otherwise specifically stated by the Architect, of any construction means, methods, techniques, sequences or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.8 The Architect will prepare Change Orders and Construction Change Directives, and may authorize minor changes in the Work as provided in Section 7.4. The Architect will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.9 The Architect will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion pursuant to Section 9.8; receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10.

§ 4.2.10 If the Owner and Architect agree, the Architect will provide one or more project representatives to assist in carrying out the Architect's responsibilities at the site. The duties, responsibilities and limitations of authority of such project representatives shall be as set forth in an exhibit to be incorporated in the Contract Documents.

§ 4.2.11 The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness.

§ 4.2.12 Interpretations and decisions of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either and will not be liable for results of interpretations or decisions rendered in good faith.

§ 4.2.13 The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

§ 4.2.14 The Architect will review and respond to requests for information about the Contract Documents. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

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 a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a separate contractor or subcontractors of a separate contractor.

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

§ 5.2 Award of Subcontracts and Other Contracts for Portions of the Work

§ 5.2.1 Unless otherwise stated in the Contract Documents or the bidding requirements, the Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner through the Architect the names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design)

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proposed for each principal portion of the Work. The Architect may reply within 14 days to the Contractor in writing stating (1) whether the Owner or the Architect has reasonable objection to any such proposed person or entity or (2) that the Architect requires additional time for review. Failure of the Owner or Architect to reply within the 14-day period shall constitute notice of no reasonable objection.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person or entity previously selected if the Owner or Architect makes reasonable objection to such substitution.

§ 5.3 Subcontractual Relations

By appropriate agreement, written where legally required for validity, 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 terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work, which the Contractor, by these Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies and redress against the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.4 Contingent Assignment of Subcontracts

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§ 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that

- assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor in writing; and
- .2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract.

§ 5.4.2 Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

§ 5.4.3 Upon such assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 Owner's Right to Perform Construction and to Award Separate Contracts

§ 6.1.1 The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and to award separate contracts in connection with other portions of the Project or other construction or operations on the site under Conditions of the Contract identical or substantially similar to these including those portions related to insurance and waiver of subrogation. If the Contractor claims that delay or additional cost is involved because of such action by the Owner, the Contractor shall make such Claim as provided in Article 15.

§ 6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

§ 6.1.3 The Owner shall provide for coordination of the activities of the Owner's own forces and of each separate contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with other separate contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to the construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, separate contractors and the Owner until subsequently revised.

§ 6.1.4 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces, the Owner shall be deemed to be subject to the same obligations and to have the same rights that apply to the Contractor under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6 and Articles 10, 11 and 12.

§ 6.2 Mutual Responsibility

§ 6.2.1 The Contractor shall afford the Owner and separate contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a separate contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly report to the Architect apparent discrepancies or defects in such other construction that would render it unsuitable for such proper execution and results. Failure of the Contractor so to report shall constitute an acknowledgment that the Owner's or separate contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work, except as to defects not then reasonably discoverable.

§ 6.2.3 The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a separate contractor because of the Contractor's delays, improperly timed activities or defective construction. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of a separate contractor's delays, improperly timed activities, damage to the Work or defective construction.

§ 6.2.4 The Contractor shall promptly remedy damage the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or separate contractors as provided in Section 10.2.5.

§ 6.2.5 The Owner and each separate contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

§ 6.3 Owner's Right to Clean Up

If a dispute arises among the Contractor, separate contractors and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Architect will allocate the cost among those responsible.

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

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§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

§ 7.1.2 A Change Order shall be based upon agreement among the Owner, Contractor and Architect; a Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor; an order for a minor change in the Work may be issued by the Architect alone.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents, and the Contractor shall proceed promptly, unless otherwise provided in the Change Order, Construction Change Directive or order for a minor change in the Work.

§ 7.1.4 Proposed Change in the Work equal to or exceeding \$25,000 additive or deductive, shall be subject to approval by the Kentucky Department of Education prior to execution of the Change Order by the Owner.

§ 7.2 Change Orders

§ 7.2.1 A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor and Architect stating their agreement upon all of the following:

- .1 The change in the Work;
- .2 The amount of the adjustment, if any, in the Contract Sum; and
- .3 The extent of the adjustment, if any, in the Contract Time.

§ 7.3 Construction Change Directives

§ 7.3.1 A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

- .1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
- .2 Unit prices stated in the Contract Documents or subsequently agreed upon;
- .3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
- .4 As provided in Section 7.3.7.

§ 7.3.4 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed in a proposed Change Order or Construction Change Directive so that application of such unit prices to quantities of Work proposed will cause substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 7.3.5 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

§ 7.3.6 A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.7 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the method and the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit not to exceed fifteen (15%) of the net cost of the change. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.7 shall be limited to the following:

- .1 Costs of labor, including social security, old age and unemployment insurance, fringe benefits required by agreement or custom, and workers' compensation insurance;
- .2 Costs of materials, supplies and equipment, including cost of transportation, whether incorporated or consumed;
- .3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;
- .4 Costs of premiums for all bonds and insurance, permit fees, and sales, use or similar taxes related to the Work; and
- .5 Additional costs of supervision and field office personnel directly attributable to the change.

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Architect determines, in the Architect's professional judgment, to be reasonably justified. The Architect's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

§ 7.3.10 When the Owner and Contractor agree with a determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Architect will prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

§ 7.4 Minor Changes in the Work

The Architect has authority to order minor changes in the Work not involving adjustment in the Contract Sum or extension of the Contract Time and not inconsistent with the intent of the Contract Documents. Such changes will be effected by written order signed by the Architect and shall be binding on the Owner and Contractor.

ARTICLE 8 TIME

§ 8.1 Definitions

§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 8.1.2 The date of commencement of the Work is the date established in the Agreement.

§ 8.1.3 The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

§ 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

§ 8.2 Progress and Completion

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, prematurely commence operations on the site or elsewhere prior to the effective date of insurance required by Article 11 to be

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furnished by the Contractor and Owner. The date of commencement of the Work shall not be changed by the effective date of such insurance.

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

§ 8.3 Delays and Extensions of Time

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by an act or neglect of the Owner or Architect, or of an employee of either, or of a separate contractor employed by the Owner; or by changes ordered in the Work; or by labor disputes, fire, unusual delay in deliveries, unavoidable casualties or other causes beyond the Contractor's control; or by delay authorized by the Owner pending mediation and arbitration; or by other causes that the Architect determines may justify delay, then the Contract Time shall be extended by Change Order for such reasonable time as the Architect may determine.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15.

§ 8.3.3 This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

§ 9.2 Schedule of Values

Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit to the Architect, before the first Application for Payment, a schedule of values allocating the entire Contract Sum to the various portions of the Work and prepared in such form and supported by such data to substantiate its accuracy as the Architect may require. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 9.3 Applications for Payment

§ 9.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2, for completed portions of the Work. Such application shall be notarized, if required, and supported by such data substantiating the Contractor's right to payment as the Owner or Architect may require, such as copies of requisitions from Subcontractors and material suppliers, and shall reflect retainage as stipulated in Section 9.3.4.

§ 9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Construction Change Directives, or by interim determinations of the Architect, but not yet included in Change Orders.

§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or material supplier, unless such Work has been performed by others whom the Contractor intends to pay.

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage and transportation to the site for such materials and equipment stored off the site.

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the

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Owner shall, to the best of the Contractor's knowledge, information and belief, be free and clear of liens, claims, security interests or encumbrances in favor of the Contractor, Subcontractors, material suppliers, or other persons or entities making a claim by reason of having provided labor, materials and equipment relating to the Work.

§ 9.3.4 When Owner direct Purchase Orders are used, retainage that would otherwise be held on materials and equipment shall transfer to the Contractor, and the material suppliers will be paid the full amount of their invoices. The Owner shall retain ten percent (10%) from each Application for Payment, and an amount equal to ten percent (10%) of approved Purchase Order payments, up to fifty percent (50%) completion of the Work, then provided the Work is on schedule and satisfactory, and upon written request of the Contractor together with consent of surety and the recommendation of the Architect, the Owner shall approve a reduction in Retainage to five percent (5%) of the current Contract Sum plus Purchase Orders. No part of the five percent (5%) retainage shall be paid until after Substantial Completion of the Work, as defined in Section 9.8. herein. After Substantial Completion, if reasons for reduction in retainage may be approved by the Owner when deemed reasonable. The minimum lump sum retainage shall be twice the estimated cost to correct deficient or incomplete work.

§ 9.4 Certificates for Payment

§ 9.4.1 The Architect will, within seven days after receipt of the Contractor's Application for Payment, either issue to the Owner a Certificate for Payment, with a copy to the Contractor, for such amount as the Architect determines is properly due, or notify the Contractor and Owner in writing of the Architect's reasons for withholding certification in whole or in part as provided in Section 9.5.1.

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluation of the Work and the data comprising the Application for Payment, that, to the best of the Architect's knowledge, information and belief, the Work has progressed to the point indicated and that the quality of the Work is in accordance with the Contract Documents. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion and to specific qualifications expressed by the Architect. The issuance of a Certificate for Payment will further constitute a representation that the Contractor is entitled to payment in the amount certified. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous onsite inspections to check the quality or quantity of the Work, (2) reviewed construction means, methods, techniques, sequences or procedures, (3) reviewed copies of requisitions received from Subcontractors and material suppliers and other data requested by the Owner to substantiate the Contractor's right to payment, or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 9.5 Decisions to Withhold Certification

§ 9.5.1 The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of

- .1 defective Work not remedied;
- .2 third party claims filed or reasonable evidence indicating probable filing of such claims unless security acceptable to the Owner is provided by the Contractor;
- .3 failure of the Contractor to make payments properly to Subcontractors or for labor, materials or equipment;
- .4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- .5 damage to the Owner or a separate contractor;
- .6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
- .7 repeated failure to carry out the Work in accordance with the Contract Documents.

§ 9.5.2 When the above reasons for withholding certification are removed, certification will be made for amounts previously withheld.

§ 9.5.3 If the Architect withholds certification for payment under Section 9.5.1.3, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or material or equipment suppliers to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Architect will reflect such payment on the next Certificate for Payment.

§ 9.6 Progress Payments

§ 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents or as required by state law, whichever is more restrictive, and shall so notify the Architect.

§ 9.6.2 The Contractor shall pay each Subcontractor no later than seven days after receipt of payment from the Owner the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

§ 9.6.3 The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and material and equipment suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay or to see to the payment of money to a Subcontractor, except as may otherwise be required by law.

§ 9.6.5 Contractor payments to material and equipment suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors and suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, shall create any fiduciary liability or tort liability on the part of the Contractor for breach of trust or shall entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

§ 9.7 Failure of Payment

If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents the amount certified by the Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days' written notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided for in the Contract Documents.

§ 9.8 Substantial Completion

§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use. The ability to occupy and utilize the Work or designated portion thereof shall require an

occupancy permit issued by the Kentucky Department of Housing, Building, and Construction and any other agencies that have statutory authority and approval requirements.

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

§ 9.8.3 Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

§ 9.8.4 When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion, shall establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance, and shall fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in such Certificate. Upon such acceptance and consent of surety, if any, the Owner shall make payment of retainage applying to such Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

§ 9.9 Partial Occupancy or Use

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer as required under Section 11.3.1.5 and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

§ 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

§ 9.10 Final Completion and Final Payment

§ 9.10.1 Upon receipt of the Contractor's written notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection and, when the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with terms and conditions of the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled. .1 Upon receipt and approval of the final Application for Payment, for each Contract and Purchase Order, if any, the Architect will prepare, and the Architect and Owner shall complete their portion of the Kentucky Department of Education BG-4 Contract Closeout Form – 2013, and forward the board-approved BG-4 form to the Kentucky Department of Education with a copy of the final Certificate for Payment upon the Board authorizing the BG-4 form, accepting the Work, and approving final payment to the Contractor or Material Supplier.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner, (3) a written statement that the Contractor knows of no substantial reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment and (5), if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien. If such lien remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging such lien, including all costs and reasonable attorneys' fees.

§ 9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of claims.

§ 9.10.4 The making of final payment shall constitute a waiver of Claims by the Owner except those arising from

- .1 liens, Claims, security interests or encumbrances arising out of the Contract and unsettled;
- .2 failure of the Work to comply with the requirements of the Contract Documents; or
- .3 terms of special warranties required by the Contract Documents.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor or material supplier shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of the Contract.

§ 10.2 Safety of Persons and Property

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

- .1 employees on the Work and other persons who may be affected thereby;
- .2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody or control of the Contractor or the Contractor's Subcontractors or Sub-subcontractors; and
- .3 other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

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§ 10.2.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities bearing on safety of persons or property or their protection from damage, injury or loss.

§ 10.2.3 The Contractor shall erect and maintain, as required by existing conditions and performance of the Contract, 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 sites and utilities.

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

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3, except damage or loss attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

§ 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.

§ 10.2.7 The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

§ 10.2.8 Injury or Damage to Person or Property

If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, written notice of such injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

§ 10.3 Hazardous Materials

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and report the condition to the Owner and Architect in writing.

§ 10.3.2 Upon receipt of the Contractor's written notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of such material or substance or who are to perform the task of removal or safe containment of such material or substance. The Contractor and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased in the amount of the Contractor's reasonable additional costs of shut-down, delay and start-up.

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§ 10.3.3 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Architect, Architect's consultants and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), except to the extent that such damage, loss or expense is due to the fault or negligence of the party seeking indemnity.

§ 10.3.4 The Owner shall not be responsible under this Section 10.3 for materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents. The Owner shall be responsible for materials or substances required by the Contract Documents, except to the extent of the Contractor's fault or negligence in the use and handling of such materials or substances.

§ 10.3.5 The Contractor shall indemnify the Owner for the cost and expense the Owner incurs (1) for remediation of a material or substance the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

§ 10.3.6 If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall indemnify the Contractor for all cost and expense thereby incurred.

§ 10.4 Emergencies

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 Contractor's Liability Insurance

§ 11.1.1 The Contractor shall purchase from and maintain in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located such insurance as will protect the Contractor from claims set forth below which may arise out of or result from the Contractor's operations and completed operations under the Contract and for which the Contractor may be legally liable, whether such operations be by the Contractor or by a Subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

- .1 Claims under workers' compensation, disability benefit and other similar employee benefit acts that are applicable to the Work to be performed;
- .2 Claims for damages because of bodily injury, occupational sickness or disease, or death of the Contractor's employees;
- .3 Claims for damages because of bodily injury, sickness or disease, or death of any person other than the Contractor's employees;
- .4 Claims for damages insured by usual personal injury liability coverage;
- .5 Claims for damages, other than to the Work itself, because of injury to or destruction of tangible
- property, including loss of use resulting therefrom;
- .6 Claims for damages because of bodily injury, death of a person or property damage arising out of ownership, maintenance or use of a motor vehicle;
- .7 Claims for bodily injury or property damage arising out of completed operations; and
- .8 Claims involving contractual liability insurance applicable to the Contractor's obligations under Section 3.18.

§ 11.1.2 The insurance required by Section 11.1.1 shall be written for not less than limits of liability specified in the Contract Documents or required by law, whichever coverage is greater. Coverages, whether written on an occurrence or claims-made basis, shall be maintained without interruption from the date of commencement of the Work until the date of final payment and termination of any coverage required to be maintained after final payment, and, with respect to the Contractor's completed operations coverage, until the expiration of the period for correction of Work or for such other period for maintenance of completed operations coverage as specified in the Contract Documents. Such insurance shall be no less than the following amounts:

(1) Public Liability	\$200,000.00 one person/maximum each person	
	\$500,000.00 one accident/maximum each person	
(2) Property Damage	\$200,000.00 one accident/maximum \$500,000.00 aggregate	

§ 11.1.2.1 The insurance required by Section 11.1.1 shall be written for not less than the following limits, or greater if required by law:

	a.	State	Statutory			
	b.	Applicable Federal (e.g., Longshoreman's)	Statutory			
	c.	Employer's Liability	\$500.000			
(2)	Co	mprehensive or Commercial General Liability (inclu	iding Premises-Operations: Independent			
()	Co	ontractor's Protection: Product Liability and Completed Operations: Broad Form Property Damage):				
	a.	General Aggregate				
		(except Products-Completed Operations)	\$1,000,000			
	h.	Products-Completed Operations Aggregate	\$1,000,000			
	c.	Personal/Advertising Injury				
	•.	(per person/organization)	\$1,000,000			
	d.	Each Occurrence				
		(Bodily Injury and Property Damage)	\$1,000,000			
	e.	Limit per Person Medical Expense	\$10.000			
	f.	Exclusions of Property in Contractors Care, Custo	dy or Control will be eliminated.			
	g.	Property Damage Liability Insurance will provide	Coverage for Explosion, Collanse, and			
	₽.	Underground Damage				
(3)	Co	ntractual Liability:				
(-)	a.	General Aggregate	\$1,000,000			
	b.	Each Occurrence (Bodily Injury and Property Dam	nage) \$1,000,000			
(4)	An	tomobile Liability.				
	а.	Bodily Injury \$	500.000 Each Person			
		S100	\$1,000,000 Fach Accident			
	h	Property Damage \$500.0	\$500,000 Each Accident or			
	•••	a combined singl	a combined single limit of \$1,000,000			
iste Maria			ie mint of \$1,000,000			
(5)	Lia	hility coverage for the Owner the Architect the Arc	chitact's Consultants and others listed in the			
(\mathbf{v})	1.40 Cur	intry coverage for me owner, the Architect, the Arc	customary evolutions for professional liability			
	ouj Lu	and arrange to additional insurad's on the Contract	ousionary exclusions for professional hability,			
	υy	chaoischicht as augmonal insuleu s on the Confact	or s maonity roncy.			

(6) Excess Liability Umbrella Form:

(1) Worker's Compensation:

EAU	ess claunty Onorcha Form.	
a.	General Aggregate	\$1,000,000
b.	Each Occurrence	\$1,000,000

§ 11.1.2.2 There shall be an endorsement in each of the above policies reading as follows: "It is hereby agreed that in the event of a claim arising under this policy, the company may not deny liability be reason of the insured being a state, county, municipal corporation or governmental agency."

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§ 11.1.3 Certificates of insurance acceptable to the Owner shall be filed with the Owner prior to commencement of the Work and thereafter upon renewal or replacement of each required policy of insurance. These certificates and the insurance policies required by this Section 11.1 shall contain a provision that coverages afforded under the policies will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner. An additional certificate evidencing continuation of liability coverage, including coverage for completed operations, shall be submitted with the final Application for Payment as required by Section 9.10.2 and thereafter upon renewal or replacement of such coverage until the expiration of the time required by Section 11.1.2. Information concerning reduction of coverage on account of revised limits or claims paid under the General Aggregate, or both, shall be furnished by the Contractor with reasonable promptness.

§ 11.1.4 The Contractor shall cause the commercial liability coverage required by the Contract Documents to include (1) the Owner, the Architect and the Architect's consultants as additional insureds for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's operations; and (2) the Owner as an additional insured for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's negligent a

§ 11.2 Owner's Liability Insurance

The Owner shall be responsible for purchasing and maintaining the Owner's usual liability insurance.

§ 11.3 Property Insurance

§ 11.3.1 Unless otherwise provided, the Owner shall purchase and maintain, in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located, property insurance written on a builder's risk "all-risk" or equivalent policy form in the amount of the initial Contract Sum, plus value of subsequent Contract Modifications and cost of materials supplied or installed by others, comprising total value for the entire Project at the site on a replacement cost basis without optional deductibles. Such property insurance shall be maintained, unless otherwise provided in the Contract Documents or otherwise agreed in writing by all persons and entities who are beneficiaries of such insurance, until final payment has been made as provided in Section 9.10 or until no person or entity other than the Owner has an insurable interest in the property required by this Section 11.3 to be covered, whichever is later. This insurance shall include interests of the Owner, the Contractor, Subcontractors and Subsubcontractors in the Project.

§ 11.3.1.1 Property insurance shall be on an "all-risk" or equivalent policy form and shall include, without limitation, insurance against the perils of fire (with extended coverage) and physical loss or damage including, without duplication of coverage, theft, vandalism, malicious mischief, collapse, earthquake, flood, windstorm, falsework, testing and startup, temporary buildings and debris removal including demolition occasioned by enforcement of any applicable legal requirements, and shall cover reasonable compensation for Architect's and Contractor's services and expenses required as a result of such insured loss.

§ 11.3.1.2 If the Owner does not intend to purchase such property insurance required by the Contract and with all of the coverages in the amount described above, the Owner shall so inform the Contractor in writing prior to commencement of the Work. The Contractor may then effect insurance that will protect the interests of the Contractor, Subcontractors and Sub-subcontractors in the Work, and by appropriate Change Order the cost thereof shall be charged to the Owner. If the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain insurance as described above, without so notifying the Contractor in writing, then the Owner shall bear all reasonable costs properly attributable thereto.

§ 11.3.1.3 If the property insurance requires deductibles, the Owner shall pay costs not covered because of such deductibles.

§ 11.3.1.4 This property insurance shall cover portions of the Work stored off the site, and also portions of the Work in transit.

§ 11.3.1.5 Partial occupancy or use in accordance with Section 9.9 shall not commence until the insurance company or companies providing property insurance have consented to such partial occupancy or use by endorsement or otherwise. The Owner and the Contractor shall take reasonable steps to obtain consent of the insurance company or

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companies and shall, without mutual written consent, take no action with respect to partial occupancy or use that would cause cancellation, lapse or reduction of insurance.

§ 11.3.2 Boiler and Machinery Insurance

The Owner shall purchase and maintain boiler and machinery insurance required by the Contract Documents or by law, which shall specifically cover such insured objects during installation and until final acceptance by the Owner; this insurance shall include interests of the Owner, Contractor, Subcontractors and Sub-subcontractors in the Work, and the Owner and Contractor shall be named insureds.

§ 11.3.3 Loss of Use Insurance

The Owner, at the Owner's option, may purchase and maintain such insurance as will insure the Owner against loss of use of the Owner's property due to fire or other hazards, however caused. The Owner waives all rights of action against the Contractor for loss of use of the Owner's property, including consequential losses due to fire or other hazards however caused.

§ 11.3.4 If the Contractor requests in writing that insurance for risks other than those described herein or other special causes of loss be included in the property insurance policy, the Owner shall, if possible, include such insurance, and the cost thereof shall be charged to the Contractor by appropriate Change Order.

§ 11.3.5 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, the Owner shall waive all rights in accordance with the terms of Section 11.3.7 for damages caused by fire or other causes of loss covered by this separate property insurance. All separate policies shall provide this waiver of subrogation by endorsement or otherwise.

§ 11.3.6 Before an exposure to loss may occur, the Owner shall file with the Contractor a copy of each policy that includes insurance coverages required by this Section 11.3. Each policy shall contain all generally applicable conditions, definitions, exclusions and endorsements related to this Project. Each policy shall contain a provision that the policy will not be canceled or allowed to expire, and that its limits will not be reduced, until at least 30 days' prior written notice has been given to the Contractor.

§ 11.3.7 Before an exposure to loss may occur, the Owner shall provide the Architect and the Kentucky Department of Education with certificates of insurance coverage required by this Section 11.3.

§ 11.3.7 Waivers of Subrogation

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The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, subsubcontractors, agents and employees, each of the other, and (2) the Architect, Architect's consultants, separate contractors described in Article 6, if any, and any of their subcontractors, sub-subcontractors, agents and employees, for damages caused by fire or other causes of loss to the extent covered by property insurance obtained pursuant to this Section 11.3 or other property insurance applicable to the Work, except such rights as they have to proceeds of such insurance held by the Owner as fiduciary. The Owner or Contractor, as appropriate, shall require of the Architect, Architect's consultants, separate contractors described in Article 6, if any, and the subcontractors, subsubcontractors, agents and employees of any of them, by appropriate agreements, written where legally required for validity, similar waivers each in favor of other parties enumerated herein. The policies shall provide such waivers of subrogation by endorsement or otherwise. A waiver of subrogation shall be effective as to a person or entity even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, did not pay the insurance premium directly or indirectly, and whether or not the person or entity had an insurable interest in the property damaged.

§ 11.3.8 A loss insured under the Owner's property insurance shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.3.10. The Contractor shall pay Subcontractors their just shares of insurance proceeds received by the Contractor, and by appropriate agreements, written where legally required for validity, shall require Subcontractors to make payments to their Sub-contractors in similar manner.

§ 11.3.9 If required in writing by a party in interest, the Owner as fiduciary shall, upon occurrence of an insured loss, give bond for proper performance of the Owner's duties. The cost of required bonds shall be charged against proceeds received as fiduciary. The Owner shall deposit in a separate account proceeds so received, which the Owner shall distribute in accordance with such agreement as the parties in interest may reach, or as determined in accordance with the method of binding dispute resolution selected in the Agreement between the Owner and Contractor. If after such loss no other special agreement is made and unless the Owner terminates the Contract for convenience, replacement of damaged property shall be performed by the Contractor after notification of a Change in the Work in accordance with Article 7.

§ 11.3.10 The Owner as fiduciary shall have power to adjust and settle a loss with insurers unless one of the parties in interest shall object in writing within five days after occurrence of loss to the Owner's exercise of this power; if such objection is made, the dispute shall be resolved in the manner selected by the Owner and Contractor as the method of binding dispute resolution in the Agreement. If the Owner and Contractor have selected arbitration as the method of binding dispute resolution, the Owner as fiduciary shall make settlement with insurers or, in the case of a dispute over distribution of insurance proceeds, in accordance with the directions of the arbitrators.

§ 11.4 Performance Bond and Payment Bond

§ 11.4.1 Unless otherwise provided, when the Contract Sum exceeds twenty-five thousand dollars (\$25,000) the Contractor shall furnish bonds covering faithful performance of the Contract and payment of obligations arising thereunder. A surety company authorized to do business in Kentucky shall execute bonds, and the cost thereof shall be included in the Contract Sum. Unless otherwise provided, the amount of each bond shall be equal to 100% of the Contract Sum plus Purchase Orders, or 100% of the Lump Sum Base Bid plus or minus accepted Alternates, whichever is greater.

§ 11.4.2 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK § 12.1 Uncovering of Work

§ 12.1.1 If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the

a separate contractor in which event the Owner shall be responsible for payment of such costs.

Architect's examination and be replaced at the Contractor's expense without change in the Contract Time. § 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, costs of uncovering and replacement shall, by appropriate Change Order, be at the Owner's expense. If such Work is not in accordance with the Contract Documents, such

costs and the cost of correction shall be at the Contractor's expense unless the condition was caused by the Owner or

§ 12.2 Correction of Work

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§ 12.2.1 Before or After Substantial Completion

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, whether discovered before or after Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

§ 12.2.2 After Substantial Completion

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of an applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of written notice from the Owner to do so unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the

Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.4.

§ 12.2.2.2 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

§ 12.2.2.3 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

§ 12.2.3 The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction, whether completed or partially completed, of the Owner or separate contractors caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

§ 12.3 Acceptance of Nonconforming Work

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

The Contract shall be governed by the law of the place where the Project is located except that, if the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

§ 13.1.1 None of the Contract Documents for this project shall be construed against the party preparing documents on the grounds that the party prepared or drafted the document, or any portion thereof.

§ 13.2 Successors and Assigns

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns and legal representatives to covenants, agreements and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make such an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate such assignment.

§ 13.3 Written Notice

Written notice shall be deemed to have been duly served if delivered in person to the individual, to a member of the firm or entity, or to an officer of the corporation for which it was intended; or if delivered at, or sent by registered or certified mail or by courier service providing proof of delivery to, the last business address known to the party giving notice.

§ 13.4 Rights and Remedies

§ 13.4.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights and remedies otherwise imposed or available by law.

§ 13.4.2 No action or failure to act by the Owner, Architect or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach there under, except as may be specifically agreed in writing.

§ 13.5 Tests and Inspections

§ 13.5.1 Tests, inspections and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of (1) tests, inspections or approvals that do not become requirements until after bids are received or negotiations concluded, and (2) tests, inspections or approvals where building codes or applicable laws or regulations prohibit the Owner from delegating their cost to the Contractor.

§ 13.5.2 If the Architect, Owner or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection or approval not included under Section 13.5.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection or approval by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.5.3, shall be at the Owner's expense.

§ 13.5.3 If such procedures for testing, inspection or approval under Sections 13.5.1 and 13.5.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure including those of repeated procedures and compensation for the Architect's services and expenses shall be at the Contractor's expense.

§ 13.5.4 Required certificates of testing, inspection or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect.

§ 13.5.5 If the Architect is to observe tests, inspections or approvals required by the Contract Documents, the Architect will do so promptly and, where practicable, at the normal place of testing.

§ 13.5.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

§ 13.6 Interest

Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at such rate as required by state law, or in the absence of law, at the legal rate prevailing at the time and place where the Project is located.

§ 13.7 Time Limits on Claims

The Owner and Contractor shall commence all claims and causes of action, whether in contract, tort, breach of warranty or otherwise, against the other arising out of or related to the Contract in accordance with the requirements of the final dispute resolution method selected in the Agreement within the time period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all claims and causes of action not commenced in accordance with this Section 13.7.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any

other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, for any of the following reasons:

- .1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;
- .2 An act of government, such as a declaration of national emergency that requires all Work to be stopped;
- .3 Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or
- .4 The Owner has failed to furnish to the Contractor promptly, upon the Contractor's request, reasonable evidence as required by Section 2.2.1.

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, repeated suspensions, delays or interruptions of the entire Work by the Owner as described in Section 14.3 constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' written notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, including reasonable overhead and profit, costs incurred by reason of such termination, and damages.

§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor or a Subcontractor or their agents or employees or any other persons performing portions of the Work under contract with the Contractor because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' written notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

- .1 repeatedly refuses or fails to supply enough properly skilled workers or proper materials;
- .2 fails to make payment to Subcontractors for materials or labor in accordance with the respective agreements between the Contractor and the Subcontractors;
- .3 repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or
- .4 otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 14.2.2 When any of the above reasons exist, the Owner, upon certification by the Initial Decision Maker that sufficient cause exists to justify such action, may without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' written notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

- .1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and
- construction equipment and machinery thereon owned by the Contractor;
- .2 Accept assignment of subcontracts pursuant to Section 5.4; and
- .3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case

may be, shall be certified by the Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract.

§ 14.3 Suspension by the Owner for Convenience

§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work in whole or in part for such period of time as the Owner may determine.

§ 14.3.2 The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay or interruption as described in Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent

- .1 that performance is, was or would have been so suspended, delayed or interrupted by another cause for which the Contractor is responsible; or
- .2 that an equitable adjustment is made or denied under another provision of the Contract.

§ 14.4 Termination by the Owner for Convenience

§ 14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

§ 14.4.2 Upon receipt of written notice from the Owner of such termination for the Owner's convenience, the Contractor shall

- .1 cease operations as directed by the Owner in the notice;
- .2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and
- .3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

§ 14.4.3 In case of such termination for the Owner's convenience, the Contractor shall be entitled to receive payment for Work executed, and costs incurred by reason of such termination, along with reasonable overhead and profit on the Work not executed.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

§ 15.1.1 Definition

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim.

§ 15.1.2 Notice of Claims

Claims by either the Owner or Contractor must be initiated by written notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party must be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

§ 15.1.3 Continuing Contract Performance

Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents. The Architect will prepare Change Orders and issue Certificates for Payment in accordance with the decisions of the Initial Decision Maker.

§ 15.1.4 Claims for Additional Cost

If the Contractor wishes to make a Claim for an increase in the Contract Sum, written notice as provided herein shall be given before proceeding to execute the Work. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

§ 15.1.5 Claims for Additional Time

§ 15.1.5.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, written notice as provided herein shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary.

§ 15.1.5.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated and had an adverse effect on the scheduled construction.

§ 15.1.6 Claims for Consequential Damages

The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes

- .1 damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and
- .2 damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 15.1.6 shall be deemed to preclude an award of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

§ 15.2 Initial Decision

§ 15.2.1 Claims, excluding those arising under Sections 10.3, 10.4, 11.3.9, and 11.3.10, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation of any Claim arising prior to the date final payment is due, unless 30 days have passed after the Claim has been referred to the Initial Decision Maker with no decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

§ 15.2.2 The Initial Decision Maker will review Claims and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

§ 15.2.3 In evaluating Claims, the Initial Decision Maker may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision Maker in rendering a decision. The Initial Decision Maker may request the Owner to authorize retention of such persons at the Owner's expense.

§ 15.2.4 If the Initial Decision Maker requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of such request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker will either reject or approve the Claim in whole or in part.

§ 15.2.5 The Initial Decision Maker will render an initial decision approving or rejecting the Claim, or indicating that the Initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties and the Architect, if the Architect is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties but subject to mediation and, if the parties fail to resolve their dispute through mediation, to binding dispute resolution.

§ 15.2.6 Either party may file for mediation of an initial decision at any time, subject to the terms of Section 15.2.6.1.

§ 15.2.6.1 Either party may, within 30 days from the date of an initial decision, demand in writing that the other party file for mediation within 60 days of the initial decision. If such a demand is made and the party receiving the demand fails to file for mediation within the time required, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.

§ 15.2.7 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 15.2.8 If a Claim relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.

§ 15.3 Mediation

§ 15.3.1 Claims, disputes, or other matters in controversy arising out of or related to the Contract except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.6 shall be subject to mediation as a condition precedent to binding dispute resolution.

§ 15.3.2 The parties shall endeavor to resolve their Claims by mediation, which shall be in accordance with the Construction Industry Mediation Procedures of the American Arbitration Association in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section 15.3.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.

§ 15.3.3 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

§ 15.4 Arbitration

§ 15.4.1 If the parties have selected arbitration as the method for binding dispute resolution in the Agreement, any Claim subject to, but not resolved by, mediation shall be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. A demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.

§ 15.4.1.1 A demand for arbitration shall be made no earlier than concurrently with the filing of a request for mediation, but in no event shall it be made after the date when the institution of legal or equitable proceedings based on the Claim would be barred by the applicable statute of limitations. For statute of limitations purposes, receipt of a written demand for arbitration by the person or entity administering the arbitration shall constitute the institution of legal or equitable proceedings based on the Claim.

§ 15.4.2 The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.

§ 15.4.3 The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement shall be specifically enforceable under applicable law in any court having jurisdiction thereof.
§ 15.4.4 Consolidation or Joinder

§ 15.4.4.1 Either party, at its sole discretion, may consolidate an arbitration conducted under this Agreement with any other arbitration to which it is a party provided that (1) the arbitration agreement governing the other arbitration permits consolidation, (2) the arbitrations to be consolidated substantially involve common questions of law or fact, and (3) the arbitrations employ materially similar procedural rules and methods for selecting arbitrator(s).

§ 15.4.4.2 Either party, at its sole discretion, may include by joinder persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in arbitration, provided that the party sought to be joined consents in writing to such joinder. Consent to arbitration involving an additional person or entity shall not constitute consent to arbitration of any claim, dispute or other matter in question not described in the written consent.

§ 15.4.4.3 The Owner and Contractor grant to any person or entity made a party to an arbitration conducted under this Section 15.4, whether by joinder or consolidation, the same rights of joinder and consolidation as the Owner and Contractor under this Agreement.

SECTION 007300 - SUPPLEMENTARY CONDITIONS

PART 1 GENERAL

1.01 SUMMARY

- A. These Supplementary Conditions amend and supplement the General Conditions defined in Document 007200 - General Conditions and other provisions of Contract Documents as indicated below.
 Provisions that are not so amended or supplemented remain in full force and effect.
- B. The terms used in these Supplementary Conditions that are defined in the General Conditions have the meanings assigned to them in the General Conditions.

1.02 DEFINITIONS

- A. The term "OWNER" as used throughout these documents means the Marion County Board of Education.
- B. The term "ARCHITECT" as used throughout these documents means RossTarrant Architects, Inc., 101 Old Lafayette Avenue, Lexington, Kentucky 40502.
- C. The terms "PLANS" and "DRAWINGS" are used interchangeably and are construed to have the same meaning.

1.03 GENERAL

- A. These specifications and drawings accompanying them describe the work to be done and the materials to be furnished for the construction of the project.
- B. The Contractor and each Subcontractor shall verify all measurements at the site before ordering any materials or doing any work. No additional compensation shall be allowed due to any discrepancy indicated and actual dimensions. The Contractor shall promptly notify the Architect of any dimensional discrepancies and shall obtain the direction of the Architect before proceeding with the Work.
- C. Bidders, before submitting proposals, shall visit and examine the site to satisfy themselves as to the nature and scope of the new construction and any difficulties attending the execution. The submission of a proposal will be construed as evidence that a visit and examination have been made. Later claims for labor, equipment, or materials required or difficulties encountered which could have been foreseen had such an examination been made will not be recognized.
- D. The Kentucky Fairness in Construction Act, KRS371.400 to KRS 371.990, applies to this construction contract, and where there is a conflict between the terms and conditions of these contract documents and the provisions of the Kentucky Fairness in Construction Act, the latter shall prevail.
- E. Within 10 days after award of contract and as required by KRS 45A.343, Section (2)(a), each Contractor and all Subcontractors performing work under the contract shall in writing to the Owner reveal any final determination of a violation by the Contractor or Subcontractor within the previous 5 year period pursuant to KRS Chapters 136, 139, 141, 337, 338, 341 and 342 that apply to the Contractor or Subcontractors. As required by KRS 45A.343, Section (2)(b), Contractors and Subcontractors performing work under the contract shall be in continuous compliance with the provisions of KRS Chapters 136, 139, 141, 337, 338, 341 and 342 that apply to the Contractor or Subcontractor or Subcontractor.
- F. By signing any Change Order/Application and Certificate of Payment, the Contractor indicates his agreement therewith, including any adjustment in the Contract Sum or Contract Time and waives any and all claims for additional compensation or Contract time against either the Owner or the Architect for work associated with the Change Order/Application and Certificate of Payment. The Contractor expressly agrees that the Architect shall be deemed a Third Party Beneficiary of this provision.

1.04 ARCHITECT'S STATUS

A. The Architect is the agent of the Owner during construction and until final payment. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents, unless otherwise modified by written instrument which will be shown to the Contractor. The Architect has authority to reject work which does not conform to the Contract Documents.

1.05 ARCHITECT'S WORK PRODUCT

A. The Architect's work product is prepared and produced for the sole and exclusive benefit of the Owner. Any real or inferred benefits to third parties is hereby expressly disclaimed.

1.06 ADMINISTRATION OF THE CONTRACT

- A. The Architect will perform certain administrative functions of the construction contract. Nothing contained in these contract documents, not any other oral or written agreements, memoranda, or communications shall create any express or implied contractual relationship between the Architect and the Contractor.
- B. The Architect may make periodic visits to the work site in accordance with the conditions of his contract with the Owner. The purpose of these visits and observations is to endeavor to guard against defects and deficiencies, not to supervise the Contractor's work.
- C. The Architect makes no express or implied representations of guaranteeing the Contractor's work.
- D. The Architect is not a specialist in construction methods, techniques, sequences or procedures and therefore assumes no responsibility for the construction operations and safety program.

1.07 INDEMNIFICATION

- A. The Contractor shall hold harmless and indemnify the Architect, employees, officers, agents and consultants from all claims, loss, damage, actions, causes of actions, expense and/or liability resulting from, brought for, or an account of any personal injury or property damage received or sustained by any person, persons, (including third parties), or any property growing out of, occurring, or attributable to any work performed under or related to this contract, resulting in whole or in part from the negligence of the Contractor, any Subcontractor, any employee, agent or representative.
- B. None of the Bidding Documents or Contract Documents prepared for this project, including, but not limited to, all contracts, drawings, or specifications, shall be construed against the party preparing any document on the ground that the party prepared or drafted the document, or any portion thereof.

1.08 WORKMANSHIP

- A. The Workmanship shall be of the highest quality, in every respect, as usually recognized in the building industry. Poor or inferior workmanship (as determined by the Architect, Engineers, or inspecting authorities) is to be removed and replaced to conform to the highest quality standards of the trades concerned, or otherwise corrected.
- B. The Contractor shall only employ labor on the Project or in connection with the Work capable of working harmoniously with all trades, crafts and any other individuals associated with the Project. The Contractor shall also use its best efforts to minimize the likelihood of any strike, work stoppage or other labor disturbance.
- C. If the Work is to be performed by trade unions, the Contractor shall make all necessary arrangements to reconcile, without delay, damage or cost to the owner and without recourse to the Architect or the Owner any conflict between the Contract Documents and any agreements or regulations of any kind in force among members or councils which regulate or distinguish what activities shall not be included in the work of any particular trade.

D. In case the progress of the Work is affected by any undue delay in furnishing or installing any items or materials or equipment required under the Contract Documents because of such conflict involving any such labor agreement or regulation, the Owner may require that other material or equipment of equal kind and quality be provided pursuant to a Change Order or Construction Change Directive.

1.09 DRAWINGS AND SPECIFICATIONS

- A. None of the Bidding Documents or Contract Documents prepared for this project, including, but not limited to, all contracts, drawings or specifications, shall be construed against the party preparing any document on the grounds that the party prepared or drafted the document, or any portion thereof.
- B. Where it is obvious that a drawing illustrates only a part of a given work or of a number of items, the remainder shall be deemed repetitious and so constructed.
- C. If there is conflict within or between Contract Documents involving quality or quantity of work required, it is intention of Contract that work of highest quality or greater quantity indicated or specified shall be provided. Whether or not the word "all" is used, coverage is specifically and expressly noted. In all cases where an item is referred to in singular number, it is intended that reference shall apply to as many such items as are required to perform the work.
- D. The work under this contract does not include any items marked N.I.C. on the drawings (not in contract).
- E. Division of Specifications into sections is done for convenience of reference and is not intended to control contractors in dividing work among subcontractors or to limit scope of work performed by any trade under any given section.
- F. The Contractor's failure to report in writing to the Architect and Owner errors, omissions or inconsistencies in the Contract Documents within ten (10) days of the Contractor's Discovery of same shall operate as a waiver of any claim or defenses by the Contractor arising from those errors, omissions or inconsistencies.

1.10 ALLOCATION OF WORK

A. Where certain materials are specified to be installed under various headings, it shall be the responsibility of the General Contractor to re-allocate such work under the proper subcontractor if the specification is in conflict with the local jurisdiction.

1.11 OWNER'S RIGHT TO STOP THE WORK

A. If the Contractor fails to correct defective work or persistently fails to supply materials or equipment in accordance with the Contract Documents, the Owner may order the Contractor to stop the work, or any portion thereof, until the cause of such order has been eliminated.

1.12 NOTICE AND SERVICE THEREOF

A. All notices (relating to any part of this contract) to Contractors from the Owner shall be in writing and considered delivered and the service thereof completed, when the notice is posted, by registered mail, to the Contractor at his last address or delivered in person to the Contractor or his authorized representative on the work.

1.13 CODES AND ORDINANCES

A. All branches of the work shown on the plans or specified, whether specifically mentioned or not, shall be executed in strict compliance with all local or state regulations and codes, and shall be in compliance with all National Codes when same have jurisdiction.

1.14 DELAYS AND EXTENSION OF TIME

A. In addition to the terms stated in Articles of the General Conditions, the following items apply to delays and extension of time.

- 1. It is agreed that time is of the essence for each and every portion of this Contract and where under the Contract an additional time is allowed for the completion of any Work, the new time limit fixed by such extension shall be of the essence of this Contract. An extension of time shall not be cause for extra compensation under the Contract. The Contractor may be granted an extension of time and/or relief from liquidated damages when the delay in completion of the Work is due to:
 - a. Any preference, priority, or allocation order duly issued by the government;
 - b. Unforeseeable cause beyond the control and without the fault or negligence of the Contractor, including, but not restricted to, acts of God, or of the public enemy, acts of the Owner, acts of another Contractor in the performance of a Contract with the Owner, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes and unusually severe weather.
- 2. Claims for extensions of time and/or relief from liquidated damages, except for weather related claims, must be made in writing not later than twenty-one (21) calendar days after the beginning of the delay. Claims for extension of time due to unusual inclement weather shall be made in writing not later than the tenth day of the month following the month in which the delay occurred.
- 3. Claims for extensions of time or relief from liquidated damages shall be stated in numbers of whole or half calendar days. The actual dates on which delay(s) occurred must be stated. In case of claims, extension of time shall be granted only because such unusual inclement weather prevented the execution of critical items of the work.
- 4. Unusual inclement weather as used herein means unusually severe weather which is beyond the normal weather recorded and expected for the locality and/or the season or seasons of the year. Normal weather shall be determined based as reported by the United States Department of Commerce, National Oceanic and Atmospheric Administration (NOAA) for the location indicated below.
- 5. When adverse weather exceeds that which is normally expected, as defined above, and the Contractor is making a claim for delay due to adverse weather, the Contractor shall submit to the Architect and Owner the following at the Project Progress Meeting immediately following the month in which the excessive adverse weather occurred:
 - a. Current weather data from NOAA for the project site which documents and proves that the adverse weather occurred at the project site on days in which work was scheduled to occur.
 - b. Historical weather data from NOAA for the project site which documents and proves that the adverse weather that occurred at the project site was more than anticipated.
 - c. Contractor's daily field reports showing that the adverse weather that was experienced at the project site caused delay in the work that was scheduled to be performed on during the period in which adverse weather was experienced.
 - d. Contractor's written detailed explanation of the delay in the work and how it was caused by the abnormal adverse weather that was experienced at the project site and was beyond the ability of the Contractor to control or mitigate the delay for each occurrence.
- B. Any claim for extension of time for strikes or lockouts shall be supported by a citation of facts concerning the strike, including, but not limited to, the dates, the craft concerned, the reason for the strike, efforts to resolve the dispute, and efforts to minimize the impact of the strike on progress.
- C. Any claims for extension of time for delays in transportation or for failures of suppliers shall be supported by a citation of facts demonstrating that the delays are beyond the Contractor's control, including, but not limited to, his efforts to overcome such delays.
- D. The time extensions for changes in the Work will depend upon the extent, if any, by which the changes cause delay in the completion of the various elements of construction. The Change Order granting the time extension may provide the Contract Completion Date will be extended only for those specific

elements so delayed and that the remaining Work will not be altered or may further provide for an equitable readjustment of liquidated damages pursuant to the new Contract completion dates.

1.15 TIMES FOR COMPLETION

- A. Anticipated Start of Construction: January 22, 2019.
- B. Substantial Completion. Subject to the conditions of Article "Delays and Extensions of Time" of the General Conditions, the total work to be done under this combined construction contract shall be commenced upon execution of the contract agreement and shall be substantially completed within three hundred thirty-five (335) calendar days.
- C. Final Completion. Subject to the conditions of Article "Delays and Extensions of Time" of the General Conditions, the total work to be done under this combined construction contract shall be fully completed in phases no later than within thirty (30) consecutive calendar days from the Date of Substantial Completion.
- D. The date of Final Completion for each phase shall be as indicated in the Owner-Contractor Agreement and the work is complete and all Contract requirements have been fulfilled by the Contractor.

1.16 LIQUIDATED DAMAGES

- A. It is mutually understood and agreed by and between parties of this contract, in execution of same, that time is of essence of the contract. In the event that the Contractor fails to substantially complete work to be performed under this contract by and at applicable completion time as identified in Article Times for Completion, including any extension of time granted, Contractor shall pay to Owner \$1,000.00 per consecutive calendar day for each additional day because of delay in completing as amended above as for liquidated damages, such as Owner's increased overhead and cost of additional architectural supervision and not as a penalty, for each and every calendar day, that Contractor shall be in default.
- B. Liquidated damages will be waived for and during extent of delay caused by Contractor's inability to obtain material or equipment by reasons such as Federal embargoes, priority orders, or other restrictions imposed by the United States Government, provided that adequate evidence is presented by Contractor to prove such delay and enable Owner to determine with exactness the extent and duration of such delay for each item of material and equipment involved.
- C. Owner shall have right to deduct liquidated damages from money in its hands otherwise due, or to become due, to Contractor or to sue for and recover compensation for damages for non-performance of this Contract at time stipulated herein.
- D. As actual damages for any delay in completion are impossible to determine, the Contractors and their sureties shall be liable for and shall pay to the Owner the sum of \$500.00 per day as fixed, agreed, and liquidated damages for each calendar day of delay past 30 days past substantial completion, the work reaches Final Completion.

1.17 PUNCH LIST OBSERVATIONS

A. At the time of substantial completion, the Architect shall prepare a list of deficient work items. The Contractor shall have thirty days to complete this list and achieve final completion, notifying the Architect once items are complete and ready to be verified. Should the Architect perform site observations to verify completion of these items more than two times, the Contractor shall be responsible for payment to the Architect for additional site visits, at a rate of \$100.00 per hour plus travel expenses. Time charged by the Architect shall include travel time, time on-site, and time in office preparing follow-up documentation.

1.18 ORDERING MATERIALS

- A. Immediately following award of contract for this work, Contractor shall determine the source of supply for all materials and length of time required for their delivery, including materials of subcontractors, and order shall be placed for such materials promptly.
- B. If, for any reason, any items specified will not be available when needed and the Contractor can show that he has made a reasonably persistent effort to obtain the items in question, the Architect is to be notified in writing within forty-five (45) days after the Contract is signed, and he will either determine a source of supply or arrange with the Owner for appropriate substitution within terms of Contract; otherwise, the Contractor will not be excused for delays in securing material specified and will be held accountable if completion of the building is thereby delayed.

1.19 HAZARDOUS MATERIALS

- A. The Contractor is hereby advised that RossTarrant Architects, Inc. is not a professional consultant in the determination of the presence of hazardous materials in any form, including, but not limited to, asbestos products, polychlorinated biphenyl (PCB) or other toxic substances. In addition, RossTarrant Architects, Inc. is not a design professional involved with making recommendations regarding the removal or encapsulation of hazardous materials in any form.
- B. If the work which is to be performed under this contract interferes in any way with existing components which contain hazardous materials, it shall be Contractor's responsibility to contact the Owner or Owner's Environmental Consultant regarding the proper means and methods to be utilized in dealing with the hazardous materials.
- C. By execution of the contract for construction, the Contractor hereby agrees to bring no claim for negligence, breach of contract, indemnity, or otherwise against the Architect, its principals, employees, agents, and consultants if such claim in any way would involve the investigation of, or any work related to hazardous materials in any form at the project site, including, but not limited to, asbestos, asbestos products, polychlorinated biphenyl (PCB) or other toxic substances. By execution of the contract for construction, the Contractor further agrees to defend, indemnify, and hold the Architect and his principals, employees, agents and consultants harmless from any such claim related to hazardous materials that may be brought by the Contractor's Subcontractors, Suppliers, or other third parties who may be acting under the direction of the Contractor pursuant to this project.

1.20 RULES OF MEASUREMENT

- A. The following Rules of Measurement shall apply in the use of Unit Prices:
 - 1. Except as provision is made hereinafter for arbitrary measurements, the quantity of excavation shall be its in-place volume before removal.
 - 2. No allowance will be made for excavating additional material of any nature taken out of the convenience of the Contractor, beyond the quantity computed under these Rules of Measurement.
 - 3. The quantities of excavation shall be computed from instrument readings in vertical cross sections located at such intervals as will assure accuracy.
 - 4. General excavation for buildings and sections of buildings, bases for equipment, sump pits, etc., involving an area of 200 or more square feet, shall be classified as "Mass Excavation".
 - 5. Excavation for pipes, wall footings, grade beams, column footings, and sections of buildings such as bases for equipment, sump pits, etc., involving an area of less than 200 square feet, shall be classified as "Trench Excavation".
 - 6. "Mass Excavation" shall be arbitrarily assumed to extend to vertical planes two (2) feet outside wall lines, and to the elevation of plan subgrade.
 - 7. "Trench Excavation" for walls, grade beams, and sections of building, such as bases for equipment, sump pits, etc., involving an area less than 200 square feet shall be arbitrarily assumed to extend 2 feet wider than wall and grade beam thicknesses and outside walls of

sections of buildings such as bases for equipment, sump pit, etc., but in no case less than three (3) feet wide sides vertical.

- 8. "Trench Excavation" for pipes shall be arbitrarily assumed to be two (2) feet wider than the outside diameter of the pipe barrel and with sides vertical.
- 9. "Trench Excavation" for wall footings and column footings shall be computed as vertical shafts, each with a horizontal cross section identical in shape and size with the plan of the footing.
- 10. The quantities of form work will be the area of forms in contact with concrete.
- 11. Concrete quantities shall be computed form plan size or if there are no drawings, from actual measurement of the work ordered and placed, waste excluded.

1.21 INSURANCE AND BONDS

Refer to Article 11.4.1 of the General Conditions. Modify the paragraph as follows:

"11.4.1 Unless otherwise provided, when the Contract Sum exceeds one hundred thousand (\$100,000) the Contractor shall furnish bonds covering faithful performance of the Contract and payment of obligations arising thereunder. A surety company authorized to do business in Kentucky shall execute bonds, and the cost thereof shall be included in the Contract Sum. Unless otherwise provided, the amount of each bond shall be equal to 100% of the Contract Sum plus Purchase Orders, or 100% of the Lump Sum Base Bid plus or minus accepted Alternates, whichever is greater."

- A. Refer to Article 11 of the General Conditions. Add the following under Article 11.3 Property Insurance: "The General Contractor shall provide property insurance related to the Bid Breakout (Owner purchased) components, including current Contract Sum plus Purchase Orders."
- B. Refer to Article 11.4.1 of the General Conditions. Revise the last sentence to read: "The amount of each bond shall be equal to 100% of the Contract Sum plus the total of all Purchase Orders."
- C. In no event shall any failure of the Owner or Architect to receive certified copies or certificates of policies required or to demand receipt of such certified copies or certificates prior to the Contractor commencing the Work be construed as a waiver by the Owner or the Architect of the Contractor's obligations to obtain insurance pursuant to requirements. The obligation to procure and maintain any insurance required is a separate responsibility of the Contractor and independent of the duty to furnish a certified copy or certificate of such insurance policies.
- D. If the Contractor fails to purchase and maintain, or require to be purchased and maintained, any insurance required, Owner may, but shall not be obligated to, upon five (5) days' written notice to the Contractor, purchase such insurance on behalf of the Contractor and shall be entitled to be reimbursed by the Contractor upon demand.
- E. When any required insurance, due to the attainment of a normal expiration date or renewal date shall expire, the Contractor shall supply the Owner with Certificates of Insurance and amendatory riders or endorsements that clearly evidence the continuation of all coverage in the same manner, limits of protection, and scope of coverage as was provided by the previous policy. In the event any renewal or replacement policy, for whatever reason obtained or required, is written by a carrier other than that with whom the coverage was previously placed, or the subsequent policy differs in any way from the previous policy, the Contractor shall also furnish the Owner with a certified copy of the renewal or replacement policy unless the Owner provides the Contractor with prior written consent to submit only a Certificate of Insurance for any such policy. All renewal and replacement policies shall be in form and substance satisfactory to the Owner and written by carriers acceptable to the Owner.
- F. Within ten (10) days of the filing of a mechanics' or materialmen's lien on the Project real estate or funds, Contractor shall at its expense furnish a bond or bonds in accordance with the appropriate statutes satisfactory for the release of or otherwise obtain the release of any mechanics' and materialmen's liens filed against the Project real estate or funds by any of Contractor's employees, subcontractors, suppliers, agents, consultants or anyone claiming through any of them. If the Contractor fails to furnish a bond within ten (10) days, the Owner may provide the bond and back

charge all costs, including attorneys' fees, costs or expenses incurred as a result of a lien filed or asserted against Owner's property.

1.22 COMPLIANCE WITH IMMIGRATION REFORM AND CONTROL ACT OF 1986 ("IRCA")

- A. Owner and Contractor agree that Contractor shall be obligated to comply with all requirements imposed on employers under IRCA with regard to every Contractor employee ("Contract Worker") who will perform services for Contractor, where such service is provided in connection with Contractor's performance of this Agreement. Contractor further agrees that Contractor is the "employer" as that term is defined at 8 C.F.R. Section 274a. 1(g), and that Owner is not the "employer" as so defined, with regard to such Contract Workers. In furtherance of its duties as employer under IRCA, Contractor agrees to do the following:
 - Complete USCIS Form I-9 for all Contract Workers: Contractor agrees that it has sole responsibility for completing Form I-9 for all Contract Workers who provide services as a part of Contractor's performance of this Agreement, and that it will do so and will further update such Form to the extent required by law. Contractor further warrants that all of Contractor's agents and/or employees who complete Form I-9 for such Contract Workers will be knowledgeable of all Form I-9 requirements, including but not limited to, knowledge of which documents do and do not satisfy the requirements of Form I-9, and that such agents and employees will otherwise complete Form I-9, and that such agents and employees will otherwise complete Form I-9 in full compliance with IRCA.
 - 2. Contractor's Warranty of Employment Authorization for all Contract Workers: Contractor hereby warrants that no Contract Worker will provide services pursuant to this Agreement until Contractor has completed Form I-9 for such Contract Worker in the manner required by IRCA. Contractor further warrants that it will not permit any Contract Worker to perform services under this Agreement who Contractor knows or has reason to believe is not authorized to work in the United States, regardless of whether such individual is able to produce documents which satisfy the requirements of Form I-9. Contractor understands that Owner is acting in reliance on Contractor's warranty as described in this subparagraph and further states that without Contractor's warranty that it has taken all necessary steps to comply with IRCA and that Contractor believes all Contract Workers are authorized to work in the United States.
 - 3. Removal of Contract Workers not Authorized for Employment in the United States: Contractor agrees that if at any time after it assigns a Contract Worker to perform services under this Agreement, Contractor learns or has reason to believe that any Contract Worker is not authorized to work in the United States, Contractor shall immediately so inform Owner and Contractor shall cease assigning work to such Contract Worker providing services under this Agreement.
 - 4. Indemnification and Hold Harmless: Contractor agrees that in any event any government agency determines that any Contract Worker hired by Contractor to perform duties under this Agreement is not authorized for employment in the United States, Contractor shall indemnify and hold harmless Owner and any of Owner's agents, employees, officers, directors, trustees, or other persons acting on Owner's behalf, from any liability incurred by Owner as a result of such determination. Such indemnification shall include, by way of example but not in any way limited to, any civil or criminal fines or penalties assessed, alleged and any costs incurred in responding to or participating in any government investigation, finding, recommendation, hearing, appeal or any other proceeding, including attorneys' fees and costs.
 - 5. Liability for Subcontractors: Contractor shall require all subcontractors to comply with these immigration provisions. The Contractor shall indemnify the Owner and any of the Owner's agents, employees, officers, directors, trustees, or other persons acting on the Owner's behalf, from any liability incurred by the Owner as a result of a determination that a subcontractor's worker hired to perform duties under this Agreement is not authorized for employment in the United States. Such indemnification shall include, by way of example but not in any way limited to, any civil or criminal fines or penalties assessed, alleged and any costs incurred in responding to or participating in any government investigation, finding, recommendation, hearing, appeal or any other proceeding, including attorneys' fees and costs.

1.23 OWNER PURCHASED MATERIALS

- A. Kentucky State Sales Tax does apply to all materials purchased for this Project, except those materials purchased directly by the Owner with an approved Purchase Order in accordance with KRS 139.495 (1) after appropriate Advertisement for Bids.
 - 1. A Material Supplier is a person or organization who has a direct Purchase Order responsibility to the Owner. A Material Supplier cannot be an installing Contractor or Subcontractor.
 - 2. The Purchase Order amount as bid may include all costs of delivery to the job site.
 - 3. Material Supplier assumes all responsibility for materials until delivery is accepted by the Contractor. The designated Contractor or Subcontractor responsible for installation of Purchase Order material or equipment is to supervise and accept delivery, unload, handle, store, lay out and install the items.
 - a. Upon delivery, the designated Contractor is to verify product suitability, quantity, quality and condition as soon as it can be ascertained and shall accept care, custody and control responsibility as if it were his own purchase. Any damage or loss after acceptance will be the responsibility of the designated Contractor or subcontractor.
 - 4. Material Supplier will guarantee all materials furnished under a purchase order to be in accordance with the requirements of the contract documents. This guarantee shall extend through the construction period and one (1) year from the date of substantial completion upon final acceptance by the Owner of the Project. Any damage or loss after acceptance will be the responsibility of the designated Contractor or subcontractor.
 - 5. The material breakout amount indicated by a prospective bidder is considered final. The KDE Form of Proposal stipulates the cost of the material and is validated by the signature of the Supplier. In order to qualify for tax exemption, the Kentucky Revenue Cabinet requires that the bid for the labor component and material component remain separate. Should a Purchase Order have an unused balance remaining at the close of the project, the Purchase Order will be closed out. At no time will the remaining balance be transferred to the Contractor.
 - 6. A Material Supplier can be paid by one payment upon satisfactory completion of the requirements of the Purchase Order with the Owner. This would include the delivery of materials and satisfactory verification of these materials and compliance with the closeout procedures as outlined in these specifications.
 - 7. Material Suppliers shall not require the Owner to complete any form of credit application. The General Contractor is responsible for guaranteeing the Owner's credit-worthiness.
- B. The Contractor shall provide a breakdown of major items (excluding sales tax) and associated Purchase Orders for the Owner's approval and signature.
 - 1. The Contractor shall prepare Purchase Orders on the KDE forms included within this Project Manual, based upon his accepted Bid Breakout List from the Form of Proposal. Once executed, Purchase Orders are not to be altered, amended or changed in any way. Any Purchase Order not returned within the allotted time shall become null and void and the value of the Purchase Order will be added to the Contract Sum with the Contractor assuming responsibility for all taxes. Upon executed of the Purchase Orders by the Owner, the Purchase Orders will be delivered to the Contractor for distribution to the respective suppliers.
 - 2. In the event the quantities of materials supplied via Purchase Orders are insufficient to complete the Work, the Contractor shall, at no expense to the Owner, provide such materials as necessary to complete the Work.
 - 3. The Owner will provide to the Contractor Kentucky Sales Tax Exemption Certificates for each Material Supplier.
- C. The Contractor shall also guarantee and warrant to the Owner that all materials listed in the breakdown to be purchased directly by the Owner by Purchase Order shall fully conform to the requirements of the Contract Documents and the quantity of such material is sufficient to complete the work.

Contractor will provide invoices from the Suppliers to the Owner with each Contractor's Application for Payment.

- D. As provided in KRS 139.310 and Kentucky Administrative Regulation 103 KAR 26:070 (Contract Construction), each contractor is responsible for Kentucky Sales and Use Tax on all materials purchased and installed by the contractor or a third party hired by the contractor.
 - 1. The sales and use tax is to be excluded only on those material items purchased by the Owner directly from the Material Supplier. If a Contractor lists his own company, or an installing subcontractor, as the supplier on those items, any purchase order will be void, and the sales and use tax on the materials used to fulfill the terms of the contract will be the liability of the Contractor.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED END OF SECTION

SECTION 011000 - SUMMARY

PART 1 GENERAL

1.01 PROJECT

- A. Project Name: Marion County Middle School Addition & Renovation.
- B. Owner's Name: Marion County Board of Education.

1.02 OWNER OCCUPANCY

- A. Owner intends to continue to occupy the Marion County Middle School during the entire construction period.
 - 1. A school calendar is available at the District's website, located here: http://www.marion.k12.ky.us/
- B. Owner intends to occupy the Project upon Substantial Completion.
- C. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.
- D. Schedule the Work to accommodate Owner occupancy.

1.03 CONTRACTOR USE OF SITE AND PREMISES

- A. Construction Operations: Limited to areas noted on Drawings. Do not disturb portions of the site beyond the areas in which the Work is indicated.
- B. Arrange use of site and premises to allow:
 - 1. Owner occupancy.
 - 2. Work by Others.
 - 3. Work by Owner.
- C. Provide access to and from site as required by law.
 - 1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
 - 2. Do not obstruct roadways, sidewalks, or other public ways without permit.
- D. Keep driveways and entrances serving the premises clear and available to the Owner, the Owner's employees and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
- E. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on site. Do not unreasonably encumber the site with materials or equipment. Confine stockpiling of materials and location of storage sheds to these areas. If additional storage is necessary, obtain and pay for such storage off site.
- F. Pressure wash driveways where mud and debris from construction is generated on a regular basis.
- G. Existing building spaces may not be used for storage.
- H. The General Contractor shall conduct all his work, and the work of his subcontractors, without interruption of the business of the school.
- I. During school hours, Contractor maintains responsibility for noise abatement. No radios will be allowed and use of power-actuated and pneumatic tools, sawing, hammering, etc. should be limited as much as possible.
- J. Workers shall abide by a code of conduct to include wearing shirts at all times. Alcohol, smoking, drugs, firearms, foul language, and fraternizing with students or staff is strictly prohibited.

K. The Contractor shall be responsible for ensuring no Contractor employee or subcontractor on its behalf appears on the school property who has been charged or convicted of a sex crime or violent crime like those covered in KRS 160.380(3) or KRS 17.545.

1.04 WORK SEQUENCE

A. Refer to Sheet _____ for information concerning phasing of construction.

B. Coordinate construction schedule and operations with Architect and Owner. **END OF SECTION**

SECTION 012000 - PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Procedures for preparation and submittal of applications for progress payments.
- B. Documentation of changes in Contract Sum and Contract Time.
- C. Change procedures.
- D. Correlation of Contractor submittals based on changes.
- E. Procedures for preparation and submittal of application for final payment.

1.02 RELATED REQUIREMENTS

- General Conditions, Special Conditions and Document 007300 Supplementary Conditions: Additional requirements for progress payments, schedules of values, final payment, changes in the work.
- B. Section 012100 Allowances: Payment procedures relating to allowances.
- C. Section 012200 Unit Prices: Monetary values of unit prices; Payment and modification procedures relating to unit prices.

1.03 SCHEDULE OF VALUES

- A. Form to be used: Use AIA Document G703 Continuation Sheets as form for Applications for Payment. If another form is used, the format must be consistent with AIA Document G703.
- B. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit draft to Architect for approval.
- C. Forms filled out by hand will not be accepted.
- D. Submit a printed schedule on forms provided by the Owner or Architect.
- E. Submit Schedule of Values electronically within 15 days after date of Owner-Contractor Agreement.
- F. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the specification section. Identify site mobilization.
- G. Include in each line item, the amount of Allowances specified in this section. For unit cost Allowances, identify quantities taken from Contract Documents multiplied by the unit cost to achieve the total for the item.
- H. Separate Contractor's overhead into a separate line item. Separate profit into either a single line item or spread throughout other costs.
- I. Revise schedule to list approved Change Orders, with each Application For Payment.
- J. Provide enough detail in Contract Sum breakdown to facilitate continued evaluation of Applications for Progress Payments.
- K. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
- L. Temporary facilities and other major cost items that are direct cost of actual work-in-place may be shown either as separate line items in the Schedule of Values or distributed as general overhead expense.
- M. The Architect may from time to time require further verification of parts or the whole of the Schedule of Values. Modifications as required by the Architect shall be made by the Contractor as directed.

Monies paid to the Contractor on previous payments shall then be modified to reflect the modifications made in the Schedule of Values.

1.04 APPLICATIONS FOR PROGRESS PAYMENTS

- A. Payment Period: Submit at intervals of once per month, within the schedule provided by the Architect and the Owner at the time of contract award.
- B. Form to be used: Use AIA Document G702 and AIA Document G703 Continuation Sheets as form for Applications for Payment. If another form is used, the format must be consistent with AIA Document G702 and AIA Document G703.
- C. Form Completion: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
- D. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to Architect for approval.
- E. Forms filled out by hand will not be accepted.
- F. For each item, provide a column for listing each of the following:
 - 1. Item Number.
 - 2. Description of work.
 - 3. Scheduled Values.
 - 4. Previous Applications.
 - 5. Work in Place and Stored Materials under this Application.
 - 6. Authorized Change Orders.
 - 7. Total Completed and Stored to Date of Application.
 - 8. Percentage of Completion.
 - 9. Balance to Finish.
 - 10. Retainage.
- G. Execute certification by signature of authorized officer.
- H. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored products.
- I. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of work.
- J. Stored Materials: Include the following:
 - 1. A list of materials consigned to the Project (which shall be clearly identified), giving the place of storage, together with copies of invoices.
 - 2. Certification that all items have been tagged for delivery to the Project and that they will not be used for any other purpose.
 - 3. Evidence of adequate insurance covering the material in storage off-site, listing the Owner as an additional insured.
- K. Submit digital copies of each Application for Payment.
- L. Include the following with the application:
 - 1. Partial release of liens from major Subcontractors and vendors. With each application, submit waivers of mechanic's liens from subcontractors, suppliers and vendors for the construction period covered by the previous application.
 - a. Provide a current Contractor's lien waiver and duly executed and acknowledged sworn statement showing all Subcontractors and materialmen with whom the Contractor has entered into subcontracts, the amount of each such subcontract, the amount requested for any Subcontractor and materialmen in the requested progress payment and the amount to be paid to the Contractor from such progress payment,

together with similar sworn statements from all such Subcontractors and materialmen;

- b. Provide duly executed waivers of mechanic's and materialmen's liens form all Subcontractors and, when appropriate, from materialmen and lower tier Subcontractors establishing payment or satisfaction of payment of all amounts requested by the Contractor on behalf of such entities or persons in any previous Application for Payment;
- c. Submit partial waivers on each item for amount requested, before deduction for retainage, on each item.
- d. Owner reserves the right to designate which entities involved in the Work must submit waivers.
- e. Forms: Submit forms for approval by Architect and Owner.
- M. Purchase Orders: With each Application for Payment, the Contractor shall submit invoices for direct payment by Owner for materials purchased by the Owner by Purchase Order. These invoices should be transmitted as follows:
 - All invoices should be accompanied by a payment summary sheet, which should include the following:
 - a. Name of Project.
 - b. Name of Contractor.
 - c. List of each payment to be made, in tabular format, with the following headings:
 - 1) Purchase Order Number.
 - 2) Name of Supplier.
 - 3) Original Purchase Order Total.
 - 4) Any Change Order amounts for that Purchase Order.
 - 5) Current adjusted Purchase Order total.
 - 6) Previous Invoices.
 - 7) Current Invoices.
 - 8) Remaining Purchase Order Balance.
 - 9) Statement signed and notarized by the Contractor, as follows: "I hereby guarantee and warrant to the Owner that all materials listed in the breakdown above for payment conform fully to the requirements of the Contract Documents. These materials have been delivered to the project site, in good condition, and have been inspected to verify product suitability, quantity, quality and condition. I hereby accept responsibility for care, custody and control of these materials."
 - 2. In addition to the payment summary sheet outlined above, each set of vendor invoicing shall include a Contractor's Purchase Order Payment Authorization form, attached at the end of this section.
 - a. Attach copies of invoices to each Contractor's Purchase Order Payment Authorization Form.

1.05 MODIFICATION PROCEDURES

1.

- A. For minor changes not involving an adjustment to the Contract Sum or Contract Time, Architect will issue instructions directly to Contractor by Field Order.
- B. For other required changes, Architect will issue a document signed by Owner instructing Contractor to proceed with the change, for subsequent inclusion in a Change Order.
 - 1. The document will describe the required changes and will designate method of determining any change in Contract Sum or Contract Time.
 - 2. Promptly execute the change.
- C. Substantiation of Costs: Provide full information required for evaluation.
 - 1. Provide detailed breakdown of labor and materials costs.
 - 2. Overhead and profit shall not exceed a total of 15% of the cost of the labor and materials cost.

- 3. The Contractor shall not include in the cost of the Work any cost or rental of small tools, or any portion of the time of the Contractor or the superintendent, or any allowance for the use of capital, insurance or bond premium or any actual or anticipated profit, or job or office overhead not previously mentioned. These items are considered as being covered under the added amount for general overhead.
- 4. Provide justification for any change in Contract Time.
- 5. Provide credit for deletions from Contract, similarly documented.
 - Support each claim for additional costs with additional information upon request:
 - a. Origin and date of claim.

6.

- b. Dates and times work was performed, and by whom.
- c. Time records and wage rates paid.
- d. Invoices and receipts for products, equipment, and subcontracts, similarly documented.
- D. Contractor shall submit an updated construction schedule that indicates the effect of the change, including but not limited to changes in activity duration, start and finish times, and activity relationship.
- E. Execution of Change Orders: Architect will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.
 - 1. Change Orders modifying the contract amount by less than \$25,000.00 may be approved and executed by the Local Board of Education. Since the Local Board of Education typically meets on a monthly schedule, this approval could take as long as one month after the Contractor returns the signed documents to the Architect.
 - 2. Change Orders modifying the contract amount by more than \$25,000.00 cannot be executed by the Local Board of Education without prior approval from the Kentucky Department of Education. These Change Orders are to be approved by the Contractor and Architect, and then submitted to the Local Board of Education where they will be accepted. With acceptance from the Local Board of Education, they will then be submitted to the Kentucky Department of Education. Upon approval from the Kentucky Department of Education, Change Orders may be executed by the Owner, and then and only then do they become a part of the Contract Documents.
 - 3. Time for obtaining formal Change Order approval shall not be used as a claim for extending the construction period. Both the Architect and the Owner shall perform their responsibilities in a reasonable amount of time, but shall not be responsible for delays in the construction schedule.
- F. After execution of Change Order, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum.
- G. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.
- H. Promptly enter changes in Project Record Documents.

1.06 APPLICATION FOR FINAL PAYMENT

- A. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Sum, previous payments, and sum remaining due.
- B. Application for Final Payment will not be considered until the following have been accomplished:
 - 1. All closeout procedures specified in Section 017000.
 - 2. All closeout documentation required by materials specifications sections.
 - 3. Evidence of completion of Project closeout requirements.
 - 4. AIA Document G707, Consent of Surety to Final Payment.
 - 5. AIA Document G706, Contractor's Affidavit of Payment of Debts & Claims
 - 6. AIA Document G706A, Contractor's Affidavit of Release of Liens
 - 7. Evidence that claims have been settled.

- 8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of the date of Substantial Completion or when Owner took possession of an assumed responsibility for corresponding elements of the Work.
 - Final liquidated damages settlement statement.

END OF SECTION

9.

SECTION 012200 - UNIT PRICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Measurement and payment criteria applicable to Work performed under a unit price payment method.

1.02 COSTS INCLUDED

A. Unit Prices included on the Bid Form shall include full compensation for all required labor, products, tools, equipment, plant, transportation, services and incidentals; erection, application or installation of an item of the Work; overhead and profit.

1.03 MEASUREMENT OF QUANTITIES

- A. Measurement methods delineated in the individual specification sections complement the criteria of this section. In the event of conflict, the requirements of the individual specification section govern.
- B. Take all measurements and compute quantities. Measurements and quantities will be verified by Architect.
- C. Assist by providing necessary equipment, workers, and survey personnel as required.
- D. Measurement Devices:
 - 1. Weigh Scales: Inspected, tested and certified by the applicable state Weights and Measures department within the past year.
 - 2. Platform Scales: Of sufficient size and capacity to accommodate the conveying vehicle.
 - 3. Metering Devices: Inspected, tested and certified by the applicable State department within the past year.
- E. Measurement by Weight: Concrete reinforcing steel, rolled or formed steel or other metal shapes will be measured by handbook weights. Welded assemblies will be measured by handbook or scale weight.
- F. Measurement by Volume: Measured by cubic dimension using mean length, width and height or thickness.
- G. Measurement by Area: Measured by square dimension using mean length and width or radius.
- H. Linear Measurement: Measured by linear dimension, at the item centerline or mean chord.
- I. Stipulated Price Measurement: Items measured by weight, volume, area, or linear means or combination, as appropriate, as a completed item or unit of the Work.
- J. Perform surveys required to determine quantities, including control surveys to establish measurement reference lines. Notify Architect prior to starting work.
- K. Contractor's Engineer Responsibilities: Sign surveyor's field notes or keep duplicate field notes, calculate and certify quantities for payment purposes.
- L. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at the Owner's expense, by an independent surveyor acceptable to Contractor.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED END OF SECTION

SECTION 012300 - ALTERNATES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Description of Alternates.
- B. Administrative and procedural requirements.

1.02 RELATED REQUIREMENTS

A. Instructions to Bidders: Instructions for preparation of pricing for alternatives.

1.03 ACCEPTANCE OF Alternates

- A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at Owner's option. Accepted Alternates will be identified in the Owner-Contractor Agreement.
- B. Coordinate related work and modify surrounding work to integrate the Work of each Alternate.

1.04 SCHEDULE OF Alternates

- A. Alternate No. 1 Owner-Preferred HVAC Controls Manufacturer: Provide HVAC controls by Trane in lieu of all other manufacturers specified. Comply with all contract document requirements.
- B. Alternate No. 2 Owner-Preferred Door Hardware Manufacturers: Provide door hardware manufacturers as outlined in Specifications Section 087100 Finish Hardware, Article _____, in lieu of all other manufacturers specified. Comply with all contract document requirements.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED END OF SECTION

SECTION 012400 - GEOTECHNICAL DATA

PART 1 GENERAL

1.01 GEOTECHNICAL REPORT

- A. A geotechnical exploration of the site was conducted by Colid Ground Consulting Engineers, PLLC, dated August 15, 2019.
 - 1. A digital copy in color may be requested of the Architect.
- B. The report of the geotechnical exploration is appended hereto for reference only and is not a part of the Contract Documents. The boring layout and log of borings is appended to the set of contract drawings. No warranty of content or accuracy is expressed or implied. Neither the Owner nor the Architect will be responsible for interpretations or conclusions drawn from this report by the Contractor. This data is made available solely for the convenience of the Contractor.

END OF SECTION



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REPORT OF GEOTECHNICAL EXPLORATION



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August 15, 2019

Marion County Public Schools c/o Mr. Kevin Macalla Ross Tarrant Architects 101 Old Lafayette Ave. Lexington, KY 40502

Subject: Report of Geotechnical Exploration Proposed Marion Co. Classroom Addition Lebanon, Kentucky 19-0231

Dear Mr. McCalla,

Solid Ground Consulting Engineers, PLLC (Solid Ground) is pleased to present our Report of Geotechnical Exploration. This report is for the proposed Marion Co. Middle School classroom addition to be located in Lebanon, Kentucky. The geotechnical exploration was conducted in general accordance with the scope of work outlined in Solid Ground Proposal 19-0128, dated July 8, 2019.

This report contains our findings and recommendations for the referenced project detailed above. Once completed, it is recommended that Solid Ground have the opportunity to review plans and specifications. In addition, it is recommended that Solid Ground be retained to perform observations during earthwork, shallow foundation, slab on grade and pavement construction. Solid Ground will not be held responsible for interpretations and field observations made by others.

We appreciate the opportunity to provide our consulting services to you. We look forward to working with you on this and future projects.

Sincerely, SOLID GROUND CONSULTING ENGINEERS, PLLC

thatten ikely

Kaitlin Berry, EIT Project Engineer

Eni C.



Eric C. Haley, PE Regional Geotechnical Manager Kentucky License Number 24260

Solid Ground Consulting Engineers, PLLC • 1403 Lexington Road • Richmond, Kentucky 40475 Phone: 859.545.4587 • Email: blake@solidgroundce.com •www.solidgroundce.com



Project Information

Purpose and Scope of Services

The purpose of this subsurface exploration was to prepare recommendations for design and construction of foundations, floor slabs, pavement and drive areas for the proposed Marion Co. Middle School classroom addition to be located off KY-327 in Lebanon, Kentucky. Our scope of work included the following:

- A discussion of site surface conditions.
- A discussion of subsurface conditions encountered and published geologic conditions at the site.
- A summary of field and laboratory testing results including a brief review of test procedures.
- A Boring logs and laboratory tests will be summarized in the report and included in the appendices.
- A discussion of specific geotechnical conditions and concerns which may affect the design or construction of the project.
- Recommendations for site preparation and construction of compacted fills.
- Recommended general design and construction criteria for the project foundations.
- A Recommended general design and construction criteria for the pavement.
- A recommendation for seismic site class according to International Building Code which was adopted by the 2018 Kentucky Building Code (KBC).

Project Description

Project information was provided in a request for proposal (RFP) from Ross Tarrant Architects (RTA), dated July 2, 2019. It is understood that the proposed project will consist of a new 2,100-sf classroom addition to be located on the south end of the existing building. The project is located on the Marion County Middle School campus located at 1155 State Hwy 327, Lebanon, Kentucky. The addition is expected to be single-story, masonry construction with slab on grade. Additional site improvements will consist of concrete walkways to connect egress routes with existing drives.

Site grading plans were not available as of the issue date of this report. Based on conversations with RTA, the finished floor elevation (FFE) of the proposed addition will match that of the existing structure. The FFE of the existing structure was measured in the





field by Solid Ground as 783.3 feet (at the base of the existing staircase on the south side of the existing structure) using Carlson GPS equipment.

Structural loading is understood to be 6 kips/foot or less for continuous wall loads and 75 kips or less for isolated column loads.

Site Conditions

Ms. Kaitlin Berry of Solid Ground directed by Mr. Eric C. Haley, PE, of Solid Ground, visited the site on July 23, 2019, to observe existing conditions, to help interpret the subsurface data and to detect conditions which could affect recommendations.

The site is located off KY-327 in Lebanon, Kentucky. KY-327 bounds the site to the east. The northern portion of the site is currently occupied by Marion Co. Middle School and the southern portion is covered with ankle to knee high grass.

The site appeared to be in good condition without obvious indications of standing water or obvious soft subgrade. Site drainage appeared to be adequate and is generally directed toward the south away from the existing structure.



Photograph 1 - General Site of Proposed Development





Subsurface Findings and Conditions Encountered

Review of Previous Site Development and Historical Information

Based on review of historical maps provided by the United States Geological Survey (USGS) and US Department of Agriculture (USDA), the site vicinity was occupied by a structure since 1953. The structure is not present in the Elizabethtown 1981 map, but this map does not have any buildings mapped. Aerial photography and imagery indicate that the existing structure has been present on the site since 1997.



1953 Lebanon West Topographic Quadrangle







1981 Elizabethtown Topographic Quadrangle



3-7-1997 Google Maps







9-16-2006 Google Maps



4-4-2006 Google Maps







4-12-2019 Google Maps

Published Geological Information

Geologic information was referenced from the Kentucky Geological Survey (KGS), geologic Maps of the Lebanon West Quadrangle, Marion County, Kentucky. Materials underlying the site are mapped as the New Albany Shale and the Boyle Dolomite.

The KGS maps for karst potential and closed depressions were reviewed. The KGS indicates that the property has low potential for karst development, with no mapped sinkholes in the nearby vicinity of the proposed development. If karst activity is encountered during earthwork operations, Solid Ground should be contacted to provide recommendations for remediation.

Subsurface Exploration Program

A Geoprobe 6620DT Drill was used to conduct soil test borings and soundings to explore the site subsurface conditions. It should be noted that, upon completion, each boring was backfilled with onsite materials and compacted. The boring logs attached to this report provide specific details at the individual boring locations.





A total of five (5) borings and one (1) sounding were drilled to explore the subsurface conditions across the site. The borings were approximately located within the building footprint from a boring location plan provided by RTA and measuring from existing site features. Boring surface elevations were measured in the field by Solid Ground personnel utilizing Carlson GPS equipment. Therefore, the boring locations and surface elevations should be considered approximate. The stratification lines shown on the boring Logs represent approximate boundaries between soil types. It should be noted that the subsurface conditions will vary between borings and the representative profile is based upon the number of borings drilled during the field operations.

The soil samples were visually classified by Ms. Berry according to the Unified Soil Classification System (USCS, ASTM D2487).

Subsurface Conditions

A description of each soil layer follows.

Surficial Layer – The borings generally encountered a thin layer of topsoil (approximately 6 inches) at the surface. It should be noted that topsoil thicknesses may vary across the site. The topsoil thicknesses presented in this report should be considered approximate.

Natural Soils, Lean Clay (CL) – The borings generally encountered soils described as medium reddish-brown lean clay (CL) underlying the topsoil to a depth of approximately 3 feet, and a yellowish-brown lean clay (CL) with chert fragment with depth from 3 feet to auger refusal, which ranged from a depth of 10 to 14 feet. The Standard Penetration Test (SPT) N-values ranged from 6 to 20 blows per foot, 13 average. The soil consistencies were judged to be firm to very stiff. Boring B-3 encountered isolated soft soils to an approximate depth of 2.5 feet.

Auger Refusal – The borings encountered auger refusal at depths ranging from 10 to 14 feet.
5 foot of coring was conducted in B-3 to determined refusal material.

Rock Coring – Bedrock in boring B-3 was cored a depth of approximately 5 feet. The percent recovery was 87.9% and the Rock Quality Designation (RQD) was 70.2%. Bedrock was visually classified as limestone.

Groundwater – Groundwater was not encountered in the borings during the exploration. Free groundwater levels fluctuate with seasonal weather conditions and may vary.





Therefore, the borings may not be representative of the actual free water levels. To achieve an accurate measurement of free groundwater levels, water wells or piezometers should be installed. `

Solid Ground should be contacted if groundwater is encountered during earthwork operations. Please note, the groundwater table can fluctuate significantly which could have an impact on the subsurface soils.

The following table summarizes our findings.

Boring Number	Auger Termination (AT) or Auger Refusal (AR)	AT or AR Depth, (ft.)	Surface Elevation (Approx.), (ft.)	Auger Termination (AT) or Auger Refusal (AR) (Approx.), (ft.)
B-1	AR	14.0	784.2	770.2
B-2	AR	10.0	780.3	770.3
B-3	AR	10.0	779.9	769.9
B-4	AR	13.5	784.3	770.8
B-5	AR	14.0	783.5	769.5

Table 1 - Boring Summary

Geotechnical Concerns and Construction Considerations

Based on the results of our borings and our understanding of the proposed project, we believe the project site is generally suitable for the proposed development. However, some concerns exist with the subsurface conditions as discussed below.

Topsoil

Based on the information gathered from the soil borings, the site has a surficial layer of topsoil, approximately 6 inches. Topsoil thicknesses are representative of conditions encountered at the boring locations only, thickness an aerial extent of the topsoil stratum may vary across the site. The topsoil may be utilized as fill within landscaping areas only.





Construction plans should adequately address stripping of topsoil prior to earthwork operations.

Soil Plasticity

The subsurface soils were field and laboratory classified as moderate plasticity lean clay (CL) to auger refusal depths. If high plasticity clays are identified during construction, testing can be conducted to assess the shrink-swell potential of the clays. Solid Ground can assist in selecting and implementing the mitigation method appropriate for site conditions.

Underground Utilities

Underground utilities, including geothermal lines are present within the footprint of the proposed classroom addition. Construction plans should include provisions for complete removal and/or relocation of utility lines encountered during site grading operations.

Stability of Adjacent Structure

Construction of the proposed addition will require excavation adjacent to the existing structure. If excavations are to extend below the elevation of the existing structure footings, underpinning measures will be required to prevent undermining of the foundations. Construction plans should address this possibility. Solid Ground can provide design of the underpinning support system if requested at an additional agreed upon cost. Based on subsurface conditions encountered, push piles would most likely be the most economical system for foundation underpinning support.

Vibration of New Equipment

We anticipate potential compaction equipment that could cause vibration during earthwork operations. It is recommended that the vibration impact to the existing structure be considered and addressed.

Construction within a Demolition Zone

The site of the proposed addition is currently occupied with concrete sidewalks and stairs. These structures will be demolished prior to construction. Project demolition plans should include provisions for complete removal of foundations, sidewalks and any other such structures encountered during the site preparation process.





Development within a Karst Region

Solution activity in areas underlain by limestone generally results from a slow process of dissolving the underlying rock units by surface runoff or rain water. Sinkholes at the ground surface are caused from either a general raveling failure within the soil unit or by rock collapse. Either phenomena typically result in depressions at the ground surface, which, if large enough, can be identified on topographic maps. In addition to the natural causes of sinkhole development previously discussed, sinkholes may form as a result from water leaking from subsurface piping and drainage systems such as buried water and sewer pipes, septic lateral fields, and roof drains beneath the building and floor slabs.

As previously stated, the Kentucky Geological Survey rates the site with a low potential for karst development. It is not possible to remove all of the risk associated with construction over known sinkholes or in sinkhole-prone, karst areas. Our experience indicates that the limestone formations mapped underlying the site pose a low risk for solution activity and sinkhole formation. The natural rising and lowering of the ground water table and surface water migration downward through the subsurface soils can create the risk of continued soil migration into solution voids in the underlying limestone.

There is some potential for sinkholes to be encountered during construction, especially in cut areas. Solid Ground should be contacted if a solution feature or other karst features are encountered during construction. Repair methods of sinkholes and other karst features exist. When sinkholes are encountered, the common practice is to excavate the soil from within the solution feature down to hard bedrock. The two most common methods of remediation are a concrete plug or an inverted filter.

We believe the risk with this development is no greater than for similar developments in the area. To further reduce the risk of unidentified sinkholes at the site would require the implementation of more sophisticated and expensive geotechnical exploration methods including borings on a tightly spaced grid or geophysical methods. However, this approach is considered expensive and is likely cost prohibitive for this project.

Construction in Cut/Fill Areas

Based on the topographic contours depicted on the site plan and FFE of 783.3 feet, we anticipate some cut and fill to achieve final grade across the building pad. The FFE was determined in the field by Solid Ground Personnel using Carlson GPS equipment with the understanding that the FFE of the addition was to match the floor elevation of the existing





structure. The sounding preformed in the proposed retention pond showed that bedrock depth was 10 feet, approximately.

Cut areas have the potential to be overcut, disturbing the insitu soils to depths below proposed finished grade. Areas to receive fill are stripped of topsoil and are also sometimes disturbed to depths deeper than intended. Both cut and fill areas shall be proofrolled prior to construction taking place. Soft, loose, or wet areas shall be identified and remediated in accordance with the recommendations provided in the "Earthwork" section of this report.

Construction During Wet Conditions

Based on our conversations it is understood that potential development will occur during wet conditions. Based on past experience with construction projects during wet conditions, subgrade remediation is often required. In addition, delays of earthwork/foundation operations should be anticipated. This is due to the onsite soils characterized as lean clay. Clays lose cohesive strength when high moisture conditions are present. To stabilize the clay, drying would be required. During wet conditions, the clays may become saturated and are unable to dry in a timely manner.

As this project is anticipated to be of fast pace, with construction potentially occurring during wet conditions, we anticipate remediation methods to occur. Typically, remediation methods consist of undercutting soft and/or saturated soils and replacing with a granular stone that is "capped" with DGA. The extent and depth of the undercut is on a case by case basis depending on the soil conditions. We recommend contracting Solid Ground to observe earthwork operations and foundation and slab on grade construction. In addition, we recommend that the earthwork contractor and the design team adequately budget for remediation repairs.

It is recommended that each spread footing and continuous footing have Dynamic Cone Penetrometer testing performed once foundation excavation is completed to ensure bearing is within the recommended net allowable as detailed in this report.

Preliminary Liquefaction Potential and Settlement

Liquefaction is the phenomenon where saturated soils develop high pore-water pressures during seismic shaking and lose their strength characteristics. This phenomenon generally occurs in areas of high seismicity where groundwater is shallow. Liquefaction can produce





excessive settlement, ground rupture, lateral spreading, or failure of shallow spread foundations.

Three conditions are generally required for liquefaction to occur:

- 1. The soil must be saturated (relatively shallow groundwater)
- 2. The soil must be loosely packed (low density)
- 3. Ground shaking of sufficient intensity must occur to function as a trigger mechanism.

Our exploration encountered clay soils with no groundwater and an estimated bedrock depth of 10 to 14 feet. They are not considered loosely packed. Therefore, the soils should be considered to have low liquefaction potential.

Site and Foundation Drainage

Past experience has shown that the onsite materials are prone to degradation during wet periods of the year and/or under heavy traffic. Surface and ground water should be controlled while the subgrade fill materials are exposed and use only enough compactive effort to achieve stability and job site requirements for compaction. In addition, it is recommended that foundation concrete, or a concrete bearing medium, be placed the same day that foundation excavation is performed. It is imperative that dewatering be maintained during construction and after the development.

The final grade should be sloped away from the structure and pavements a minimum of two percent to promote positive drainage. Roof drains and foundation drains should be installed and should discharge surface runoff away from the structure to provide positive site drainage. It should be noted that drainage should be designed and constructed without impacting neighboring properties. Drainage design is beyond our scope of work.

It is imperative that dewatering be maintained during construction and after development. If positive dewatering methods are not continually applied and maintained, the potential of remedial subgrade measures is greatly increased.

Recommendations

The following recommendations are based on the information gathered and subsurface conditions encountered during this exploration. It should be noted that Solid Ground cannot be held liable for fill placed or performance of the subgrade without observations. It is recommended to retain Solid Ground to perform proofrolling of the building pads and




pavement areas, prior to the beginning of fill placement and during fill placement (if required).

Earthwork

Site Preparation

- Topsoil materials should be stripped to prepare the site for construction.
 - The stripping should extend a minimum of five feet outside of the pavement and building areas.
 - Isolated soft surficial soils (encountered near B-3) may require undercut and replacement.
- After stripping and cutting operations, the subgrade should be evaluated by Solid
 Ground by proofrolling methods with a fully loaded dump truck.
 - Possible remediation methods may be required if the subgrade and site soils are exposed to wet weather conditions.

Structural Fill Placement

Final grading plans are not available at this time. Based on the site topography, it is suspected that minor grading will be required to establish finished grade. Backfill materials for structural fill placement may consist of soil or durable crushed stone. The following steps are recommended for fill placement within the building pad. **The onsite soils are expected to meet the requirements for structural fill.**

Structural fill material, if required, is defined as the following:

- Inorganic natural soil with maximum particle sizes of 3 inches.
- Plasticity Index of no greater than 30 percent and liquid limit less than 50.
- Solid Ground should observe to ensure the soils meet applicable standards for structural fill.
- Other sources of structural fill should be verified by Solid Ground.
 - If other sources of structural fill are anticipating, Solid Ground should collect a bulk sample for standard Proctor testing.

The following are recommendations for placement of soil structural fill:

Structural fill should be placed in 6-inch to no greater than 8-inch-thick layers.





- Structural fill should be compacted to at least 98 percent of the soil's maximum dry density as determined by the standard Proctor compaction test (ASTM D698).
- The moisture content of the fill material should be maintained about 2 percent (above or below) of its standard Proctor optimum moisture content depending on the results of the Proctor tests.
- In-place density testing must be performed as a check that the previously recommended compaction criteria have been achieved.
- Fill placement should be monitored on a full-time basis by Solid Ground during site grading.
- Fill placement should extend to a minimum of 5 feet beyond the building footprint.

Solid Ground should be contacted if any unexpected subsurface conditions are encountered during earthwork construction.

It is important that Solid Ground observe earthwork construction.

Foundation

Discussion

Minor grading consisting of fill is anticipated to achieve final finished grade across the building pad and the site in general. **Solid Ground recommends that the foundation bearing elevation be 30 inches below final finished grade.** In addition, it is recommended that landscaping and underground irrigation systems be located a minimum of 5 feet beyond the edge of the building on all sides.

It is recommended that the structure foundations bear on stiff or better natural soils or engineered fill. We recommend the use of a maximum net allowable bearing pressure of 2,000 psf (pounds per square foot) for foundations bearing on these materials.

A detailed settlement analysis was beyond the scope of this report. Based on the assumed structural loads, the available site grading information, the recommended bearing pressure, knowledge of the site's development and empirical correlation for the subsurface conditions encountered beneath the proposed structure, we estimate the total settlements of the foundation to be about one-inch or less. Differential settlements are estimated to be about $\frac{1}{2}$ inch or less.





Once the design is finalized, we recommend allowing Solid Ground the opportunity to review the plans and specifications.

Construction Considerations

The following construction considerations are recommended:

- Column footings should be at least 24 inches wide and strip footings should be at least
 18 inches wide.
- All exterior footing bottoms should be at least 30 inches below the lowest adjacent exterior grade for protection against frost penetration, and to provide a more stable moisture condition.
- Clean the foundation bearing area so it is nearly level and is free of ponded water and loose material.
- Dewatering methods may be necessary if the foundation excavation takes place during wet weather.
- Solid Ground should be on site while the foundation construction is performed.
- Please note, we recommend to perform Dynamic Cone Penetrometer (DCP) testing at each isolated spread footing and every 10 to 20 feet for continuous footings to ensure bearing capacity is met or exceeded, prior to concrete and reinforcement placement. Remediation may be required to achieve the net allowable bearing capacity if the soils become saturated or if the net allowable bearing is not achieved during DCP testing.
- Once the bearing is determined as suitable from DCP field testing by Solid Ground, the foundation excavations should be protected from wet weather conditions by placement of concrete immediately after or utilizing a "mud mat". Please note, providing positive site drainage is critical to the performance of the foundations.

Slab on Grade

We assume that the slab on grade will be utilized for light loads. If this assumption is incorrect, Solid Ground should be contacted to modify recommendations. The following recommendations should be followed:

Solid Ground should observe the finished subgrade utilizing proofrolling once grading is completed. If excessive pumping and/or rutting is observed remediation may be required. Typical remediation methods consist of undercutting the unsuitable soil and placing recompacted soil or granular material.





- If construction is to take place during wet periods of the year, there is a potential that remediation methods will be required to stabilize the soil subgrade. Solid Ground should be consulted to assist in selecting the method most appropriate for site conditions. These methods may consist of any or combination of the following:
 - Tensar geogrid reinforcement.
 - "Walking" No. 2 stone into the soft subgrade.
 - \circ $\;$ Application of compacted No. 57 stone.
- It is imperative that quality control be performed specifically for the slab on grade to ensure that moisture contents, as well as compaction efforts, are within optimum. If clay fill material is placed above optimum, there is potential that slab settlement could occur.
- It is recommended that the floor slab be constructed with a DGA stone base of a minimum of 6 inches in thickness. The floor slab should be constructed with a minimum of 4 inches of reinforced concrete.
- A subgrade modulus, *k*, of 60 pounds per cubic inch (pci) for design of the floor slab supported by granular material.
- It is recommended to utilize a minimum 6 mil vapor barrier between bottom of concrete slab and stone subbase.
- Control joints should be placed in the slab around any columns and along footing supported walls so these elements may move independently.
- Place horizontal control joints into the slab, spaced approximately 12 feet apart to control cracking.
- The floor slab should be fully ground-supported. This will reduce the possibility of cracking and displacement of the floor slab due to differential settlement.
- It is recommended to perform proofrolling prior to placing stone to serve as the slab working base, and again immediately prior to constructing the slab.

Below Grade Walls

Construction plans for the proposed structure were not available as of the issue date of this report. Recommendations are being provided for active, passive and at-rest conditions. The walls should also be designed to provide sufficient drainage at the rear of the wall to relieve hydrostatic pressure.

We recommend the walls be backfilled using a compacted granular material. The granular material should preferably be "SP" or "GW" as classified by the USCS, so that





it will be clean, free draining, and exhibit an angle of shear resistance of 30 degrees or more. KDOH No. 57 stone is suitable for this purpose.

- To utilize the following granular material earth pressure values, the granular material must occupy a triangular shaped minimum backfill zone. The minimum zone starts at the base of the wall from the outside face of the footing. At the top of the backfill, the zone should extend from the edge of footing a distance of three-fifths of the backfill height.
- The backfill zone may be drained using a perforated pipe placed at the base of the footing. Either gravity drainage or a sump pump system should be used to remove accumulated water.
- A minimum thickness of two feet of low plasticity clay should be provided on top of the granular wall backfill material where the backfill material will be exposed to the weather. This low plasticity clay cap is recommended to minimize the potential for infiltration of surface water runoff behind below grade walls. The onsite residual soils are suitable for this purpose.
- The coefficient of friction of concrete over soil utilized for design consideration should be 0.35.

The following table presents granular backfill, earth pressure design parameters for Equivalent Hydrostatic Pressures (EHP) and Earth Pressure coefficients. The values given assume the backfill surface is level, the backfill is drained, the zone of backfill conforms to the minimum zone size given above, and no surcharge is placed on the backfill.

and Ear	rth Pressure Co	efficients	
Condition	EHP (pcf)	Coefficients	
Active	40	Ka = 0.30	
At Rest	65	$K_0 = 0.50$	
Passive	on EHP (pcf) Coefficient 40 Ka = 0.30 65 Ko = 0.50 400 Kp = 3.0		

Granular Backfill Material Equivalent Hydrostatic Pressures (EHP)





Alternate Below Grade Wall Design

If implementation of the full recommendation for a triangular shaped granular backfill zone against below grade walls would be cost prohibitive to this project, a minimum granular backfill zone of 2 feet against the wall, with the remainder of the backfill consisting of the onsite lean clay soils may be utilized for wall design. The equivalent hydrostatic pressures (EHP) for the onsite fat clay (CL) soils are provided in the table below.

Condition	EHP (pcf)	Coefficients
Active	40	K _a = 0.35
At Rest	60	K _o = 0.55
Passive	315	K _p = 2.8

Cohesive Soil (CL) Backfill Material Equivalent Hydrostatic Pressures (EHP) and Earth Pressure Coefficients

The following assumptions were utilized in calculation of the EHP values listed above.

- The onsite soils used for backfill are classified as lean clay (CL).
- The estimated standard proctor maximum dry density is 100 pcf.
- The estimated optimum moisture content is 20 percent.

The triangular granular backfill recommendations for below grade wall design and construction carry the least degree of risk and represent the method recommended by Solid Ground for long term performance.

The EHP parameters for a 2-foot granular layer and cohesive soil (CL) backfill carry a slightly higher degree of risk and have been provided in the interest of the project budget.

Seismic Site Classification

This classification is based on the seismic standards and design values from the 2009 NEHRP Recommended Seismic Provisions and the 2010 ASCE-7 Standard. Based on the results of our exploration and the geology of the area, we assign a site seismic classification of "C".





Seismic Design P	arameters - Provided by USGS
Code Used	2009 NEHRP
Site Classification	Site Class "C"
Location	37.587324°N, -85.345793°W
Fa	1.2
Fv	1.7
SDS	0.152g
S _{D1}	0.117g

Plan Review

To better assure conformance of the final design documents with the recommendations contained in this report, and to better comply with the building department's requirements, Solid Ground should review the completed project plans prior to construction. The plans should be made available for our review as soon as possible after completion so that we can better assist in keeping your project schedule on track.

We recommend that the following project-specific note be added to the architectural, structural, and civil plans: "The geotechnical aspects of the project, including site grading, utility and foundation excavations, slab on grade construction, placement and compaction of engineered fill, installation of site drainage should be performed in accordance with the recommendations of the *"Geotechnical Report prepared by Solid Ground Consulting Engineers, PLLC, dated August 15, 2019."*

Construction Monitoring and Observations

Based on past experience, in order to obtain the Certificate of Occupancy for this development, you will be required to directly contract a qualified and certified inspection firm to provide special inspection items consisting of observing the following:

- Soil Construction
- Foundation Construction
- 🔺 Concrete Placement
- Reinforcement Placement
- Steel Construction

It is advantageous to the owner to contract with Solid Ground Engineering, Inc. to provide construction monitoring and observations for this project. Some of those benefits are as follows:





- As the Geotechnical Engineer of Record (GER) for this project, we will provide confirmation that subsurface conditions exposed during construction are substantially the same as those interpolated from our limited subsurface exploration, on which the analysis and design were based.
- The recommendations in this report are based on limited subsurface information. The nature and extent of variation across the site may not become evident until construction. If variations are then exposed, it will be necessary to re-evaluate our recommendations. In the event that subsurface conditions differ from those anticipated, we as the GER will provide recommendations if deemed necessary.

REPORT LIMITATIONS

This report has been prepared for the exclusive use of <u>Ross Tarrant Architects and Marion</u> <u>Co. Public Schools</u> for specific application to the project site. Our recommendations have been prepared using generally accepted standards of geotechnical engineering practice in the Commonwealth of Kentucky. No other warranty is expressed or implied.

The recommendations provided are based on the subsurface information and other findings obtained by Solid Ground as well as information provided by you. If there are revisions to the plans for this project or if subsurface conditions detailed in this report are encountered during construction that are different than our exploration, we should be notified immediately to modify the foundation recommendations if deemed necessary. We cannot be held responsible for the impact of those conditions on the project if those impacts are not made known to us.

The scope of services did not include an environmental assessment for determining the presence or absence of wetlands or hazardous or toxic materials. Any statements in this report or on the test pit logs regarding odors, colors, and unusual or suspicious items or conditions are strictly for informational purposes.

ASSOCIATED GEOTECHNICAL RISK

The analytical tools which are used by the geotechnical engineer in this area are generally empirical and must be used in conjunction with professional engineering judgment and experience. Therefore, the recommendations presented in this geotechnical exploration should not be considered risk-free and are not a guarantee that the proposed structure will perform as planned. The engineering recommendations presented in this are based on the





information gathered during the subsurface exploration, information provided by you and past experience with similar projects.



APPENDICES

APPENDIX A – APPROXIMATE SITE LOCATION PLANS APPENDIX B – APPROXIMATE BORING LOCATIONS APPENDIX C – KENTUCKY GEOLOGICAL SURVEY MAP APPENDIX D – KGS KARST POTENTIAL APPENDIX E – BORING AND SOUNDING LOGS APPENDIX F – LABORATORY TESTING

APPENDIX A - APPROXIMATE SITE LOCATION PLAN





Project Number - 19-0231

APPENDIX B - APPROXIMATE BORING LOCATIONS





APPENDIX C – KENTUCKY GEOLOGICAL SURVEY MAP



MDna New Albany Shale (Middle Devonian - Lower Mississippian) USGS Unit Info: <u>GEOLEX (id: NewAlbany_2968)</u> Mapped or described as these unit(s) on the original GQ:

NEW ALBANY SHALE

USGS Unit Info: <u>GEOLEX (id: NewAlbany 2968)</u> Primary Lithology: Shale

Shale, carbonaceous, dark-gray; massive where fresh, weathers to iron-stained fissile mass; contains veinlets, laminae, blebs, and nodules of pyrite. Light-gray silty shale occurs locally in lower part of unit; a few phosphatic nodules occur in upper 5 feet. Basal contact sharp, well exposed. Where underlying Boyle Limestone is absent in northwestern part quadrangle, New Albany Shale rests unconformably on Brassfield Dolomite and on Saluda Dolomite and Bardstown Members of Drakes Formation.

Boyle Dolomite (also Boyle Limestone, Boyle Formation) (Middle Devonian - Upper Devonian) USGS Unit Info: <u>GEOLEX (id: Boyle 584)</u>

Mapped or described as these unit(s) on the original GQ:

BOYLE LIMESTONE USGS Unit Info: <u>GEOLEX (id: Boyle 584)</u> Primary Lithology: Limestone and dolomite

Limestone and dolomite: Limestone and dolomite Limestone and dolomite: Limestone, cherty, light-yellowishgray, medium- to very coarse grained, bioclastic, medium- to thick-bedded; contains winged crinoid columnals, horn corals, and brachiopods. Locally upper 1 to 5 feet is dolomite fragments 1 to 3 mm across in a fine-grained dolomite matrix. Basal contact locally well exposed in streams and roadcuts, but mostly covered by loess on hill tops and gentle hill slopes. Unit missing in northwestern part of quadrangle, elsewhere rests unconformably on Bardstown and Rowland Members of Drakes Formation. Equivalent to Beechwood Limestone Member of Sellersburg Limestone recognized to the north in Saint Catharine quadrangle (Peterson, 1975).

Map provided by Kentucky Geological Map





Kentucky Geological Survey Map Proposed Classroom Addition Lebanon, Kentucky Project Number 19-0231

Approximate Site Location

APPENDIX D – KGS KARST POTENTIAL





APPENDIX E – BORING AND SOUNDING LOGS



		B-1					ક્ર	C O N S U Engineering	LTD LTING		ROL N E E R S	, PLL	D . C
	Marion County	Middle School Addition					\bigvee	Linginouring	inioration, r	fortung out			B001
Veather: Sunny	/ 80's	Date: July 23, 2	2019	•			*Appr	oximate Si	urface E	levatior	ı: 784.2	feet	
ocation of Bori	ng: northeast addit	tion corner Drill Rig: Geo	pro	be 6620	DT								
uger Size: 8 inc	ches	Method: Hollo	- ow S	Stem Aug	er		Ham	mer Type:	Automa	tic			
roundwater	: Not Encountered	Engineer: Eri	c C. I	Haley, PE			Dri	ller: M&W	Drilling	g			
*Approximat Surface Elevation (ft.	e *Approximate Depth from existing grade (ft.)	Material Description	Symbol	Sample Depth (ft)	Sample Type		Blows per 6 inch increment	SPT "N" Value	Recovery (inches)	Atterberg Limits	Moisture Content (%)	Percent Fines	Approximate Peak Stress (PSF)
784.2	0.0												
	1.0	TOPSOIL (6 INCHES)		1	SS	2,	2, 2	4			17.5		
782.2	2.0	SOFT, medium reddish-brown											
	3.0	LEAN CLAY (CL), moist											
780.2	4.0			3 1/2	SS	3,	2, 1	3			19.6		
	5.0												
778.2	6.0			6	SS	6,	6, 10	16			15.7		
	7.0												
776.2	8.0	SOFT TO HARD, yellow-brown											
	9.0	LEAN CLAY (CL) with chert		81/2	SS	4,	6, 7,	13			17.4		
774.2	10.0	fragments at depth, moist											
772.2	11.0												
112.2	12.0												
770.2	13.0												
//0.2	14.0	ALCED DEFLICAL AT 14 0 FEFT		13 1/2	SS	14,	50/0	50			18.1		
7(0.2	15.0	AUGER REFUSAL AT 14.0 FEET											
700.2	16.0												
766.2	17.0												
700.2	18.0												
764.2	19.0												
701.2	20.0												
762.2	21.0												
702.2	22.0												
760.2	23.0												
	24.0												
	25.0												
oring Logs are for	26.0 informational purpo	ses only.	1			I		I	1		1		<u> </u>

	19	-0231	Boring Log B-2	5				द्ध	V	SOL CONSUL			E E R S ,	P L L	D C
	N	Iarion County	Middle School Addition					\forall		Engineering in	novation; Pro	waing Solut	ions to you	r Challeng	es.
Wea	ather: Sunny/ 8	80's	Date: July 23, 2	2019)			:	*Appro	oximate Su	rface El	evation	: 780.3	feet	
Loc	ation of Boring	: southeast addit	ion corner Drill Rig: Geo	opro	be 6620	DT									
Aug	er Size: 8 inche	es	Method: Holl	ow S	tem Aug	er			Hamn	ner Type: A	utomat	ic			
Gro	undwater 🗸: N	Not Encountered	Engineer: Eri	c C. I	laley, PI	2			Dril	ler: M&W I	Drilling				
*	*Approximate Surface Elevation (ft.)	*Approximate Depth from existing grade (ft.)	Material Description	Symbol	Sample Depth (ft)	Sample Type		Blows per 6 inch	increment	SPT "N" Value	Recovery (inches)	Atterberg Limits	Moisture Content (%)	Percent Fines	Approximate Peak Stress (PSF)
	780.3	0.0													
		1.0	TOPSOIL (6 INCHES)		1	SS	1,	2,	2	4			18.0		
	778.3	2.0	SOFT, medium reddish-brown												
		3.0	LEAN CLAY (CL), moist												
	776.3	4.0			3 1/2	SS	5,	5,	8	13			16.3		
		5.0													
	774.3	6.0	STIFF TO HARD, yellow-brown		6	SS	4,	4,	7	11			20.4		
		7.0	LEAN CLAY (CL) with chert												
	772.3	8.0	fragments at depth, moist												
-	770.2	9.0			81/2	SS	12,	50/2		50			19.6		
	770.5	10.0	ALICED DEFLICAL AT 10.0 FEFT												
-	768 3	11.0	AUGER REFUSAL AT 10.0 FEET												
	700.5	12.0													
	766.3	13.0													
		14.0													
	764.3	16.0													
		17.0													
	762.3	18.0													
		19.0													
	760.3	20.0													
		21.0													
	758.3	22.0													
		23.0													
	756.3	24.0													
		25.0													
		26.0		1											

	Pag 19	e 1 of 1 -0231	Boring Log B-3	Г •				S	V	SOL CONSUL Engineering Inr	TING		E E R S ,	P L L	D C 28,
	N	larion County	y Middle School Addition					V							
w	/eather: Sunny/ 8	2019)	<u> </u>		:	*Appr	oximate Su	rface Ele	evation	779.9	feet			
Lo	ocation of Boring	: southewest ad	dition corner Drill Rig: Geo	pro	be 6620	DT									
A	Auger Size: 8 inches Method: Hollow					ger			Hamr	ner Type: A	utomati	c			
G	Groundwater V: Not Encountered Engineer: Eric C.					3			Dril	ller: M&W D	rilling				
	*Approximate Surface Elevation (ft.)	*Approximate Depth from existing grade (ft.)	Material Description	Symbol	Sample Depth (ft)	Sample Type		Blows per 6 inch	increment	SPT "N" Value	Recovery (inches)	Atterberg Limits	Moisture Content (%)	Percent Fines	Approximate Peak Stress (PSF)
	779.9	0.0													
		1.0	TOPSOIL (6 INCHES)		1	SS	w	0	Н	0			21.8		
	777.9	2.0	VERY SOFT, medium reddish-												
		3.0	brown LEAN CLAY (CL), moist												
	775.9	4.0			3 1/2	SS	4,	6,	7	13			17.1		
	772.0	5.0													
	//3.9	6.0	STIFF TO HARD, medium reddish-		6	SS	2,	7,	9	16			20.1		
	771.9	7.0	fragments at depth, moist												
	//1.5	8.0	n agmente at aepai, mote							-					
	769.9	9.0			81/2	55	10,	50/2		50			19.4		
		11.0	AUGER REFUSAL AT 10.0 FEET	<u>11111</u>											
	767.9	12.0													
		13.0													
	765.9	14.0													
		15.0													
	763.9	16.0													
		17.0													
	761.9	18.0													
		19.0													
	759.9	20.0													
	757.0	21.0													
	737.9	22.0													
	755.9	23.0													
		24.0													
		25.0													
Bo Bo So *D	oring Logs are for in oring includes cond oil was visually class Depths are consider	formational purpo itions observed du sified in the field. ed approximate.	ses only. ring the site visit and for this particular l	ocat	ion.	1	<u>1</u>			1	1		<u> </u>		<u>ı </u>

Pag 19	e 1 of 1 -0231	Boring Log B-4	3				र्श्व	V		TING		E E R S ,	P L L	D C
Ν	Marion County Middle School Addition								Linginooring in	novanon, i n	Maing Oola	10113 10 100	onunong	
eather: Sunny/ 8	ther: Sunny/ 80's Date: July 23, 2019								roximate S	urface l	Elevatio	n: 784.	3 feet	
cation of Boring	DT													
iger Size: 8 inch	es	Method: Holl	ow S	tem Aug	er			Han	nmer Type:	Automa	atic			
roundwater V: Not Encountered Engineer: Eric C. Haley, PE								Dril	ler: M&W I	Drilling				
*Approximate Surface Elevation (ft.)	*Approximate Depth from existing grade (ft.)	Material Description	Symbol	Sample Depth (ft)	Sample Type		Blows per 6 inch	increment	SPT "N" Value	Recovery (inches)	Atterberg Limits	Moisture Content (%)	Percent Fines	Approximate Peak Stress
784.3	0.0													
	1.0	TOPSOIL (6 INCHES)		1	SS	1,	3,	3	6			17.2		
782.3	2.0	FIRM, medium reddish-brown												
	3.0	LEAN CLAY (CL), moist												
780.3	4.0			3 1/2	SS	5,	2,	4	6			20.2		
	5.0													
778.3	6.0			6	SS	4,	7,	9	16			17.7		
== ()	7.0													
776.3	8.0	FIRM TO HARD, medium reddish-												
774 2	9.0	brown LEAN CLAY (CL) with chert fragments at depth moist		81/2	SS	7,	9,	11	20			16.6		
//4.5	10.0	naginents at depui, moist												
772 3	11.0													
772.5	12.0													
770.3	13.0			121/2		50.0			50			172		
	14.0	AUGER REFUSAL AT 13.5 FEET	01111	13 1/2	22	50/2			50			17.5		
768.3	15.0													
	17.0													
766.3	18.0													
	19.0													
764.3	20.0													
	21.0													
762.3	22.0													
	23.0													
760.3	24.0													
	25.0													
	26.0													

	Pag 19	e 1 of 1 -0231	Boring Log B-5	Г •				S	V	Sol Consul Engineering Int	TING	GR ENGIN widing Soluti	E E R S ,	P L L (C es.
	M	larion County	y Middle School Addition					V							
w	/eather: Sunny/ 8	2019)			×	*Appro	oximate Su	face El	evation	783.2	feet			
Lo	ocation of Sound	ing: middle of ad	dition footprint Drill Rig: Geo	pro	be 6620	DT									
Aı	uger Size: 8 inche	ow S	Stem Aug	er			Hamn	ner Type: A	utomati	ic					
Gi	roundwater 🗸: N	c C. I	Haley, PE	PE Driller: M&W Drilling											
	*Approximate Surface Elevation (ft.)	*Approximate Depth from existing grade (ft.)	Material Description	Symbol	Sample Depth (ft)	Sample Type		Blows per 6 inch	increment	SPT "N" Value	Recovery (inches)	Atterberg Limits	Moisture Content (%)	Percent Fines	Approximate Peak Stress (PSF)
	783.2	0.0													
		1.0	TOPSOIL (6 INCHES)		1	SS	3,	3,	3	6			19.7		
	781.2	2.0	FIRM, medium reddish-brown												
		3.0	LEAN CLAY (CL), moist												
	779.2	4.0			3 1/2	SS	1,	2,	4	6			19.1		
		5.0													
	777.2	6.0			6	SS	6,	9,	11	20			19.8		
	775.0	7.0													
	//5.2	8.0	FIRM TO HARD, medium reddish-												
	773.2	9.0	fragments at depth, moist		81/2	SS	6,	8,	10	18			17.6		
	,,,,,,,	10.0													
	771.2	11.0													
		12.0													
	769.2	13.0			131/2	55	17	50/0		50			187		
		15.0	AUGER REFUSAL AT 14.0 FEET	011111	101/2	55	17,	5070		50			10.7		
	767.2	16.0													
		17.0													
	765.2	18.0													
		19.0													
	763.2	20.0													
		21.0													
	761.2	22.0													
		23.0													
	759.2	24.0													
		25.0													
F		26.0													
BO BO SO *D	oring Logs are for in oring includes cond oil was visually class depths are consider	itions observed du sified in the field. red approximate.	ses only. ring the site visit and for this particular l	ocat	ion.										

	Pag 19	e 1 of 1 -0231	Sounding Lo S-1	Sounding Log S-1				7 Solid Ground Consulting Engineers, PLLC Engineering Impaging Providing Solutions to Your Challenges						
	M	larion County	Middle School Addition				\bigvee			0				
W	/eather: Sunny/ 8	30's)		*Appro	oximate Su	rface El	evation	: 777.8	feet				
L	ocation of Sound	ing: field adjacen	DT											
A	uger Size: 8 inch	es	Method: Holl	ow S	tem Aug	er								
G	roundwater 🔻 !	Not Encountered	Engineer: Er	ic C. I	Haley, PI	2	Dril	ler: M&W [Drilling					
	*Approximate Surface Elevation (ft.)	*Approximate Depth from existing grade (ft.)	Material Description	Symbol	Sample Depth (ft)	Sample Type	Blows per 6 inch increment	SPT "N" Value	Recovery (inches)	Atterberg Limits	Moisture Content (%)	Percent Fines	Approximate Peak Stress (PSF)	
	777.8	0.0												
		1.0	TOPSOIL (6 INCHES)											
	775.8	2.0												
		3.0												
	773.8	4.0												
		5.0	medium to dark-brown LEAN											
	771.8	6.0	CLAY (CL), moist											
		7.0												
	769.8	8.0												
	767.9	9.0												
	/0/.8	10.0	ALICED DEFLICAL AT 10.0 FEET		1									
	765.8	11.0	AUGER REFUSAL AT 10.0 FEET											
		12.0												
	763.8	13.0												
		14.0												
	761.8	16.0												
		17.0												
	759.8	18.0												
		19.0												
	757.8	20.0												
		21.0												
	755.8	22.0												
		23.0												
	753.8	24.0												
		25.0												
r		26.0												
BC SC *E	bring Logs are for in pring includes cond pil was visually class Depths are consider	itions observed dur sified in the field. ed approximate.	ses only. ring the site visit and for this particular	locat	ion.									

APPENDIX F – LABORATORY TESTING





SECTION 013000 - ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Electronic document submittal service.
- B. Preconstruction meeting.
- C. Pre-Installation meetings.
- D. Progress meetings.
- E. Preconstruction and construction photographs.
- F. Coordination drawings.

1.02 RELATED REQUIREMENTS

- A. General Conditions
- B. Document 00 7300 Supplementary Conditions
- C. Section 01 1000 Summary
- D. Section 017000 Execution and Closeout Requirements: Additional coordination requirements.
- E. Section 017800 Closeout Submittals: Project record documents; operation and maintenance data; warranties and bonds.

1.03 PROJECT COORDINATION

- A. Coordinate construction operations included in various Sections of these Specifications to assure efficient and orderly installation of each part of the Work. Coordinate construction operations included under different Sections that depend upon each other for proper installation, connection and operation.
 - 1. Where installation of one part of the Work is dependent upon installation of other components, either before or after its own installation, schedule construction activities in the sequence required to obtain the best results.
 - 2. Coordinate installation of different components to assure maximum accessibility for required maintenance, service and repair.
 - 3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Where necessary, prepare memoranda for distribution to each party involved outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings.
 - 1. Prepare similar memoranda for the Owner and separate Contractors where coordination of their Work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
 - 1. Preparation of schedules.
 - 2. Installation and removal of temporary facilities.
 - 3. Delivery and processing of submittals.
 - 4. Progress meetings.
 - 5. Project close-out activities.
- D. Coordination Drawings: Prepare coordination drawings where careful coordination is needed for installation of products and materials fabricated by separate entities, and where limited space

availability necessitates maximum utilization of space for efficient installation of difference components.

- 1. Show the relationship of components shown on separate shop drawings.
- 2. Indicate required installation sequences.
- 3. Comply with requirements for submittals.
- 4. Contractor shall prepare coordination drawings of sprinkler, HVAC and electrical work. Work shall not begin until all subcontractors have signed off on drawings.
- E. Staff Names: Within 15 days of Notice to Proceed, submit a list of the Contractor's principal staff assignments, including the Superintendent and other personnel in attendance at the site. Identify individuals and their duties and responsibilities. List their addresses and telephone numbers.
 - 1. Post copies of the list in the project field office meeting room, the temporary field office, and at each temporary telephone.
- F. General Coordination Provisions:
 - 1. Inspection of Conditions: Require the Installer of each major component to inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.
 - 2. Manufacturer's Instructions: Comply with manufacturer's installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents.
 - 3. Inspect materials or equipment immediately upon delivery and again prior to installation. Reject damaged and defective items.
 - 4. Provide attachment and connection devices and methods necessary for securing Work. Secure Work true to line and level. Allow for expansion and building movement.
 - 5. Visual Effects: Provide uniform joint widths in exposed Work. Arrange joints in exposed Work to obtain the best visual effect. Refer questionable choices to the Architect for final decision.
 - 6. Recheck measurements and dimensions, before starting each installation.
 - 7. Install each component during weather conditions and Project status that will ensure the best possible results. Isolate each part of the completed construction from incompatible material as necessary to prevent deterioration.
 - 8. Coordinate temporary enclosures with required inspections and tests, to minimize the necessity of uncovering completed construction for that purpose.
 - 9. Mounting Heights: Where mounting heights are not indicated, install individual components at standard mounting heights recognized within the industry for the particular application indicated. Refer questionable mounting height decisions to the Architect for final decision.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 ELECTRONIC DOCUMENT SUBMITTAL SERVICE

- A. All documents transmitted for purposes of administration of the contract are to be in electronic (PDF, MS Word, or MS Excel) format, as appropriate to the document, and transmitted via an Internet-based submittal service that receives, logs and stores documents, provides electronic stamping and signatures, and notifies addressees via email.
 - 1. Besides submittals for review, information, and closeout, this procedure applies to Requests for Interpretation (RFIs), progress documentation, contract modification documents (e.g. supplementary instructions, change proposals, change orders), applications for payment, field reports and meeting minutes, Contractor's correction punchlist, and any other document any participant wishes to make part of the project record.
 - 2. Contractor and Architect are required to use this service.
 - 3. It is Contractor's responsibility to submit documents in allowable format.
 - 4. Users of the service need an email address, internet access, and PDF review software that includes ability to mark up and apply electronic stamps (such as Adobe Acrobat,

www.adobe.com, or Bluebeam PDF Revu, www.bluebeam.com), unless such software capability is provided by the service provider.

- 5. Paper document transmittals will not be reviewed; emailed electronic documents will not be reviewed.
- 6. All other specified submittal and document transmission procedures apply, except that electronic document requirements do not apply to samples or color selection charts.
- B. Cost: The services will be provided to the Contractor at no cost.
- C. Submittal Service: The selected service is: Newforma
- D. Training: One, one-hour, web-based training session will be arranged for all participants, with representatives of Architect and Contractor participating; further training is the responsibility of the user of the service.

3.02 PRECONSTRUCTION MEETING

- A. Architect will schedule a meeting after Contract Award.
- B. Attendance Required:
 - 1. Owner.
 - 2. Architect.
 - 3. Contractor.
 - 4. All Subcontractors and Major Suppliers.
 - 5. Special Inspections & Testing Agency.

3.03 PRE-INSTALLATION MEETINGS

- A. Schedule preinstallation meetings at the project site before each construction activity that requires coordination with other construction.
- B. 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.
- C. Record significant conference discussions, agreements, and disagreements.
- D. Do not proceed with installation if the meeting cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the meeting at earliest feasible date.

3.04 PROGRESS MEETINGS

- A. Architect will make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.
- B. Contractor shall provide a written Monthly Progress Report at each meeting, including the following:
 - 1. Construction activities and items completed within the last 30 days.
 - 2. Construction activities and items planned within the next 30 days.
- C. Attendance Required: Job superintendent, major Subcontractors and suppliers, Owner, Architect, as appropriate to agenda topics for each meeting.

3.05 PRECONSTRUCTION AND CONSTRUCTION PHOTOGRAPHS

- A. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Phorographs with blurry or out-of-focus areas will not be accepted.
 - 1. Maintain key plan with each set of construction photographs that identifies each photographic location.

- B. Preconstruction Photographs: Before starting construction, take color, digital photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points.
- C. Construction Photographs: Record the Work with periodic construction photographs.
- D. Final Completion Photographs: After completing construction, take color, digital photographs of Project.
- E. Maintain one set of all digital photographs at project site for reference; same copies as submitted, identified as such.
- F. Photography Type: Digital; electronic files.
- G. In addition to periodic, recurring views, take photographs of each of the following events:
 - 1. Completion of site clearing.
 - 2. Excavations in progress.
 - 3. Foundations in progress and upon completion.
 - 4. Structural framing in progress and upon completion.
 - 5. Enclosure of building, upon completion.
 - 6. Final completion, minimum of ten (10) photos.
- H. Views:
 - 1. Provide non-aerial photographs from four cardinal views at each specified time, until date of Substantial Completion.
 - 2. Consult with Architect for instructions on views required.
 - 3. Provide factual presentation.
 - 4. Provide correct exposure and focus, high resolution and sharpness, maximum depth of field, and minimum distortion.
 - 5. Provide view from outer stadium at same location once monthly.
- I. Digital Photographs: Provide images produced by a digital camera with minimum sensor size of 4.0 megapixels, and at an image resolution of not less than 1600 x 1200, in JPG format; provide files unaltered by photo editing software.
 - 1. File Naming: Include project identification, date and time of view, and view identification.

3.06 NUMBER OF COPIES OF SUBMITTALS

- A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.
- B. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.

Retained samples will not be returned to Contractor unless specifically so stated.

END OF SECTION

1.

SECTION 013216 - CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Preliminary schedule.
- B. Construction progress schedule, bar chart type.

1.02 RELATED SECTIONS

A. Section 011000 - Summary: Work sequence.

1.03 REFERENCE STANDARDS

- A. AGC (CPSM) Construction Planning and Scheduling Manual; 2004.
- B. M-H (CPM) CPM in Construction Management Project Management with CPM; O'Brien; 2006.

1.04 SUBMITTALS

- A. Within 10 days after date of Agreement, submit preliminary schedule.
- B. Within 10 days after joint review, submit complete schedule.
- C. Submit updated schedule with each Application for Payment.
- D. Submit to Architect.

1.05 SCHEDULE FORMAT

A. Listings: In chronological order according to the start date for each activity. Identify each activity with the applicable specification section number.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRELIMINARY SCHEDULE

A. Prepare preliminary schedule in the form of a horizontal bar chart.

3.02 CONTENT

- A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.
- B. Identify each item by specification section number.
- C. Identify work of separate stages and other logically grouped activities.
- D. Provide sub-schedules to define critical portions of the entire schedule.
- E. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.
- F. Provide legend for symbols and abbreviations used.

3.03 BAR CHARTS

- A. Include a separate bar for each major portion of Work or operation.
- B. Identify the first work day of each week.

3.04 REVIEW AND EVALUATION OF SCHEDULE

- A. Participate in joint review and evaluation of schedule with Architect at each submittal.
- B. Evaluate project status to determine work behind schedule and work ahead of schedule.
- C. After review, revise as necessary as result of review, and resubmit within 10 days.

3.05 UPDATING SCHEDULE

- A. Maintain schedules to record actual start and finish dates of completed activities.
- B. Indicate progress of each activity to date of revision, with projected completion date of each activity.
- C. Annotate diagrams to graphically depict current status of Work.
- D. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.
- E. Indicate changes required to maintain Date of Substantial Completion.
- F. Submit reports required to support recommended changes.

3.06 DISTRIBUTION OF SCHEDULE

- A. Distribute copies of updated schedules to Contractor's project site file, to subcontractors, suppliers, Architect, Owner, and other concerned parties.
- B. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.

END OF SECTION

SECTION 013217 - CONSTRUCTION PROGRESS REPORTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. This section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
 - 1. Daily construction reports.
 - 2. Material location reports.
 - 3. Field condition reports.
 - 4. Special reports.

1.02 RELATED SECTIONS

A. Drawings and general provisions of the Contract, including General and Special Conditions and other Division 1 Specification Sections, apply to this Section.

1.03 DAILY CONSTRUCTION REPORTS

- A. 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. High and low temperatures and general weather conditions.
 - 5. Accidents.
 - 6. Meetings and significant decisions.
 - 7. Unusual events (refer to Special Reports).
 - 8. Stoppages, delays, shortages and losses.
 - 9. Meter readings and similar recordings.
 - 10. Emergency procedures.
 - 11. Orders and requests of authorities having jurisdiction.
 - 12. Change orders received and implemented.
 - 13. Construction change directives received.
 - 14. Services connected and disconnected.
 - 15. Equipment or system tests and startups.
 - 16. Partial completions and occupancies.
 - 17. Substantial completions authorized.
- B. Submit 1 copy at weekly intervals to project team members.

1.04 MATERIAL LOCATION REPORTS

A. At weekly intervals, prepare a comprehensive list of materials delivered to and stored at project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from project site.

1.05 FIELD CONDITION REPORTS

A. Immediately on discovery of a difference between field conditions and the contract documents, prepare 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.

1.06 SPECIAL REPORTS

A. Submit special reports directly to Architect within one day of occurrence. Distribute copies of report to parties affected by the occurrence.

B. 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 Architect in advance when these events are known or predictable.

PART 2 PRODUCTS

PART 3 EXECUTION

3.01 REPORT PREPARATION

A. Submit all reports in typed, legible format through electronic document management system. **END OF SECTION**

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Special Conditions and other Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

1.03 RELATED SECTIONS

- A. Division 1 Sections for submitting schedules and reports, including Contractor's Construction Schedule and the Submittals Schedule.
- B. Division 1 Sections for submitting test and inspection reports and for mockup requirements.
- C. Division 1 Sections for submitting warranties.
- D. Division 1 Sections for submitting Record Drawings, Record Specifications, and Record Product Data.
- E. Division 1 Sections for submitting operation and maintenance manuals.
- F. Divisions 2 through 33 Sections for specific requirements for submittals in those Sections.

1.04 DEFINITIONS

- A. Action Submittals: Written and graphic information that requires Architect's responsive action.
- B. Informational Submittals: Written information that does not require Architect's responsive action. Submittals may be rejected for not complying with requirements.

1.05 SUBMITTAL PROCEDURES

- A. General: Electronic copies of CAD Drawings of the Contract Drawings may be provided by Architect for Contractor's use in preparing submittals. Contractor will provide Architect with a waiver of liability and with a fee for electronic copies.
- B. Electronic Submission: Comply with instructions in Section 013000 Administrative Requirements for electronic submission of all submittals.
- C. 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. 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.
- D. Submittals Schedule: Comply with requirements in Division 1 Sections for list of submittals and time requirements for scheduled performance of related construction activities.
- E. Processing Time: Allow enough 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 a minimum of 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.
 - a. Material color selections: Submittals for all interior finish colors shall be coordinated by the Contractor to be submitted in one interior finish color selection package.
- 2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
- 3. Resubmittal Review: Allow a minimum of 15 days for review of each resubmittal.
- 4. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow a minimum of 21 days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.
- 5. No extension of Contract Time will be authorized because of failure to transmit submittals to the Architect sufficiently in advance of the work to permit processing.
- F. Deviations: Highlight, encircle, or otherwise specifically identify deviations from the Contract Documents on submittals.
- G. Additional 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.
- H. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
 - 1. Note date and content of previous submittals.
 - 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 indicating final unrestricted release or final-but-restricted release.
- 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.
- J. Use for Construction: Use only final submittals with mark indicating final unrestricted release or final-but-restricted release.
- K. Each and every shop drawings, setting drawings, etc., submitted to the Architect shall bear a stamp certified over the Contractor's signature indicating the drawings have been thoroughly pre-checked and approved by the Contractor. Drawings which do not bear such certification will be returned for pre-checking. Any delay in securing final approval of such drawings shall be adjudged to the fault of the Contractor. By reviewing, approving and submitting shop drawings, the Contractor thereby represents that he has determined and verified all field measurements, field construction criteria, materials, member sizes catalog numbers, and similar data and that he has checked and coordinated shop drawings with the requirements of the project and of the contract documents.
- L. Work requiring shop drawings, whether called for by the contract documents or requested by the Contractor, shall not commence until the submission has been reviewed by the Architect/Engineer. Work shall be in accordance with and performed from the reviewed drawings and the Contractor of his Subcontractor shall make certain that proper shop drawings are at the site of the work.

PART 2 - PRODUCTS

2.01 ACTION SUBMITTALS

- A. General: Prepare and submit Action Submittals required by individual Specification Sections.
- 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 printed 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 written recommendations.
 - b. Manufacturer's product specifications.
 - c. Manufacturer's installation instructions.
 - d. Color charts.
 - e. Manufacturer's catalog cuts.
 - f. Wiring diamgrams showing factory-installed wiring.
 - g. Printed performance curves.
 - h. Operational range diagrams.
 - i. Mill reports.
 - j. Standard product operation and maintenance manuals.
 - k. Compliance with specified reference standards.
 - 1. Testing by recognized testing agency.
 - m. Application of testing agency labels and seals.
 - n. Notation of coordination requirements.
 - o. Manufacturer recommended maintenance procedures.
 - p. Maintenance schedule.
 - q. Parts and spare parts list.
 - r. Troubleshooting guide.
 - s. Single line diagrams.
- 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.
 - 1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Dimensions.
 - b. Identification of products.
 - c. Fabrication and installation drawings.
 - d. Roughing-in and setting diagrams.
 - e. Wiring diamgrams showing field-installed wiring, including power, signal, and control wiring.
 - f. Shopwork manufacturing instructions.
 - g. Templates and patterns.
 - h. Schedules.
 - i. Design calculations.
 - j. Compliance with specified standards.
 - k. Notation of coordination requirements.
 - 1. Notation of dimensions established by field measurement.
 - m. Relationship to adjoining construction clearly indicated.
 - n. Seal and signature of professional engineer if specified.
 - o. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
 - 2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings sized as pdf format electronic documents at least 8-1/2 by 11 inches (215 by 280 mm) but no larger than 30 by 40 inches (750 by 1000 mm).
- 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 appropriate Specification Section.
- 3. 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
- 4. 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 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 return submittal with options selected
- 5. 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:
 - 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 sets of paired units that show approximate limits of variations.
- E. Product Schedule or List: 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.
 - 2. Number and name of room or space.
 - 3. Location within room or space.
- F. Submittals Schedule: Comply with requirements specified in Division 1 Section "Construction Progress Documentation."
- G. Application for Payment: Comply with requirements specified in Division 1 Section "Payment Procedures."
- H. Schedule of Values: Comply with requirements specified in Division 1 Section "Payment Procedures."
- I. 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.

2.02 INFORMATIONAL SUBMITTALS

- A. General: Prepare and submit Informational Submittals required by other Specification Sections.
 - 1. Certificates and Certifications: Provide a notarized 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.
 - 2. Test and Inspection Reports: Comply with requirements specified in Division 1 Sections.

- 3. All reports should be typewritten. The Architect reserves the right to reject submission of hand-written materials.
- B. Coordination Drawings: Comply with requirements specified in Division 1 Sections.
- C. Contractor's Construction Schedule: Comply with requirements specified in Division 1 Sections.
- D. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- E. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.
- F. Installer Certificates: Prepare 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.
- G. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
- H. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- I. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- J. Material Test Reports: Prepare 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.
- K. Product Test Reports: Prepare written reports indicating 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.
- L. Research/Evaluation Reports: Prepare 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.
- M. Schedule of Tests and Inspections: Comply with requirements specified in Division 1 and individual technical Sections.
- N. Preconstruction Test Reports: Prepare 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.
- O. Compatibility Test Reports: Prepare 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.

- P. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, 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.
- Q. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements specified in Division 1 Sections.
- R. Design Data: Prepare 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.
- S. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:
 - 1. Preparation of substrates.
 - 2. Required substrate tolerances.
 - 3. Sequence of installation or erection.
 - 4. Required installation tolerances.
 - 5. Required adjustments.
 - 6. Recommendations for cleaning and protection.
- T. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:
 - 1. Name, address, and telephone number of factory-authorized service 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.
- U. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.

PART 3 - EXECUTION

3.01 CONTRACTOR'S REVIEW

- A. 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. 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.

3.02 ARCHITECT'S ACTION

- A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.
- B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:
 - 1. Final Unrestricted Release: Where submittals are marked "Reviewed" or "Approved," that part of the Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents; final acceptance will depend upon that compliance.
 - 2. Final-But-Restricted Release: When submittals are marked "Corrections as Noted," that part of the Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents; final acceptance will depend on that compliance.
 - 3. Returned for Resubmittal: When submittal is marked "Revise and Resubmit," do not proceed with that part of the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal in accordance with the notations; resubmit without delay. Repeat if necessary to obtain a different action mark.
 - a. Do not permit submittals marked "Revise and Resubmit" to be used at the Project site, or elsewhere where Work is in progress.
 - b. On resubmitted drawings, the Contractor shall direct specific attention in writing or on the submitted drawings to revisions other than requested by the Architect/Engineer or previous submission.
 - 4. Other Action: Where a submittal is primarily for information or record purposes, special processing or other activity, the submittal will be returned, marked "Action Not Required".
- C. 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.
- D. Partial submittals are not acceptable, will be considered nonresponsive, and will be returned without review.

E. Submittals not required by the Contract Documents may not be reviewed and may be discarded. **END OF SECTION**

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. References and standards.
- B. Submittals.
- C. References and standards.
- D. Control of installation.
- E. Inspection agencies and services.
- F. Control of installation.
- G. Manufacturers' field services.
- H. Defect Assessment.

1.02 REFERENCE STANDARDS

- A. ASTM C1021 Standard Practice for Laboratories Engaged in Testing of Building Sealants; 2008 (Reapproved 2014).
- B. ASTM C1077 Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation; 2014.
- C. ASTM C1093 Standard Practice for Accreditation of Testing Agencies for Masonry; 2013.
- D. ASTM D3740 Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction; 2012a.
- E. ASTM E329 Standard Specification for Agencies Engaged in Construction Inspection and/or Testing; 2014a.
- F. ASTM E543 Standard Specification for Agencies Performing Nondestructive Testing; 2013.
- G. ASTM E699 Standard Specification for Agencies Involved in Testing, Quality Assurance, and Evaluating of Manufactured Building Components; 2016.
- H. IAS AC89 Accreditation Criteria for Testing Laboratories; 2010.

1.03 SUBMITTALS

- A. See Section 013000 Administrative Requirements, for submittal procedures.
- B. Testing Agency Qualifications:
 - 1. Prior to start of Work, submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.
 - 2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
- C. Design Data: Submit for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.
- D. Test Reports: After each test/inspection, promptly submit digital copies of report to Architect and to Contractor.
 - 1. Include:
 - a. Date issued.

- b. Project title and number.
- c. Name of inspector.
- d. Date and time of sampling or inspection.
- e. Identification of product and specifications section.
- f. Location in the Project.
- g. Type of test/inspection.
- h. Date of test/inspection.
- i. Results of test/inspection.
- j. Compliance with Contract Documents.
- k. When requested by Architect, provide interpretation of results.
- 2. All test reports shall be typewritten. The Architect reserves the right to reject handwritten reports.
- E. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.
 - 1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
 - 2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect.
- F. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.
- G. Manufacturer's Field Reports: Submit reports for Architect's benefit as contract administrator or for Owner.
 - 1. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.
- H. Erection Drawings: Submit drawings for Architect's benefit as contract administrator or for Owner.
 - 1. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.
 - 2. Data indicating inappropriate or unacceptable Work may be subject to action by Architect or Owner.

1.04 REFERENCES AND STANDARDS

- A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Comply with reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.
- C. Obtain copies of standards where required by product specification sections.
- D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.
- E. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.
- F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from Contract Documents by mention or inference otherwise in any reference document.

1.05 TESTING AND INSPECTION AGENCIES AND SERVICES

- A. Owner will employ services of an independent testing agency to perform certain specified testing as outlined in Chapter 17 Structural Test and Special Inspections of the Kentucky Building Code. The independent testing agency will also be responsible for the following:
 - 1. All inspections and testing items as identified in Division 31 of the specifications.
 - 2. All inspections for Stone Base and Concrete Pavements as identified in Division 32 of the specifications.
 - 3. All Subdrainage installation including drainage panels and piping for subgrade and retaining walls.
 - 4. Excavation and Backfill work for Utilities as identified in Division 33 of the specifications.
 - 5. Fluid-Applied Waterproofing of Sub-Grade walls as identified in Division 07 of the specifications.
- B. Contractor shall employ serivces of an independent testing agency to perform all other specified testing.
 - 1. Should any of these tests fail, the Contractor shall be responsible for correction and for the cost of retesting.
- C. Contractor shall employ and pay for services of an independent testing agency to perform all other specified testing.
- D. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.
- E. Contractor Employed Agency:
 - 1. Testing agency: Comply with requirements of ASTM E329, ASTM E543, ASTM E699, ASTM C1021, ASTM C1077, ASTM C1093, and ASTM D3740.
 - 2. Laboratory Qualifications: Accredited by IAS according to IAS AC89.
 - 3. Laboratory: Authorized to operate in the State in which the Project is located.
 - 4. Laboratory Staff: Maintain a full time registered Engineer on staff to review services.
 - 5. Testing Equipment: Calibrated at reasonable intervals either by NIST or using an NIST established Measurement Assurance Program, under a laboratory measurement quality assurance program.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

- A. 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-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 quality-control procedures that facilitate compliance with the Contract Document requirements.
 - 3. Requirements for Contractor to provide quality-control services required by Architect, Owner or authorities having jurisdiction are not limited by provisions of this Section.
- B. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.
- C. Comply with manufacturers' instructions, including each step in sequence.
- D. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.

- E. Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- F. Have work performed by persons qualified to produce required and specified quality.
- G. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.
- H. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.02 TESTING AND INSPECTION

- A. See individual specification sections for testing required.
- B. Testing Agency Duties:
 - 1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
 - 2. Perform specified sampling and testing of products in accordance with specified standards.
 - 3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
 - 4. Promptly notify Architect and Contractor of observed irregularities or non-compliance of Work or products.
 - 5. Perform additional tests and inspections required by Architect.
 - 6. Attend preconstruction meetings and progress meetings.
 - 7. Submit reports of all tests/inspections specified.
- C. Limits on Testing/Inspection Agency Authority:
 - 1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 - 2. Agency may not approve or accept any portion of the Work.
 - 3. Agency may not assume any duties of Contractor.
 - 4. Agency has no authority to stop the Work.
- D. Contractor Responsibilities:
 - 1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
 - 2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
 - 3. Provide incidental labor and facilities:
 - a. To provide access to Work to be tested/inspected.
 - b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
 - c. To facilitate tests/inspections.
 - d. To provide storage and curing of test samples.
 - 4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
 - 5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
 - 6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
- E. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by Architect. Payment for re testing will be charged to the Contractor by deducting testing charges from the Contract Price.

3.03 MANUFACTURERS' FIELD SERVICES

A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces

and installation, quality of workmanship, start-up of equipment, test, adjust, and balance equipment as applicable, and to initiate instructions when necessary.

- B. Submit qualifications of observer to Architect 30 days in advance of required observations.
 1. Observer subject to approval of Architect.
- C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.04 DEFECT ASSESSMENT

- A. Replace Work or portions of the Work not complying with specified requirements.
- B. If, in the opinion of Architect or Owner, it is not practical to remove and replace the work, Architect or Owner will direct an appropriate remedy or adjust payment.

END OF SECTION

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Temporary utilities, support, security and protection facilities include, but are not limited to, the following:
- B. Temporary utilities.
- C. Temporary telecommunications services.
- D. Temporary sanitary facilities.
- E. Temporary Controls: Barriers, enclosures, and fencing.
- F. Temporary electric and lighting.
- G. Temporary HVAC for construction activities.
- H. Temporary water service and distribution.
- I. Security requirements.
- J. Vehicular access and parking.
- K. Waste removal facilities and services.
- L. Project identification signs.
- M. Temporary and additional required signs.
- N. Field offices.
- O. Storage and fabrication sheds.
- P. Fire extinguishers.
- Q. Sewers, drainage and stormwater control.
- R. Environmental protection.
- S. Tree and plant protection.
- T. Lifts and hoists.
- U. Construction aids and miscellaneous services and facilities.

1.02 RELATED REQUIREMENTS

- A. Section 015713 Temporary Erosion and Sediment Control: Erosion controls during construction.
- B. Section 024119 Selective Structure Demolition.
- C. Divisions 2 through 22 for temporary heat, ventilation, and humidity requirements for products in those Sections.
- D. Section 311500 Protection of Existing and New Trees: Plant protection during construction.
- E. Section 312319 Dewatering: Dewatering of site during construction.
- F. Section 312513 Permanent Erosion Controls: Erosion control to remain after construction is complete.

1.03 DEFINITIONS

A. Permanent Enclosure: As determined by Architect, permanent or temporary roofing is complete, insulated, and weathertight: exterior walls are insulated and weathertight: and all openings are closed with permanent construction or substantial temporary closures.

1.04 TEMPORARY UTILITIES

- Contractor may use the Owner's existing water and electric utilities at the site (except phone/internet and utilities for field office(s)) as required for the renovation and addition portions of this project. However, if the privilege of using the Owner's utilities are abused, then the Contractor shall reimburse the Owner any amount over a normal monthly bill amount.
 - 1. Conditions of Use of Owner's Utilities: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Take necessary fire prevention measures. Do not overload facilities, or permit them to interfere with progress. Do not allow hazardous dangerous or unsanitary conditions, or public nuisances to develop or persist on the site.
 - 2. Engage appropriate local utility company to install temporary service or connect to existing service. Where utility company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with utility company recommendations.
 - 3. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
 - 4. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner, Architect, testing agencies and authorities having jurisdiction.
 - 5. Contractor to pay all fees, taps, certifications, permits, and etc. that comply with all Federal, State and local regulations and utility company requirements. Arrange for authorities having jurisdiction to test and inspect each temporary utility before use.
 - 6. Provide adequate capacity at each stage of construction. before temporary utility is available, provide trucked-in services.
 - 7. All required temporary work shall provide for safe and proper performance of the work. The Contractor shall be responsible for adequate design and construction of all temporary work used in construction of Contract Work.
 - 8. Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
 - 9. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.
 - 10. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed facilities.
 - 11. At earliest feasible time, when acceptable to Owner, change over from use of temporary service to use of permanent service.

1.05 ELECTRICAL SERVICE

- A. Owner will not provide power distribution service to specific areas of construction, that is the responsibility of the Contractor.
- B. Provide, weatherproof, grounded electric power service and distribution system of size, capacity, and power characteristics during constriction period. Include meters, transformers, overload-protected disconnection means, automatic ground-fault, and main distribution switchgear.
 - 1. Electrical service to comply with NECA, NEMA, UL and NFPA for temporary electrical needs.
 - 2. Electrical outlets: Properly configured, NEMA-polarized outlets to prevent insertion of 110-to120-V plugs into higher-voltage outlets; equipped with ground-fault circuit interrupters, reset button, and pilot light. Provide receptacle outlets adequate for connection of power tools and equipment.

- 3. Power distribution system circuits: Where permitted and overhead and exposed for surveillance, wiring circuits, not exceeding 125-V ac, 20-A rating, and lighting circuits may be nonmetallic sheathed cable.
- 4. Provide waterproof connectors to connect separate lengths of electrical power cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.
- 5. Provide warning signs at power outlets other than 110 to 120 V.
- C. Temporary Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations and traffic conditions.
 - 1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

1.06 HEATING AND COOLING

- A. Heating and cooling equipment: Unless Owner authorizes use of permanent heating or cooling 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. Fuel needed to power portable, non-permanent heating or cooling equipment is to be paid for by the Contractor.
 - 3. Heating and cooling to be provided as required by construction activities for curing and drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity.
 - a. Maintain a minimum temperature of 50 degrees F in permanently enclosed portions of building for normal construction activities, and 65 degrees F for finishing activities and areas where finished work has been installed.
 - b. 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.

1.07 WATER SERVICE

- A. Owner will not provide water distribution service to specific areas of construction, that is the responsibility of the Contractor.
- B. Contractor to provide temporary water and distribution service as required by construction activities. .
 1. Use trigger-operated nozzles for water hoses, to avoid waste of water.
- C. Prevent water-filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.
- D. Provide water at gravel wash pit(s), where indicated and, at construction exits of the site.
 1. Provide water, with pressure necessary, to clean vehicles and tires of mud and debris prior to exiting construction site.
- E. General Contractor/Construction Manager to coordinate with the lightweight insulating concrete installer for the payment, provision and inclusion of all water required for the installation of the lightweight insulating concrete.

1.08 VENTILATION AND HUMIDITY CONTROL

A. Contractor to provide temporary ventilation as required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment from that specified 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.

1.09 TELECOMMUNICATIONS SERVICES

- A. Provide, maintain, and pay for telephone and internet service to field office at time of project mobilization.
- B. Phone service shall be for use by all personnel engaged in construction activities, throughout the construction period.
 - 1. At each telephone, post a list of important telephone numbers.
 - 2. Cellular telephone service may be substituted for use by the Contractor's superintendent.
 - 3. Internet service with an e-mail address for the Contractor's superintendent is to be provided.
 - 4. Contractor required to have personnel on site with smartphone(s), laptop and/or a tablet with internet access/connections.
 - a. Internet service with an e-mail address for the Contractor's superintendent is to be provided.
 - 5. Wireless (WiFi) internet service is to be provided in the construction trailer.
 - a. WiFi access to be provided for Owner, Architect, and Owner and Architects Consultants.

1.10 TEMPORARY SANITARY FACILITIES

- A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization. Comply with regulations and health codes for type, number, location, operation and maintenance of fixtures and facilities.
 - 1. Single occupant units of chemical, aerated recirculation, or combustion type; fully vented; fully enclosed with a glass-fiber-reinforced polyester shell or similar material.
 - 2. Provide containerized, tap-dispenser, bottled-water drinking-water units, including paper cup supply.
- B. Maintain daily in clean and sanitary condition.
- C. Owner's existing restroom facilities in the building are not to be used under any circumstances.

1.11 ENVIRONMENTAL PROTECTION

- A. Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects. Avoid using tools and equipment that produce harmful noise. Restrict use of noise making tools and equipment to hours that will minimize complaints from persons or other entities near Project site.
 - 1. Use water mist, temporary enclosures, and other suitable methods to limit the spread of dust and dirt. Do not use water when it may damage existing construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.
- B. Stormwater Control: Refer to stormwater control requirements of specification section 015713 Temporary Erosion and Sediment Control.
- C. Tree and Plant Protection: Refer to tree and plant protection requirements of specification section 311500 Protection of Existing and New Trees.

1.12 BARRIERS

- A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.
- B. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.
 - 1. Refer also to 2015 IBC with Kentucky Amendments, Chapter 33 for additional protection requirements.

- C. Provide protection for plants designated to remain. Replace damaged plants.
- D. Barricades, warning signs and lights shall comply with standards and code requirements for erecting structurally adequate barricades. Paint with appropriate colors, graphics and warning signs to inform personnel and public of possible hazard. Where appropriate and needed, provide lighting, including flashing red or amber lights.
 - 1. For safety barriers, sidewalk bridges, and similar uses, provide minimum 5/8 inch thick exterior plywood.

1.13 FENCING

- A. Contractor to fence construction, staging and fabrication areas.
 - 1. Site Enclosure Fence: Before construction operations begin, install chain-link enclosure fence with lockable entrance gates. Locate where indicated on drawings to accommodate construction operations. Install in a timely manner that will prevent people, dogs, and other animals from easily entering site except by entrance gates.
 - 2. Construction: Commercial grade chain link fence.
 - 3. Provide minimum 6 foot high fence around construction site; equip with vehicular and pedestrian gates with locks.
 - a. Maintain security by limiting the number of keys and restricting distribution to authorized personnel.
 - b. Used fencing is acceptable for use.
 - c. Fencing to be permanent or portable type. Metal stands, or solid concrete blocks made to accept fencing panels are acceptable.
- B. Refer to staging or site plan for area to be fenced during construction.

1.14 EXTERIOR ENCLOSURES

- A. Provide temporary insulated weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.
 - 1. Tarpaulins shall be fire-resistive labeled with flame-spread rating of 15 or less. Secure with fire-retardent-treated wood framing or other materials.
 - 2. Where temporary wood or plywood exceeds 100 sq. ft. in area use fire--treated material for framing and sheathing.
 - 3. Close openings in floor or roof decks and other horizontal surfaces with load-bearing, wood framed construction.
 - 4. Close openings in walls or other vertical surfaces of 25 sq. ft. or less with plywood or similar materials.
- B. Roofing Membrane:
 - 1. Areas of the existing or new roof, where work is in progress, or completed, shall not be used for storage without the written agreement of the Architect. Do not place "pallets" on new insulation or roofing material.
 - 2. Remove no more existing roofing than can be covered in one day by new roofing.
 - 3. Coordinate removal of existing roofing with installation of new and existing to remain roof insulation and/or roofing to ensure that existing to remain and new insulation and roof deck are not exposed to precipitation or left exposed overnight.
 - 4. Provide water cut-offs at the end of each day's work.
 - 5. Provide temporary walkways, as required, to protect existing substrates from damage by roofing operations.
 - 6. See applicable Division 7 Section for new roofing requirements.

C. General Contractor may provide new or used materials for temporary exterior enclosure. Undamaged, previously used materials in serviceable condition may be used if approved by the Architect. Provide materials suitable for use intended.

1.15 INTERIOR ENCLOSURES

- A. Provide temporary partitions as indicated on the Phasing/Staging Plan to separate work areas from Owner-occupied areas, to prevent penetration of dust, fumes and moisture into Owner-occupied areas, and to prevent damage to existing materials and equipment.
 - 1. Construct dustproof partitions of not less than nominal 4-inch wood studs, 5/8-inch gypsum wallboard with joints taped on occupied side, and 1/2-inch fire-retardant plywood on the demolition side.
 - 2. Insulate partition to provide noise protection to occupied areas.
 - 3. Seal joints and perimeter. Equip partitions with dustproof doors and security locks.
 - 4. Protect air-handling equipment.
 - 5. Close openings in floor or roof decks and other horizontal surfaces with load-bearing, wood framed construction.
 - 6. Close openings in walls or other vertical surfaces of 25 sq. ft. or less with plywood or similar materials.
- B. Openings: Framing and reinforced polyethylene sheet materials with closed joints and sealed edges at intersections with existing surfaces:
- C. General Contractor may provide new or used materials for temporary interior enclosure. Undamaged, previously used materials in serviceable condition may be used if approved by the Architect. Provide materials suitable for use intended.

1.16 SECURITY

- A. Provide security and facilities to protect Work, existing facilities, and Owner's operations from unauthorized entry, vandalism, or theft.
 - 1. Install substantial temporary enclosure around partially completed areas of construction. Provide lockable entrances.

1.17 LIFTS AND HOISTS

A. Provide facilities for hoisting materials and personnel. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

1.18 TEMPORARY FIRE PROTECTION

- A. Until fire protection needs are supplied by permanent facilities, install and maintain temporary fire protection facilities of the types needed to protect against reasonably predictable and controllable fire loses. Comply with Section 3309 of the 2012 International Building Code with Kentucky Amendments.
- B. Fire extinguishers: Hand carried portable, UL rated. Provide class and extinguishing agent as indicated or a combination of extinguishers of NFPA recommended classes for exposures.
 - 1. Locate fire extinguishers where convenient and effective for their intended purpose, but not less than one extinguisher on each floor at or near each usable stairwell.
 - 2. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire protection facilities, stairways and other access routes for fighting fires. Prohibit smoking in hazardous fire exposure areas.
- C. Store combustible materials in containers in fire-safe locations.
- D. Provide supervision of welding operations, combustion type temporary heating units, and similar sources of fire ignition.

1.19 VEHICULAR ACCESS AND PARKING

- A. All employee, and project related, vehicles shall park inside the fenced construction area. No parking permits will be provided by the Owner for parking outside the fenced construction area.
- B. Coordinate access and haul routes with governing authorities and Owner.
- C. Provide and maintain fire department access to fire hydrants, free of obstructions.
- D. Provide means of removing mud from vehicle wheels before entering streets. Streets used as access to and from the site shall be kept free of mud and debris.
- E. Existing on-site roads and parking areas shall not be used for construction traffic, staging and storage, unless specifically addressed on the staging plan.
- F. Fire Truck Access: Access to the building site and surrounding buildings must be maintained during construction for local fire truck access. Phase construction as required to maintain access to new, existing, or temporarily relocated standpipe, fire hydrant connections, the requirements of Section 3311 and 3312 of the 2012 International Building Code with Kentucky Amendments, and fire alarm annunciator panels. Coordinate with the local fire department that would respond to an alarm during the initial start up of construction to ensure a complete understanding of their requirements.

1.20 WASTE REMOVAL

- A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition. All exitways, walks, drives, grass areas, and landscaping must be kept free from debris at all times.
- B. Provide adequate trash containers of proper size.
- C. Provide containers with lids. Collect waste from construction areas and elsewhere daily. Remove trash from site per following.
 - 1. Dispose of all material in a lawful manner.
 - 2. Do not hold materials more than 7 days during normal weather or 3 days when the temperature is expected to rise above 80 degrees F.
- D. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.
- E. Handle hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing properly. Comply with NFPA 241 for removal of combustible waste material and debris.
- F. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.
- G. Failure to comply with the above requirements shall be cause for stopping work until the condition is corrected.

1.21 PROJECT IDENTIFICATION

- A. Provide project identification sign of design and construction indicated in this section.
 - 1. Do not permit installation of unauthorized signs.
 - 2. Engage an experienced sign company to produce the signs required.
- B. Temporary Signs: Prepare signs to provide directional information to construction personnel and visitors.
- C. Project Sign: Contractor to provide and install project sign of size, style, composition and color as described. Installation shall include all supporting framing and setting materials required to make the

sign weather resistant and capable of withstanding normal environmental forces including rain, snow, ice and wind.

- 1. Sign can be digitally printed on pressure sensitive vinyl with UV resistant inks and mounted on a 1/2 inch MDO board or printed directly on the MDO board using UV resistant inks.
- 2. Architect will provide camera ready artwork to the Contractor.
- 3. The sign shall be no larger than 4 foot x 8 foot, or dimensions for a maximum sign square footage of 32 sf.
- 4. All wood framing and supporting members shall be pressure treated lumber. Sign posts shall be 4" x 4" posts set in 1' diameter holes 3'-6" deep filled with concrete.
- D. Additional Required Signs: Contractor to provide sign or signs in a location or locations clearly visible to all Contractors, not less than 2' x 4' in dimension, with the following wording "Unlawful possession of a weapon on school property in Kentucky is a felony punishable by a maximum of five (5) years in prison and a ten thousand dollar (\$10,000) fine." Installation shall include all supporting framing and setting materials required.
 - 1. Sign can be digitally printed on pressure sensitive vinyl with UV resistant inks and mounted on a 1/2 inch MDO board or 10 mm PVC board or printed directly on the MDO or PVC board with UV resistant inks.
- E. Erect on site at location established by Architect.
- F. No other signs are allowed without Owner permission except those required by law.
- G. Owner reserves the right to take possession of Project Identification Signs.

1.22 FIELD OFFICES

- A. Contractor's to provide a field office on site.
 - 1. Field office to be on site, with functioning utilities, minimum one week prior to the first scheduled progress meeting.
 - 2. Field office(s) utilities are to be metered separately from construction related utilities. Field office utilities are to be paid for by the contractor.
- B. Office: Provide weathertight, insulated, with lockable entrances, operable windows and serviceable finishes; lighting, electrical outlets, heating, cooling and ventilating equipment; on foundations adequate for normal loading and equipped with sturdy furniture, drawing rackand drawing display table.
- C. Provide space for Project meetings, with table and chairs to accommodate 10 persons.
- D. Locate offices a minimum distance of 30 feet from existing and new structures.

1.23 STORAGE AND FABRICATION SHEDS

- A. Provide sheds sized, furnished and equipped to accommodate materials and equipment involved, including temporary utility services. Sheds may be open shelters or fully enclosed spaces within building or elsewhere on-site.
 - 1. Locate for easy access to the Project.
 - 2. Construct framing, sheathing, and siding using fire-retardant-treated lumber and plywood.
 - 3. Paint exposed lumber and plywood with exterior-grade acrylic-latex emulsion over exterior primer.

1.24 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

- A. Remove each temporary 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.
- B. Remove temporary utilities, equipment, facilities, materials, prior to Date of Substantial Completion inspection.
- C. Remove underground installations to a minimum depth of 2 feet. Grade site as indicated.

D. Clean and repair damage caused by installation or use of temporary work.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED END OF SECTION 015000

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Re-use of existing products.
- B. Transportation, handling, storage and protection.
- C. Product option requirements.
- D. Substitution limitations.
- E. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 RELATED REQUIREMENTS

A. Section 014000 - Quality Requirements: Product quality monitoring.

1.03 SUBMITTALS

- A. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- B. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- C. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
 - 1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

PART 2 PRODUCTS

2.01 EXISTING PRODUCTS

A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by the Contract Documents.

2.02 NEW PRODUCTS

A. Provide new products unless specifically required or permitted by the Contract Documents.

2.03 PRODUCT OPTIONS

- A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.
- C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.
- D. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged, and unless otherwise indicated, that 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. Where products are accompanied by the term "match sample," sample to be matched is Architect's.
- 6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products
- E. Product Selection Procedures: Procedures for product selection include the following:
 - 1. Product: Where Specification paragraphs or subparagraphs titled "Product" name a single product and manufacturer, provide the product named.
 - 2. Manufacturer/Source: Where Specification paragraphs or subparagraphs titled "Manufacturer" or "Source" name single manufacturers or sources, provide a product by the manufacturer or from the source named that complies with requirements.
 - 3. Products: Where Specification paragraphs or subparagraphs titled "Products" introduce a list of names of both products and manufacturers, provide one of the products listed that complies with requirements.
 - 4. Manufacturers: Where Specification paragraphs or subparagraphs titled "Manufacturers" introduce a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.
 - 5. Available Manufacturers: Where Specification paragraphs or subparagraphs titled "Available Manufacturers" introduce a list of manufacturers' names, provide a product by one of the manufacturers listed.
 - 6. Product Options: Where Specification paragraphs titled "Product Options" indicate that size, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide the specific product or system indicated.
 - 7. Visual Matching Specification: Where Specifications require matching an established Sample, select a product (and manufacturer) that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches satisfactorily.
 - 8. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product (and manufacturer) that complies with other specified requirements.
 - a. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that does not include premium items.
 - b. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that includes both standard and premium items.
 - 9. Allowances: Refer to individual Specification Sections and "Allowance" provisions in Division 1 for allowances that control product selection and for procedures required for processing such selections.

2.04 MAINTENANCE MATERIALS

- A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.
- B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 SUBSTITUTION LIMITATIONS

A. Such requests shall include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitution including drawings, performance and test data, and other information necessary for an evaluation. A statement setting forth changes in other materials, equipment or other portions of the Work, including changes in the work of other contracts that

incorporation of the proposed substitution would require, shall be included. The burden of proof of the merit of the proposed substitution is upon the proposer. The Architect's decision of approval or disapproval of a proposed substitution shall be final.

- 1. Substitutions merely for convenience are not permissable.
- B. Conditions: Written approval shall be obtained from the Architect covering any substitution. Substitutions are permitted in the following instances:
 - 1. Failure to meet quality and intent of specifications.
 - 2. Failure of the supplier or manufacturer to meet delivery schedules or other conditions of the contract.
 - 3. Written release by the supplier or manufacturer listed in the contract documents and the Contractor's Form of Proposal.
- C. Documentation: Provide evidence of the following:
 - 1. Requested substitution does not require extensive revisions to the Contract Documents.
 - 2. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - 3. Substitution request is fully documented and properly submitted.
 - 4. Requested substitution will not adversely affect Contractor's Construction Schedule.
 - 5. In the case of failure of the supplier or manufacturer to meet delivery schedules or other conditions of the contract, provide comprehensive written evidence to support this failure.
 - 6. Substitution request includes a release from the supplier/manufacturer listed in the contract documents and the Contractor's Form of Proposal.
- D. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.
- E. A request for substitution constitutes a representation that the submitter:
 - 1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
 - 2. Agrees to provide the same warranty for the substitution as for the specified product.
 - 3. Agrees to coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner.
 - 4. Waives claims for additional costs or time extension that may subsequently become apparent.
 - 5. Agrees to reimburse Owner and Architect for review or redesign services associated with re-approval by authorities.
- F. The Contractor's request for substitution and accompanying information in no way limits the Architect's responsibility to review the proposed substitution for compliance with the contract documents.
- G. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

3.02 TRANSPORTATION AND HANDLING

- A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.
- B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.
- C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.
- D. Transport and handle products in accordance with manufacturer's instructions.

- E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.
- F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.
- G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.
- H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.
- I. If any material or piece of equipment is damaged during transportation and handling, the Owner has the right to reject this material or equipment and require a new, undamaged replacement.

3.03 STORAGE AND PROTECTION

- A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.
- B. Store and protect products in accordance with manufacturers' instructions.
- C. Store with seals and labels intact and legible.
- D. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.
- E. For exterior storage of fabricated products, place on sloped supports above ground.
- F. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.
- G. Comply with manufacturer's warranty conditions, if any.
- H. Do not store products directly on the ground.
- I. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- J. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
- K. Prevent contact with material that may cause corrosion, discoloration, or staining.
- L. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- M. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.
- N. If any material or piece of equipment is damaged during storage or after installation but before occupancy, the Owner has the right to reject this material or equipment and require a new, undamaged replacement.

END OF SECTION

SECTION 017000 - EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Examination, preparation, and general installation procedures.
- B. Pre-installation meetings.
- C. Surveying for laying out the work.
- D. Cleaning and protection.
- E. Starting of systems and equipment.
- F. Demonstration and instruction of Owner personnel.
- G. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.
- H. General requirements for maintenance service.

1.02 RELATED REQUIREMENTS

- A. Section 011000 Summary: Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials.
- B. Section 013000 Administrative Requirements: Submittals procedures, Electronic document submittal service.
- C. Section 014000 Quality Requirements: Testing and inspection procedures.
- D. Section 015000 Temporary Facilities and Controls: Temporary exterior enclosures.
- E. Section 017800 Closeout Submittals: Project record documents, operation and maintenance data, warranties and bonds.

1.03 SUBMITTALS

- A. See Section 013000 Administrative Requirements, for submittal procedures.
- B. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.04 PROJECT CONDITIONS

- A. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.
- B. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.
- C. Perform dewatering activities, as required, for the duration of the project.
- D. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
- E. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
 - 1. Provide dust-proof enclosures to prevent entry of dust generated outdoors.
 - 2. Provide dust-proof barriers between construction areas and areas continuing to be occupied by Owner.
- F. Erosion and Sediment Control: Comply with all project requirements.

- G. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.
- H. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.
- I. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

1.05 COORDINATION

- A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
- B. Notify affected utility companies and comply with their requirements.
- C. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- D. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- E. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- F. Coordinate completion and clean-up of work of separate sections.
- G. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

PART 2 PRODUCTS

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.
- B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.
- C. Examine and verify specific conditions described in individual specification sections.
- D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.
- E. Verify that utility services are available, of the correct characteristics, and in the correct locations.
- F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

- B. Seal cracks or openings of substrate prior to applying next material or substance.
- C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 PREINSTALLATION MEETINGS

- A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.
- B. Require attendance of parties directly affecting, or affected by, work of the specific section.
- C. Notify Architect 10 days in advance of meeting date.
- D. Prepare agenda and preside at meeting:
 - 1. Review conditions of examination, preparation and installation procedures.
 - 2. Review coordination with related work.

3.04 LAYING OUT THE WORK

- A. Verify locations of survey control points prior to starting work.
- B. Promptly notify Architect of any discrepancies discovered.
- C. Contractor shall locate and protect survey control and reference points.
- D. Protect survey control points prior to starting site work; preserve permanent reference points during construction.
- E. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.
- F. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.
- G. Utilize recognized engineering survey practices.
- H. Establish a minimum of two permanent bench marks on site, referenced to established control points. Record locations, with horizontal and vertical data, on project record documents.
- I. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
 - 1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations; and .
 - 2. Grid or axis for structures.
 - 3. Building foundation, column locations, ground floor elevations, and .
 - 4. Controlling lines and levels required for mechanical and electrical trades.
- J. Periodically verify layouts by same means.
- K. Maintain a complete and accurate log of control and survey work as it progresses.
- L. On completion of foundation walls and major site improvements, prepare a certified survey illustrating dimensions, locations, angles, and elevations of construction and site work.

3.05 GENERAL INSTALLATION REQUIREMENTS

- A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.
- B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.

- C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.
- D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.
- E. Make neat transitions between different surfaces, maintaining texture and appearance.

3.06 PROGRESS CLEANING

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
- B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
- C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
- D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.07 PROTECTION OF INSTALLED WORK

- A. Protect installed work from damage by construction operations.
- B. Provide special protection where specified in individual specification sections.
- C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- F. Protect work from spilled liquids. If work is exposed to spilled liquids, immediately remove protective coverings, dry out work, and replace protective coverings.
- G. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- H. Prohibit traffic from landscaped areas.
- I. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.08 DEMONSTRATION AND INSTRUCTION

- A. Demonstrate operation and maintenance of products to Owner's personnel two weeks prior to date of Substantial Completion.
- B. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled time, at equipment location.
- C. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
- D. Provide a qualified person who is knowledgeable about the Project to perform demonstration and instruction of Owner's personnel.
- E. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.

F. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

3.09 ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.

3.10 FINAL CLEANING

- A. Execute final cleaning prior to final project assessment.
 - 1. Clean areas to be occupied by Owner prior to final completion before Owner occupancy.
- B. Use cleaning materials that are nonhazardous.
- C. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
- D. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.
- E. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
- F. Clean filters of operating equipment.
- G. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, and drainage systems.
- H. Clean site; sweep paved areas, rake clean landscaped surfaces.
- I. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.11 CLOSEOUT PROCEDURES

- A. Make submittals that are required by governing or other authorities.
 1. Provide copies to Architect.
- B. Accompany Project Coordinator on preliminary inspection to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's Notice of Substantial Completion.
- C. Substantial Completion:
 - 1. Notify Architect when work is considered ready for Substantial Completion.
 - 2. Before requesting field observation for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.
 - a. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete. All items on the list relating to commissioned systems must be complete before a certificate of Substantial Completion is issued.
 - b. Responses to and status of all open Corrective Action Log items.
 - c. Completion and approval of all scheduled Start-up and Checkout Plans for commissioned systems.
 - d. Completion and approval of all scheduled Functional Tests for commissioned systems.
 - e. Completion of all scheduled Owner training sessions.
 - f. Advise Owner of pending insurance changeover requirements.
 - g. Submit specific warranties, workmanship bonds, maintenance serviec agreements, final certifications, and similar documents.

- h. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
- i. Prepare and submit Project Record Documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
- j. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
- k. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
- 1. Complete startup testing of non-commissioned systems.
- m. Submit test/adjust/balance records.
- n. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
- o. Advise Owner of changeover in heat and other utilities.
- p. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
- q. Complete final cleaning requirements, including touchup painting.
- r. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- 3. Field Observation: Submit a written request for field observation for Substantial Completion. On receipt of request, Architect will either proceed with field observation or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after field observation 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.
- 4. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.
- 5. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.
- 6. Complete items of work determined by Architect's final field observation.
- D. Final Completion
 - 1. Preliminary Procedures: Before requesting final field observation for determining date of Final Completion, complete the following:
 - a. Submit a final Application for Payment.
 - b. Submit certified copy of Architect's Substantial Completion field observation list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 - c. Completion of all Owner training scheduled after Substantial Completion.
 - d. Completion and approval of all Functional Tests for commissioned systems scheduled after Substantial Completion.
 - e. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
 - f. Submit pest-control final inspection report and warranty.
 - g. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training videotapes.
 - 2. Final Field Observation: Submit a written request for final field observation for acceptance. On receipt of request, Architect will either proceed or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after field observation or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
- E. List of Incomplete Items (Punch List):

- 1. Preparation: Submit preliminary list to Architect. 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.
 - a. Organize list of spaces in sequential order.
 - b. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
 - c. Include the following information at the top of each page:
 - 1) Project name.
 - 2) Date.
 - 3) Page number.

F. Warranties:

- 1. Submittal Time: 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.
- 2. Provide additional copies of each warranty to include in operation and maintenance manuals.

3.12 MAINTENANCE

- A. Provide service and maintenance of components indicated in specification sections.
- B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.
- C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.
- D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.
- E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

END OF SECTION

SECTION 017300 - CUTTING AND PATCHING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes procedural requirements for cutting and patching.
- B. Related Sections include the following:
 - 1. Division 1 Section "Coordination" for demolition of selected portions of the building for alterations.
 - 2. Division 2 Section " Selective Structure Demolition" for cutting and patching procedures for selective demolition operations.
 - 3. Divisions 2 through 28 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.
 - a. Requirements in this Section apply to mechanical and electrical installations. Refer to Divisions 20 and 28 Sections for other requirements and limitations applicable to cutting and patching mechanical and electrical installations.

1.03 DEFINITIONS

- A. Cutting: Removal of existing construction necessary to permit installation or performance of other Work.
- B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

1.04 SUBMITTALS

- A. Cutting and Patching Proposal: Submit a proposal describing procedures at least 10 days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:
 - 1. Extent: Describe cutting and patching, show how they will be performed, and indicate why they cannot be avoided.
 - 2. Changes to Existing Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building's appearance and other significant visual elements.
 - 3. Products: List products to be used and firms or entities that will perform the Work.
 - 4. Dates: Indicate when cutting and patching will be performed.
 - 5. Utilities: List utilities that cutting and patching procedures will disturb or affect. List utilities that will be relocated and those that will be temporarily out of service. Indicate how long service will be disrupted.
 - 6. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.
 - 7. Architect's Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

1.05 QUALITY ASSURANCE

A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.

- B. 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.
- C. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces 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.
- D. 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

2.01 MATERIALS

- A. General: Comply with requirements specified in other Sections of these Specifications.
- B. Existing Materials: Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
 - 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of existing materials.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.
 - 1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
 - 2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Temporary Support: Provide temporary support of Work to be cut.
- B. Protection: Protect existing 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.
- C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas..

3.03 PATCHING AND REPAIRS

- A. Promptly patch and repair holes and damaged surfaces caused to adjacent construction by selective demolition operations.
- B. Where repairs to existing surfaces are required, patch to produce surfaces suitable for new materials.
 1. Fill holes and depressions in existing masonry walls to remain with an approved masonry patching material, applied according to manufacturer's printed recommendations.
- C. Restore exposed finishes of patched areas and extend finish restoration into adjoining construction to remain in a manner that eliminates evidence of patching and refinishing.
- D. Patch and repair floor and wall surfaces in the new space where demolished walls or partitions extend from one finished area into another. Provide a flush and even surface of uniform color and appearance.
 - 1. Closely match texture and finish of existing adjacent surface.
 - 2. Patch with durable seams that are as invisible as possible. Comply with tolerances.

- 3. Where patching smooth painted surfaces, extend final paint coat over entire unbroken surface containing the patch after the surface has received primer and second coat.
- 4. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
- 5. Inspect and test patched areas to demonstrate integrity of the installation, where feasible.
- E. Existing penetrations and openings due to the removal of existing communications, data, life safety, electrical, HVAC, sprinkler, or plumbing systems are to be filled and patched as follows:
 - 1. Above New Ceiling Heights:
 - a. Existing through-wall penetrations above new ceiling height 4" diameter/square or less, patch with solid, permanent fill material flush with adjacent wall surface.
 - b. Existing through-wall penetrations above new ceiling height from 4" diameter/square to approximately 1'-0" x 1'-0" diameter/square. Fill opening with sound attenuation blankets and attach 5/8" gypsum board to both sides of the adjacent wall surface to close opening.
 - c. Existing through-wall penetrations above new ceiling height 1'-0" x 1'-0" diameter/square or larger in an existing framed wall. Frame opening with metal studs @ 12" on center. Fill space between studs with sound attenuation blankets and attach 5/8" gypsum board to both sides of the adjacent wall surface to close opening.
 - d. Existing penetrations located above new ceiling height 1'-0" x 1'-0" diameter/square or larger in an existing CMU, or structural clay tile wall. Infill existing opening with CMU. Toothing into existing bond pattern is not required at above ceiling locations.
 - 2. Below New Ceiling Heights:
 - a. Existing through-wall penetrations below new ceiling height 4" diameter/square or less. Patch with solid, permanent fill material. New plaster finish to match existing plaster surface texture, if applicable.
 - Existing through-wall penetrations below new ceiling height 4" diameter/square to approximately 1'-0" x 1'-0" diameter/square. Fill opening with sound attenuation blankets and inset 5/8" gypsum board on both sides of the wall to close opening. New plaster finish to match existing plaster surface texture, if applicable.
 - c. Existing through-wall penetrations below new ceiling height 1'-0" x 1'-0" diameter/square or larger in an existing framed wall. Frame opening with metal studs @ 12" on center. Fill space between studs with sound attenuation blankets and attach 5/8" gypsum board to both sides of the adjacent wall surface to close opening. New plaster finish to match existing plaster surface texture, if applicable.
 - d. Existing through-wall penetrations located below new ceiling height 1'-0" x 1'-0" diameter/square or larger in an existing CMU or structural clay tile wall. Infill existing opening with CMU, or structural clay tile set back from the existing wall surface to allow new plaster finish to be installed in specified thickness and to match existing surface texture, if applicable.
 - e. Existing through-wall penetrations located below new ceiling height 1 inch diameter/square or larger in walls with exposed CMU, or glazed structural tile units. Infill existing opening with CMU, or glazed structural tile unit, to match existing surface texture and bond pattern. Remove whole masonry unit(s) and tooth-in to match existing bond pattern.
 - f. Existing through-wall penetrations in rated wall assemblies to receive fire rated gypsum board, fire blankets and fire resistant caulk at the intersection of the existing wall and fire rated gypsum or rated CMU wall construction. Provide new plaster finish to match existing plaster surface texture if applicable.
 - 3. Partial Wall Openings/Non-Through-Wall Penetrations Below New Ceiling Heights:
 - a. Wall openings left behind after demolition of fully or partially recessed electrical panels and other electrical items, communications, data, life safety, HVAC, sprinkler, or plumbing are to receive infill materials to match the surface of the wall.

- 1) Existing CMU/Glazed Structural Clay Tile Walls: Toothing into existing CMU, or glazed structural tile, matching bond pattern is required at below ceiling locations.
 - (a) Tooth-in with whole units.
- Existing Framed Walls: Frame opening with metal studs @ 12" on center. Fill space between studs with sound attenuation blankets and attach 5/8" gypsum board to exposed side of the adjacent wall surface to close opening.
- b. Set back infill material as necessary to provide new plaster finish to match existing plaster surface texture if applicable.

3.04 PERFORMANCE

- A. 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 existing 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. Cutting: Cut existing 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.
- C. 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 possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.

END OF SECTION 017300

SECTION 017800 - CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Project Record Documents.
- B. Operation and Maintenance Data.
- C. Warranties and bonds.

1.02 RELATED REQUIREMENTS

- A. Section 013300 Submittal Procedures: Submittals procedures, shop drawings, product data, and samples.
- B. Section 017000 Execution and Closeout Requirements: Contract closeout procedures.
- C. Individual Product Sections: Specific requirements for operation and maintenance data.
- D. Individual Product Sections: Warranties required for specific products or Work.

1.03 SUBMITTALS

- A. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.
- B. Operation and Maintenance Data:
 - 1. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
 - 2. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
- C. Warranties and Bonds:
 - 1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
 - 2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
 - 3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.
- D. Special Note: Coordinate submission of all close-out documents with Architect. Architect and Owner may prefer that all submissions be provided electronically.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

- A. Maintain on site one set of the following record documents; record actual revisions to the Work:
 - 1. Drawings.
 - 2. Specifications.
 - 3. Addenda.
 - 4. Change Orders and other modifications to the Contract.
 - 5. Reviewed shop drawings, product data, and samples.
 - 6. Manufacturer's instruction for assembly, installation, and adjusting.
- B. Ensure entries are complete and accurate, enabling future reference by Owner.
- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress.
- E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
 - 1. Manufacturer's name and product model and number.
 - 2. Product substitutions or alternates utilized.
 - 3. Changes made by Addenda and modifications.

3.02 OPERATION AND MAINTENANCE DATA

- A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.
- B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
- C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.
- D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.
- E. Include all training videos and digital photographs on CD Rom with the O & M submittal.

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

- A. For Each Product, Applied Material, and Finish:
 - 1. Product data, with catalog number, size, composition, and color and texture designations.
 - 2. Information for re-ordering custom manufactured products.
- B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.
- C. Moisture protection and weather-exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.
- D. Additional information as specified in individual product specification sections.
- E. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.
- F. Provide a listing in Table of Contents for design data, with tabbed fly sheet and space for insertion of data.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

- A. For Each Item of Equipment and Each System:
 - 1. Description of unit or system, and component parts.
 - 2. Identify function, normal operating characteristics, and limiting conditions.
 - 3. Include performance curves, with engineering data and tests.
 - 4. Complete nomenclature and model number of replaceable parts.
 - 5. System set points.
 - 6. As-delivered performance data.

- B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.
- C. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.
- D. Include color coded wiring diagrams as installed.
- E. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
- F. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- G. Provide servicing and lubrication schedule, and list of lubricants required.
- H. Include manufacturer's printed operation and maintenance instructions.
- I. Include sequence of operation by controls manufacturer.
- J. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- K. Provide control diagrams by controls manufacturer as installed.
- L. Provide Contractor's coordination drawings, with color coded piping diagrams as installed.
- M. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- N. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- O. Include test and balancing reports.
- P. Additional Requirements: As specified in individual product specification sections.

3.05 WARRANTIES AND BONDS

- A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.
- B. Verify that documents are in proper form, contain full information, and are notarized.
- C. Co-execute submittals when required.
- D. Retain warranties and bonds until time specified for submittal.
- E. Manual: Bind in commercial quality 8-1/2 by 11 inch three D side ring binders with durable plastic covers.
- F. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible company principal.
- G. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.

H. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

END OF SECTION

SECTION 024119 - SELECTIVE STRUCTURE DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Selective demolition of built site elements.
- B. Selective demolition of building elements for alterations purposes.
- C. Selective demolition of existing utilities and utility structures.
- D. Demolition of the existing roofing and associated roof items.
- E. Patching and repairs of existing elements to remain.

1.02 RELATED SECTIONS

- A. Section 011000 Summary: Limitations on Contractor's use of site and premises.
- B. Section 011000 Summary: Sequencing and staging requirements.
- C. Section 013000 Administrative Requirements: Preconstruction photographs taken prior to building demolition.
- D. Section 015000 Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.
- E. Section 017000 Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products.
- F. Section 017300 Cutting and Patching: Repairs to existing surfaces.
- G. Section 311000 Site Clearing: Vegetation and existing debris removal.
- H. Section 312200 Grading: Topsoil removal.
- I. Divisions 21 through 28 Sections for or relocating of site mechanical and electrical items.

1.03 REFERENCES

- A. 29 CFR 1926 U.S. Occupational Safety and Health Standards; current edition.
- B. NFPA 241 Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2004.

1.04 **DEFINITIONS**

- A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or recycled.
- B. Remove and salvage: Detach items from existing construction and deliver them to Owner.
- C. Remove and reinstall: Remove items indicated; clean, service, and otherwise prepare them for reuse; store and protect against damage. Reinstall items in the same locations or in locations indicated.
- D. Existing to remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or recycled. Protect construction indicated to remain against damage and soiling during selective demolition.

1.05 MATERIALS OWNERSHIP

A. Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain the Owner's property, demolished materials shall become the Contractor's property and shall be removed from the site with further disposition at the Contractor's option.

1.06 SUBMITTALS

- A. See Section 013000 Administrative Requirements, for submittal procedures.
- B. Site Plan: Showing:
 - 1. Areas for temporary construction and field offices.
- C. Selective Demolition Plan: Submit selective demolition plan as specified by OSHA and local authorities.
 - 1. Indicate extent of selective demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences.
 - 2. Indicate starting and ending dates for each activity.
 - 3. Identify demolition firm and submit qualifications.
 - 4. Include a summary of safety procedures.
 - 5. Coordination for shutoff, capping, and continuation of utility services.
 - 6. Locations of temporary protection and means of egress.
 - 7. Use of elevator and stairs.
 - 8. Detailed sequence of selective demolition and removal work to ensure Owner's uninterrupted continuing occupancy of adjacent buildings and partial use of premises.
- D. Salvage Inventory: After building demolition is complete, Construction Manager/General Contractor to maintain a list of items that have been removed and salvaged to the Owner. Refer to the form at the end of this specification section.
- E. Reinstallation Inventory: After building demolition is complete, Construction Manager/General Contractor to maintain a list of items that have been removed and stored for reinstallation. Refer to the form at the end of this specification section.
- F. Proposed Dust-Control Measures: Submit statement or drawing that indicates the measures proposed for use, proposed location, and proposed time frame for their operation. Identify options if proposed measures are later determined to be inadequate.
- G. Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by selective demolition operations. Submit before work begins.
- H. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

1.07 QUALITY ASSURANCE

- A. Conference: Conduct conference at Project site to comply with requirements in Division 1 sections. Review methods and procedures related to building demolition including, but not limited to, the following:
 - 1. Inspect and discuss condition of construction to be selectively demolished.
 - 2. Review structural load limitations of existing structures.
 - 3. Review and finalize selective demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Review and finalize protection requirements.

1.08 PROJECT CONDITIONS

- A. Conditions existing at time of inspection for bidding purposes will be maintained by Owner as far a practical.
- B. Before building demolition, Owner will remove the following items: 1.
- C. Minimize production of dust due to demolition operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.

- D. Storage or sale of removed items or materials on-site is not permitted.
- E. Comply with other requirements specified in Section 017000.

1.09 HAZARDOUS MATERIALS

- A. Hazardous Materials: It is not expected that hazardous material will be encountered in the work.
 - 1. If material suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Fill Material: As specified in Section 312200 Grading
- B. Repair Materials: Use repair materials identical to existing materials.
 - Where identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
 - 2. Use materials whose installed performance equals or surpasses that of existing materials.

PART 3 EXECUTION

1

3.01 SCOPE

- A. Remove portions of existing building as indicated on the drawings.
- B. Area of building(s) to be selectively demolished will be vacated and their use discontinued before start of Work.
- C. Owner will occupy another area immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
 - 1. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.
 - Maintain access to existing walkways, exits, and other adjacent occupied or used facilities.
 a. Do not close or obstruct walkways, exits, or other occupied or used facilities without written permission from authorities having jurisdiction.
- D. Remove other items indicated, for salvage and relocation.
- E. Fill excavations, open pits, and holes in ground areas generated as result of removals, using specified fill; compact fill as required so that required rough grade elevations do not subside within one year after completion.

3.02 EXAMINATION

- A. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- B. Review Project Record Documents of existing construction provided by Owner. Owner does not guarantee that existing conditional are the same as those indicated in Project Record Documents.
- C. Inventory and record the condition of items to be removed and salvaged.
- D. When unanticipated mechanical, electrical, or structural elements are encountered, investigate and measure the nature and extent of the element. Promptly submit a written report to the Architect.
- E. Survey the condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during building demolition operations.

3.03 GENERAL PROCEDURES AND PROJECT CONDITIONS

- A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
 - 1. Obtain required permits.
 - 2. Use of explosives is not permitted.
 - 3. 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 portable fire-suppression devices during flame-cutting operations.
 - a. Maintain adequate ventilation when using cutting torches.
 - 4. Proceed with demolition of structural framing members systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the lower level.
 - 5. 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. To minimize disturbance of adjacent surfaces, use hand or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
 - 6. Cut or drill from the exposed surface or finished side into concealed surfaces to avoid marring existing finished surfaces.
 - 7. Buildings over one story remove debris from elevated portions by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
 - a. Remove structural framing members and lower to ground by method suitable to minimize ground impact or dust generation.
 - 8. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
 - a. Locate selective demolition equipment throughout the structure and remove debris and materials so as to not impose excessive loads on supporting walls, floors, or framing.
 - 9. Provide, erect, and maintain temporary barriers and security devices.
 - a. Comply with requirements in Division 1 Temporary Facilities and Controls.
 - 10. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
 - 11. Do not close or obstruct roadways or sidewalks without permit.
 - 12. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.
 - 13. Obtain written permission from owners of adjacent properties when selective demolition equipment will traverse, infringe upon or limit access to their property.
- B. Do not begin removal until receipt of notification to proceed from Owner.
- C. Protect existing structures and other elements that are not to be removed.
 - 1. Provide bracing and shoring.
 - 2. Prevent movement or settlement of adjacent structures.
 - 3. Stop work immediately if adjacent structures appear to be in danger.
- D. Below-Grade Construction:
 - 1. Remove below-grade construction, including basements, foundation walls, and footings completely.
- E. Site Restoration:
 - 1. Staging, Parking and Storage: Restore lawn areas used for staging and storage of construction materials or parking during the project back to their original condition.
- F. Removed and salvaged items: Comply with the following:

1. Contractor to remove and salvage the following items:

a.

- 2. Clean salvaged items of dirt and demolition debris.
- 3. Pack or crate items after cleaning. Identify contents of containers.
- 4. Store items in a secure area until delivery to Owner.
- 5. Transport items to Owner's storage area on-site.
 - a. Off-site storage located at
- 6. Protect items from damage during transport and storage.

3.04 EXISTING UTILITIES

- A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.
- B. Protect existing utilities to remain from damage.
- C. Do not disrupt public utilities without permit from authority having jurisdiction.
- D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.
- E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.
- F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.
- G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.
- H. Prepare selective demolition areas by disconnecting and capping utilities outside the demolition zone; identify and mark utilities to be subsequently reconnected, in same manner as other utilities to remain.
 - 1. Cut off pipe or conduit flush with grade. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.
 - 2. Cut off pipe or conduit a minimum of 36 inches below grade. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.
 - 3. Demolish existing utilities and below-grade utility structures that are within 5 feet outside of footprint indicated for new construction. Abandon utilities outside this area.
 - a. Fill abandoned utility structures with satisfactory soil materials according to backfill requirements in Division 31 Sections.
 - 4. Refer to Divisions 21 through 28 Sections for shutting off, disconnecting, removing, and sealing or capping utilities. Do not start demolition work until utility disconnecting and sealing have been completed and verified in writing.

3.05 SELECTIVE DEMOLITION

- A. Drawings showing existing construction and utilities are based on field observation and existing record documents only.
- B. Separate areas in which selective demolition is being conducted from other areas that are still occupied or are to remain.
 - 1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 015000 in locations indicated on drawings.
- C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage to structure or interior areas.
- D. Protect walls, ceilings, floors, and other existing finish work that are to remain and are exposed during selective demolition operations.

- E. Cover and protect furniture, furnishings, and equipment that have not been removed.
- F. Remove existing work as indicated and as required to accomplish new work.
 - 1. Remove rotted wood, corroded metals, and deteriorated masonry and concrete and promptly remove off-site.
 - 2. Concrete: Cut concrete, in small sections, full depth at junctures with construction indicated to remain, using power-driven saw, then remove concrete between saw cuts. Do not use power-driven impact tools.
 - 3. Masonry: Cut masonry, in small sections, at junctures with construction indicated to remain, using power-driven saw, then remove masonry between saw cuts. Do not use power-driven impact tools.
 - 4. Concrete Slabs-on Grade: Saw-cut perimeter of area to be demolished at junctures with construction indicated to remain, then break up and remove, unless otherwise shown to remain.
 - 5. Steel: Dismantle field connections without bending or damaging steel members. Do not use flame cutting torches unless otherwise authorized.
 - a. Steel trusses and joists as whole units without dismantling them further.
 - 6. Ceramic, Porcelain and Quarry Floor Tile and Base: Remove tile, grout, mastic, mudset bed, spacers, mesh and lathe in its entirety to leave remaining subfloor and wall surface in clean, smooth condition ready for new flooring material.
 - a. Mud/Thick set tile: Remove mud/thickset in its entirety to leave remaining subfloor and wall surface in clean, smooth condition ready for new flooring and fill material.
 - 7. Ceramic, Porcelain Quarry Wall Tile and Base: Remove tile, grout, mastic, spacers, mesh and lathe in its entirety to leave remaining CMU wall surface in clean, smooth condition ready for new wall material.
 - 8. Ceramic, Porcelain Quarry Wall Tile and Base: Remove tile, grout, mastic, spacers, mesh and lathe and backer board in its entirety ready for new backer board installation.
 - 9. Carpet: Remove in large pieces and roll tightly after removing demolition debris, trash, adhesive, tack strips, pad. Remove all adhesives, staples and other carpet securement items in their entirety to leave remaining subfloor in clean, smooth condition ready for new flooring material.
 - 10. Resilient Floor Covering: Remove resilient floor coverings and adhesive according to recommendations of the Resilient Floor Covering Institutes (RFCI) "Recommended Work Practices for the Removal of Resilient Floor Coverings" and Addendum.
 - a. Remove residual adhesive and prepare substrate for new floor coverings by one of the methods recommended by RFCI.
 - 11. Gypsum/Drywall Board Ceilings, Soffits and Bulkheads: Remove gypsum/drywall board, suspension hangers, clips, suspension grid system, furring or other stud support system in its entirety so existing ceiling area is ready to receive new ceiling system.
 - 12. HVAC Equipment: Disconnect equipment at nearest fitting connection to services, complete with service valves. Remove as whole units, complete with controls.
 - 13. Remove items indicated on drawings.
- G. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove existing systems and equipment as indicated.
 - 1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components.
 - 2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
 - 3. See Section 011000 for other limitations on outages and required notifications.
 - 4. Verify that abandoned services serve only abandoned facilities before removal.
 - 5. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification.

- H. Protect existing work to remain.
 - 1. Prevent movement of structure; provide shoring and bracing if necessary.
 - 2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
 - 3. Repair adjacent construction and finishes damaged during removal work.
 - 4. Patch as specified for patching new work.
 - a. Patching is specified in Division 1 Section "Cutting and Patching".
- I. Roofing Demolition:
 - 1. Remove no more existing roofing than can be covered in one day by new temporary roofing.
 - 2. Coordinate removal of existing roofing with installation of new temporary roofing and existing roof drains to remain. Coordinate repairs of existing roof deck with installation of temporary roofing.
 - 3. Provide water cut-offs, that do not create a water dam, at the end of each day's work.
 - 4. Remove existing roofing material by method to avoid damage to existing substrates.
 - 5. Remove debris from the roof by chute, hoist, or other device that will convey debris to grade level in a controlled descent. Do not throw materials from the roof.
 - 6. Do not traverse re-roofed areas to carry removed materials to chutes; where possible, relocate chutes to areas where demolition is occuring.
 - 7. Provide temporary walkways, as required, to protect existing substrates from damage by roofing operations.
 - 8. See applicable Division 7 Section for new roofing requirements.

3.06 DEBRIS AND WASTE REMOVAL

- A. Except for items or materials indicated to be reused, salvaged, and 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.
- B. Transport demolished materials from Owner's property and legally dispose of them.
- C. Transport demolished materials approved for fill and dispose of at designated spoils areas on Owner's property.
- D. Do not burn demolished materials on site.
- E. Leave site in clean condition, ready for subsequent work.
- F. Clean up spillage and wind-blown debris from public and private lands.
- G. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return to condition existing before start of selective demolition.
- H. Change filters on air-handling equipment on completion of selective demolition operations.

END OF SECTION 024119

SECTION 031000 - CONCRETE FORMING AND ACCESSORIES

PART 1 GENERAL

1.1 RELATED SECTIONS

- A. Division 01 Sections
- B. Section 032000 Concrete Reinforcing.
- C. Section 033000 Cast-in-Place Concrete.

1.2 REFERENCES

ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials.

ACI 301 – Standard Specifications for Structural Concrete.

ACI 318 – Building Code Requirements for Structural Concrete.

ACI 347 – Guide to Formwork for Concrete.

ASTM D1751 – Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

ASTM D6817 – Standard Specification for Rigid Cellular Polystyrene Geofoam.

1.3 DEFINITIONS

A. Architectural Concrete: All concrete members exposed to public view are classified as Architectural Concrete and shall comply with the Architectural Concrete provisions in this specification and ACI 301.

1.4 SUBMITTALS

- A. Submit locations of construction joints in framed construction for approval.
- B. Submit manufacturer's data for:
 - 1. Expansion/Isolation Joint Filler.
 - 2. Waterstops.

1.5 DESIGN OF FORMWORK

- A. Design of formwork, shoring, and reshoring and its removal is the Contractor's responsibility.
- B. Design of formwork, shoring, and reshoring shall conform to ACI 117, ACI 301, ACI 318, and ACI 347.
- C. Design formwork in a manner such that existing or new construction is not overloaded.

PART 2 PRODUCTS

2.1 FORM MATERIALS

- A. Form Material: Wood, plywood, metal, fiberglass or a combination of these, with sufficient strength to prevent distortion.
- B. Form Definitions
 - 1. Standard Forms: No form-facing material required. Standard forms are acceptable everywhere except for Architectural Concrete elements.
 - 2. Architectural Concrete Forms: Form-facing material shall be plywood, tempered concrete-form-grade hardboard, metal (unrusted) or plastic that will produce a smooth, uniform texture on the concrete. Do not use form-facing material with raised grain, torn edges, worn edges, patches, dents, or other defects that will impair the texture of the exposed concrete surfaces. Intent is that when the forms are removed, the exposed concrete surfaces will be free from all blemishes. Architectural concrete forms are required for all concrete elements indicated as Architectural Concrete.

2.2 FORMWORK ACCESSORIES

A. Formwork Accessories: Commercially manufactured products, including ties and hangers. Do not use nonfabricated wire form ties.

2.3 FORM RELEASE AGENT

A. Form release agent shall not bond with, stain, nor adversely affect concrete surfaces.

2.4 EXPANSION / ISOLATION JOINT FILLER

A. Expansion / Isolation Joint Filler: ASTM D1751, asphalt impregnated premolded fiberboard, 1/4-inch thick by full thickness of slab or joint, unless indicated otherwise in the Structural Drawings.

2.5 CONSTRUCTION JOINTS

- A. Slabs-On-Grade: Steel plate dowel such as manufactured by PNA Construction Technologies, Inc., Greenstreak Group, Inc., or approved equal.
 - 1. Plate Thickness: 1/4-inch thick for slabs up to 6 inches in thickness; 3/8-inch for slabs over 6 inches and up to 8 inches in thickness; 3/4-inch thick for slabs over 8 inches in thickness and up to 12 inches in thickness.

2.6 WATERSTOPS

- A. Waterstops at construction joints and contraction joints indicated in the Structural Drawings shall be sized to suit the joints.
- B. Waterstops: Preformed, non-expansive, plastic adhesive waterstops such as Synko-Flex, manufactured by Henry Company, or approved equal.

2.8 GEOFOAM

A. Geofoam: Foam-controlled EPS Geofoam, Type EPS22, complying with ASTM D6817.

PART 3 EXECUTION

3.1 GENERAL

A. Erect formwork in accordance with ACI 301 and ACI 347.

- B. Finished work shall comply with tolerances of ACI 117.
- C. Provide 3/4-inch chamfer at all formed corners.

3.2 FOUNDATION ELEMENTS

- A. Form foundation elements if soil or other conditions are such that earth trench forms are unsuitable.
- B. Sides of perimeter grade beams, foundation walls, and turned-down slabs shall be formed.
- C. Maintain minimum coverage of reinforcing steel as indicated in Structural Drawings.

3.3 FORM PREPARATION

- A. Seal form joints to prevent leakage.
- B. Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before concrete is placed.
- C. Before reinforcement is placed, coat contact surfaces of form with form release agent in accordance with manufacturer's recommendations. Do not allow excess form release agent to accumulate in forms or come in contact with concrete surfaces against which fresh concrete will be placed.

3.4 INSERTS AND EMBEDMENT ITEMS

- A. Install and secure in position required inserts, embeds, hangers, sleeves, anchors, and nailers.
- B. Locate anchor bolts/rods in position in accordance with approved setting drawings and secure to prevent displacement during concrete placement.

3.5 **PROVISIONS FOR OTHER TRADES**

- A. Install openings in concrete formwork to accommodate work of other trades. Determine size and location of openings and recesses from trades requiring such items. Obtain approval from Structural Engineer for openings not shown in Structural Drawings.
- B. Accurately place and securely support items built into forms.

3.6 CONSTRUCTION JOINTS

A. Slabs-On-Grade: Install steel plate dowels in accordance with manufacturer's recommendations. Place plate dowels at mid-depth of slab (+/-1/4-inch), unless noted otherwise in the Structural Drawings.

3.7 WATERSTOPS

A. Prepare surface and install strip applied waterstops in accordance with manufacturer's recommendations.

3.9 FORMWORK REMOVAL

A. Remove formwork carefully in such manner and at such time as to ensure complete safety of structure. Do not remove formwork, shoring, or reshoring until members have acquired sufficient strength to support their weight and the load thereon safely.

B. For conventionally reinforced framed slabs, formwork shall remain in place for a minimum of 5 days after concrete placement.

3.10 FINISHES OF FORMED SURFACES

- A. Standard Form Finish: Patch tie holes and defects. Chip or rub off fins exceeding ¹/₄ inch in height. Leave surface with the texture imparted by the forms.
- B. Architectural Concrete Finish: Patch tie holes and defects. Remove all fins completely. Produce finish on newly hardened concrete no later than the day following formwork removal. Wet the surface and rub it with carborundum or other abrasive until uniform color and texture are produced. Use no cement grout other than cement paste drawn from the concrete itself by the rubbing process.

3.11 GEOFOAM

- A. Protect and install Geofoam in accordance with manufacturer's recommendations.
- B. Provide positive mechanical means to prevent displacement during concrete placement.

END OF SECTION

SECTION 032000 - CONCRETE REINFORCING

PART 1 GENERAL

1.1 RELATED SECTIONS

- A. Division 1 Sections
- B. Section 031000 Concrete Forming and Accessories.
- C. Section 033000 Cast-in-Place Concrete.

1.2 REFERENCES

ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials.

ACI 301 – Standard Specifications for Structural Concrete.

ACI 315 – Details and Detailing of Concrete Reinforcement.

ACI 318 – Building Code Requirements for Structural Concrete.

ASTM A185 - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete Reinforcement.

ASTM A615 – Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

ASTM A706 – Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.

AWS D1.4 – Structural Weld Code - Reinforcing Steel.

AWS D12.1 – Recommended Practices for Welding Reinforcing Steel Metal Inserts, and Connections in Reinforced Concrete Construction.

CRSI – Manual of Standard Practice.

1.3 SUBMITTALS

- A. Refer to Structural Quality Assurance Plan in the Structural Drawings for additional submittal requirements.
- B. Shop Drawings:
 - 1. Notify Structural Engineer prior to detailing reinforcing steel shop drawings.
 - 2. Indicate size, spacing, location and quantities of reinforcing steel and wire fabric, bending and cutting schedules, splice lengths, stirrup spacing, supporting and spacing devices. Detail reinforcing steel in accordance with ACI 315 and CRSI Standards.
 - 3. Written description of reinforcement without adequate sections, elevations, and details is not acceptable.
 - 4. Reproduction of Structural Drawings for shop drawings is not permitted. Electronic drawing files will not be provided to the Contractor.
- C. Submit manufacturer's data for tension and compression splicers.

1.4 QUALITY ASSURANCE

A. Refer to the Structural Quality Assurance Plan in the Structural Drawings.

1.5 STORAGE AND PROTECTING

A. Store reinforcing steel above ground so that it remains clean. Maintain steel surfaces free from materials and coatings that might impair bond.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Deformed Reinforcing Steel: ASTM A615, refer to Structural Drawings for grade (Grade 60 minimum).
- B. Welded Steel Wire Fabric: ASTM A185.

2.2 ACCESSORY MATERIALS

- A. Annealed Steel Tie Wire: 16¹/₂ gage minimum.
- B. Bar Supports: Plastic-tipped steel Class I bar supports conforming to CRSI Specifications. Concrete brick may be used to support reinforcement to obtain proper clearance from earth.

2.3 SPLICERS

A. Tension Splicers: Capable of developing 125% of the reinforcing steel ASTM specified minimum yield strength.

2.4 DOWEL ADHESIVE

A. Dowel Adhesive: EPCON System Ceramic 6 Epoxy adhesive supplied by ITW Ramset/Red Head, HIT HY150 injection adhesive supplied by Hilti Fastening Systems, Power-Fast epoxy injection gel or AC100 Plus supplied by Powers Fasteners, SET High Strength Epoxy supplied by Simpson, or approved equal.

PART 3 EXECUTION

3.1 FABRICATION

- A. Fabricate reinforcing steel in accordance with ACI 318 and CRSI standards.
- B. Bend bars cold. Do not heat or flame cut bars. No field bending of bars partially embedded in concrete is permitted, unless specifically approved Structural Engineer and checked by Testing and Inspection Agency for cracks.
- C. Weld only as indicated. Perform welding in accordance with AWS D1.4 and AWS D12.1.
- D. Tag reinforcing steel for easy identification.

3.2 INSTALLATION

A. Before placing concrete, clean reinforcement of foreign particles and coatings.

- B. Place, support, and secure reinforcement against displacement in accordance with ACI 318 and CRSI standards. Do not deviate from alignment or measurement.
- C. Place concrete beam reinforcement support parallel to main reinforcement.
- D. Locate welded wire reinforcement in the top third of slabs. Overlap mesh one lap plus two inches at side and end joints.
- E. Furnish and install dowels or mechanical splices at intersections of walls, columns and piers to permit continuous reinforcement or development lengths at such intersections.
- F. Maintain cover and tolerances in accordance with ACI and CRSI Specifications, unless indicated otherwise on Structural Drawings.

3.3 SPLICES

- A. Do not splice reinforcement except as indicated on Structural Drawings.
- B. Tension couplers may be used and installed in accordance with manufacturer's recommendations.

3.4 DOWELS IN EXISTING CONCRETE

- A. Install dowels with approved adhesive in existing concrete as shown on the Drawings. Dowels to be installed with adhesive at locations not specifically shown on the Drawings shall be approved by the Structural Engineer.
- B. Minimum embedment length into the existing concrete shall be 12 bar diameters, unless noted otherwise.

END OF SECTION

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 RELATED SECTIONS

- A. Division 1 Sections
- B. Section 031000 Concrete Forming and Accessories.
- C. Section 032000 Concrete Reinforcing.

1.2 REFERENCES

ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials.

- ACI 214 Recommended Practice for Evaluation of Strength Test Results of Concrete.
- ACI 301 Specifications for Structural Concrete.
- ACI 302.1 Guide for Concrete Floor and Slab Construction.
- ACI 304 Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.
- ACI 305 Hot Weather Concreting.
- ACI 306 Cold Weather Concreting.
- ACI 308 Guide to Concrete Curing.
- ACI 309 Recommended Practice for Consolidation of Concrete.
- ACI 318 Building Code Requirements for Reinforced Concrete.

ASTM C31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.

- ASTM C33 Standard Specification for Concrete Aggregates.
- ASTM C39 Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
- ASTM C94 Standard Specification for Ready-Mixed Concrete.

ASTM C138 – Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.

ASTM C143 – Standard Test Method for Slump of Hydraulic-Cement Concrete.

ASTM C150 – Standard Specification for Portland Cement.

ASTM C172 – Standard Practice for Sampling Freshly Mixed Concrete.

ASTM C173 – Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.

ASTM C230 - Standard Specification for Flow Table for Use in Tests of Hydraulic Cement.

ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.

ASTM C309 – Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

ASTM C494 – Standard Specification for Chemical Admixtures for Concrete.

ASTM C618 – Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.

ASTM E1155 – Standard Test Method for Determining F_F Floor Flatness and F_L Floor Levelness Numbers.

1.3 SUBMITTALS

- A. Refer to Structural Quality Assurance Plan in the Structural Drawings for additional submittal requirements.
- B. Submit three copies of the concrete mix designs. Include the following:
 - 1. Documentation of mix design proportions complying with ACI 318, Chapter 5.
 - 2. Type and quantities of materials including admixtures
 - 3. Slump
 - 4. Air content
 - 5. Water/cement ratio
 - 6. Fresh unit weight
 - 7. Aggregates sieve analysis
 - 8. Design compressive strength
 - 9. Location of placement in structure
 - 10. Method of placement
 - 11. Method of curing
 - 12. Seven-day and 28-day compressive strengths
 - Mix design submittals not conforming to the above will be rejected.

1.4 QUALITY ASSURANCE

- A. The ready-mixed concrete plant shall be certified for conformance with the requirements of the National Ready Mix Concrete Association.
- B. Refer to the Structural Quality Assurance Plan in the Structural Drawings.

1.5 MOCK-UP

- A. Provide concrete as necessary (including temporary wall base or foundation) to accommodate project mock-up requirements as shown in architectural drawings and specifications.
- B. Mock-up shall be protected for the duration of the construction and will be used as the basis of acceptance for constructed work.

PART 2 PRODUCTS

2.1 CONCRETE MIX DESIGN

- A. Establish concrete mix design proportions in accordance with ACI 318, Chapter 5.
- B. Concrete Strength: See Structural Notes in Structural Drawings.

C. Slump

- 1. Design concrete with a slump between four and ten inches.
- 2. If a slump greater than five inches is desired, use a mid-range or high-range water reducer.
- D. Water/Cementitious Materials Ratio (w/cm): See Structural Notes in Structural Drawings.
- E. Entrained Air Content: See Structural Notes in Structural Drawings.

F. Fresh Unit Weight

1. Normal weight concrete: Fresh unit weight of 137 to 148 pcf.

2.2 MATERIALS

A. Materials designated by specific manufacturer's trade names are approved, subject to compliance with the quality and performance indicated by the manufacturer. Instructions and recommendations, published by the manufacturer of such materials are included in and are a part of these Specifications.

2.3 CEMENT

A. Cement: Type I Portland cement complying with ASTM C150, unless noted otherwise. Use one brand only.

2.4 AGGREGATE

- A. Fine Aggregate: Fine aggregate complying with ASTM C33.
- B. Coarse Aggregate: Gravel or crushed stone complying with ASTM C33 for normal weight concrete. Size coarse aggregate in accordance with ACI 318.

2.5 WATER

A. Water: Potable water free of deleterious substances complying with ACI 318.

2.6 AIR ENTRAINING AGENT

A. Air Entraining Agent: Air entraining agent complying with ASTM C260.

2.7 WATER REDUCER

A. Water Reducer: Water reducing agent complying with ASTM C494.

2.8 MID-RANGE/HIGH-RANGE WATER REDUCER

A. Mid-range/High-range Water Reducer: Mid-range and high-range water reducers (plasticizers) complying with ASTM C494.

2.9 CHLORIDE

A. Chlorides: Chlorides of any form shall not be used in concrete.

2.10 EVAPORATION RETARDER

A. Provide an evaporation retarder such as Confilm by BASF, or approved equal during placement and finishing of concrete slabs. This product will aid in reducing plastic shrinkage cracks and surface moisture evaporation caused by high ambient and/or mix temperatures, low humidity, high winds, direct sunlight or work within heated interiors during cold weather.

2.11 CURING COMPOUND – VERTICAL SURFACES

A. Curing Compound: Vertical Surfaces Only – A water-based, "odorless," acrylic curing compound with a minimum solid content of 20 percent may be used at the Contractor's option complying with ASTM C309.

2.12 FLY ASH

A. Fly Ash: Class F fly ash with a loss on ignition of less than five percent or Class C fly ash with a loss on ignition of less than one percent complying with ASTM C618.

2.13 ACCELERATORS

A. Accelerators: Non-chloride accelerators complying with ASTM C494.

2.14 RETARDERS

A. Retarders: Retarders complying with ASTM C494.

2.15 CONTRACTION JOINT SEALANT

A. Contraction Joint Sealant: Semi-rigid, epoxy joint filler.

PART 3 EXECUTION

3.1 GENERAL

- A. Prepare place of deposit, mix, convey, and place in accordance with ACI 301 and ACI 304.
- B. Wet forms before placing concrete.
- C. Deposit concrete as near as practical to final position.
- D. Do no flowing of concrete with vibrators.
- E. Place slabs in accordance with ACI 302.
- F. Place and finish concrete members to comply with tolerances in ACI 117.
- G. Do not use aluminum equipment in placing and finishing concrete.

3.2 SLABS-ON-GRADE

A. Place concrete for slabs-on-grade on properly prepared granular subbase with vapor barrier.

CAST-IN-PLACE CONCRETE

B. Place thickened slabs for partitions integral with floor slabs.

3.3 MID-RANGE / HIGH-RANGE WATER REDUCERS

A. Mid-range or high-range water reducers are to be added at dosage recommended by the manufacturer. The slump of the concrete shall be one to four inches at the time the water reducers are added. Do not permit fresh concrete containing superplasticizers to come in contact with fresh concrete not containing superplasticizers.

3.5 ADDITION OF WATER AT JOB SITE

A. Water may be added at the jobsite if neither the maximum permissible water/cement ratio nor the maximum slump is exceeded. All concrete delivery trucks will have actual batch weight tickets available that clearly indicate the quantity of water that may be added at the jobsite that will not exceed the maximum water/cement ratio.

3.6 TIME LIMIT

A. Deposit concrete within one and one-half hours after batching.

3.7 EVAPORATION RETARDER

A. Apply with a constant pressure or industrial type sprayer in accordance with manufacturer's recommendations.

3.8 VIBRATION

- A. Consolidate concrete in accordance with ACI 301 and ACI 309.
- B. In Insulated Concrete Formed Walls (ICF) vibrate full depth of walls at 16" oc. Use a pencil type vibrator.

3.9 CURING

- A. Begin curing procedures immediately following the commencement of the finishing operation.
- B. Cure concrete in accordance with ACI 308. Keep the concrete surface moist. Place burlap, burlene, or similar vapor barrier on the surface. Maintain moist concrete surface for a minimum three days.
- C. If an acrylic curing compound is used *for vertical surfaces*, apply in accordance with manufacturer's recommendations, to the surfaces of concrete not protected (for five days) by formwork.

3.10 WEATHER PROVISIONS

- A. Perform cold weather concreting in accordance with ACI 306.
- B. Perform hot weather concreting in accordance with ACI 305.
- C. Protect concrete from drying and excessive temperature for the first seven days.
- D. Protect fresh concrete from wind.

3.11 CONTRACTION JOINTS

- A. Obtain Architect/Structural Engineer's approval for location of contraction joints. Do not use contraction joints in framed floors or composite slabs, unless noted in Structural Drawings.
- B. Provide contraction joints in slabs-on-grade to form a regular grid with a maximum spacing as noted in the Structural Drawings. The long dimension of the grid shall not exceed 1.5 times the short dimension of the grid. Contraction joints may be saw cut if cut within 24 hours after placement of concrete. Saw cuts shall be a depth equal to one-fourth the slab thickness by one-eighth inch wide. Alternately, contraction joints may be provided by preformed plastic strip inserts.
- C. Provide contraction joints in concrete walls at approximately 30'-0" centers, or as noted in the Structural Drawings; coordinate location with Architect. Contraction joints shall be formed as a V-groove on both faces of the wall, 3/4-inch minimum depth.

3.12 CUTTING CONCRETE

A. Obtain Architect/Structural Engineer's written approval prior to cutting concrete for installation of other work.

3.13 PATCHWORK AND REPAIRS

A. Notify Architect/Structural Engineer of any defective areas in concrete to be patched or repaired. Repair and patch defective areas with non-shrink grout. Cut out defective areas over 2 inches in diameter to solid concrete but not less than a depth of one inch. Make edges of cuts perpendicular to the concrete surface.

3.14 CONCRETE FINISHES

- A. Finish Concrete in accordance with ACI 301.
- B. All slabs shall be troweled finish, unless noted otherwise.
- C. Finish slabs to the following flatness and levelness tolerances:
 - 1. $F_F 25/F_L 20$ minimum overall for composite of all measured values and $F_F 17/F_L 12$ minimum for any individual floor section.
 - 2. Architect/Structural Engineer will identify which sections of slabs are to be tested for flatness and levelness.
 - a. F_L values are applicable only if testing is performed within 72 hours of concrete placement, before tensioning of tendons, and before removal of formwork.
 - b. F_F values are applicable to all types of slab construction and are not subject to any time constraints.
- D. Exterior slabs such as loading docks shall receive a light broom finish and slope away from building.

3.15 CONTRACTION JOINT AND CRACK SEALANT

- A. Remove dirt and debris from joints. Joints shall be dry and free from all substances that inhibit bond. Install sealant to prevent three-sided bonding.
- B. Coordinate filling contraction joints and cracks with Architectural flooring specifications.

END OF SECTION

SECTION 042000 - UNIT MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Concrete block.
- B. Clay facing brick.
- C. Mortar and grout.
- D. Reinforcement and anchorage.
- E. Flashings.
- F. Accessories.
- G. Installation of embedded items not specified in this section.
- H. Installation of cast stone units.
- I. Masonry Cleaners.
- J. Products furnished, but not installed, under this Section include the following:
 - 1. Dovetail slots for masonry anchors, installed under Division 3 Section 'Cast In Place Concrete".
 - 2. Anchor section of adjustable masonry anchors for connecting to structural steel frame, installed under Division 5 Section "Structural Steel".
- K. Products installed, but not furnished, under this Section include the following:
 - 1. Steel lintels for unit masonry, furnished under Division 5 Section "Structural Steel Framing".
 - 2. Sheet metal flashings and manufactured reglets in masonry joints for metal flashing, furnished under Division 7 Section " Sheet Metal Flashing and Trim" and "Roof Specialties".
 - 3. Hollow-metal frames in unit masonry openings, furnished under Division 8 Section " Steel Doors and Frames".
 - 4. Wood nailers and blocking built into unit masonry are specified in Division 6 " Rough Carpentry".

1.02 RELATED REQUIREMENTS

- A. Section 013000 Administrative Requirements: Submittal procedures.
- B. Section 047200 Cast Stone Masonry
- C. Section 061000 Rough Carpentry: Nailing strips built into masonry.
- D. Section 070810 Exterior Building Enclosure Air Barrier Requirements: Requirements for an airtight building enclosure.
- E. Section 071113 Bituminous Dampproofing: Dampproofing parged masonry surfaces.
- F. Section 072100 Thermal Insulation: Insulation for cavity spaces.
- G. Section 079005 Joint Sealers: Backing rod and sealant at control and expansion joints.
- H. Section 081113 Hollow Metal Doors and Frames: Frame anchoring requirements.

1.03 REFERENCE STANDARDS

- A. ACI 530/530.1/ERTA Building Code Requirements and Specification for Masonry Structures and Related Commentaries; 2011.
- B. ACI 530.1/ASCE 6/TMS 602 Specification For Masonry Structures; American Concrete Institute International; 2008.

- C. ASTM A82/A82M Standard Specification for Steel Wire, Plain, for Concrete Reinforcement; 2007.
- D. ASTM A153/A153M Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.
- E. ASTM A615/A615M Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement; 2015.
- F. ASTM A641/A641M Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 2009a (Reapproved 2014).
- G. ASTM A1064/A1064M Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2015.
- H. ASTM C56 Standard Specification for Structural Clay Nonloadbearing Tile; 2013.
- I. ASTM C67 Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile; 2014.
- J. ASTM C90 Standard Specification for Loadbearing Concrete Masonry Units; 2014.
- K. ASTM C91/C91M Standard Specification for Masonry Cement; 2012.
- L. ASTM C129 Standard Specification for Nonloadbearing Concrete Masonry Units; 2011.
- M. ASTM C144 Standard Specification for Aggregate for Masonry Mortar; 2011.
- N. ASTM C150/C150M Standard Specification for Portland Cement; 2015.
- O. ASTM C207 Standard Specification for Hydrated Lime for Masonry Purposes; 2006 (Reapproved 2011).
- P. ASTM C216 Standard Specification for Facing Brick (Solid Masonry Units Made From Clay or Shale); 2014.
- Q. ASTM C270 Standard Specification for Mortar for Unit Masonry; 2014a.
- R. ASTM C90 Standard Specification for Loadbearing Concrete Masonry Units; 2014.
- S. ASTM C 1019 Standard Test Method for Sampling and Testing Grout; 2009.
- T. BIA Technical Notes No. 7 Water Penetration Resistance Design and Detailing; 2005.
- U. BIA Techical Notes No. 28B Brick Veneer/Steel Stud Walls; 2005.
- V. BIA Technical Notes No. 46 Maintenance of Brick Masonry; 2005.
- W. BIA Technical Notes No. 7 Water Penetration Resistance Design and Detailing; 2005.
- X. BIA Technical Notes No. 28B Brick Veneer/Steel Stud Walls; 2005.
- Y. BIA Technical Notes No. 46 Maintenance of Brick Masonry; 2005.
- Z. ASTM E 119 Standard Test Methods for Fire tests of Building Construction and materials.
- AA. Brick Industry Association: Technical Notes on Brick Construction; Current Edition.
- AB. IMIAWC (CW) Recommended Practices & Guide Specifications for Cold Weather Masonry Construction; International Masonry Industry All-Weather Council; 1993.
- AC. IMIAWC (HW) Recommended Practices & Guide Specifications for Hot Weather Masonry Construction; International Masonry Industry All-Weather Council; current edition.
- AD. UL (FRD) Fire Resistance Directory; current edition.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all relevant installers.
- B. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings" and adhere to the following specifics regarding masonry pre-installation conference guidelines.
 - 1. The General Contractor/Construction Manager should organize and hold a meeting with the Owner, Architect, General Contractor/Construction Manager, site superintendent, masonry company owner, masonry foreman, all bricklayers, carriers and any other personnel from the masonry company that will be working at the project site. Also include testing and inspection agency representative, installers of cavity wall insulation, storefront, curtain wall, door and window, installers of steel, joist and deck, installers of mechanical, electrical and plumbing items, installers of other work in and around the masonry that must precede or follow masonry work.
 - 2. Review foreseeable methods and procedures related to masonry work, including but not necessarily limited to the following:
 - a. a)Sample and Mock-up Wall Sections:
 - 1) Size and Location
 - 2) Products and Detail required
 - 3) Protection Methods of Sample and Mock-up Wall Sections
 - 4) Approval Authority and Notification
 - b. Site Inspection:
 - 1) Identity of Responsible Person
 - 2) Frequency of Inspection
 - c. Materials:
 - 1) Storage & Protection
 - 2) Delivery Process
 - d. Submittals:

e.

- 1) Product Certification
- 2) Shop Drawing Requirements
- 3) Time Expectation
- 4) Testing and Inspection Requirements
- Construction Means and Methods:
 - 1) Hot & Cold Weather Protection
 - 2) Protection of Work in Process
 - 3) Material Handling Process
 - 4) Cleaning Process
- f. Schedule:
 - 1) Product Availability
 - 2) Review of Associated Trades Responsibility
- g. Project Closeout:
 - 1) Punch List Procedure
- 3. Record (Contractor) discussions of conference, including decisions and agreements (or disagreements) reached, and furnish copy of record to each party attending. If substantial disagreements exist at conclusion of conference, determine how disagreements will be resolved and set date for reconvening conference.

1.05 FIELD REQUIREMENTS

- 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 and hold cover securely in place.

- 2. Where one wythe of multiwythe masonry is completed in advance of other wythes, secure cover a of 24 inches down face next to unobstructed 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 mortar splatter by coverings spread on the 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 and as specified herein.
 - 1. Cold Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.
 - 2. Hot Weather Requirements: Protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide artificial shade and wind breaks and use cooled materials as required.
 - a. When ambient temperature exceeds 100 deg F, or 90 deg F with a wind velocity greater than 8 mph, do not spread mortar beds more than 48 inches ahead of masonry. Set masonry units within one minute of spreading mortar.
 - 3. Cold Weather Construction: When the ambient temperature is within the limits indicated, perform the following construction procedures. Temperature ranges indicated below apply to air temperatures existing at time of installation except for grout. For grout, temperature ranges apply to anticipated minimum night temperatures. In heating mortar and grout materials, maintain mixing temperature selected within 100 F.
 - a. 400 F to 320 F:
 - 1) Mortar: Heat sand or mixing water to produce mortar temperature between 400 F and 1200 F at time of mixing.
 - 2) Grout: Grout does not require heated materials, unless the temperature of materials is below 320 F.
 - 3) 320 F to 250 F:
 - Mortar: Heat mixing water and sand to produce mortar temperatures between 400 F and 1200 F; maintain temperature of mortar on boards above freezing.
 - (b) Grout: Heat grout materials to produce grout temperature between 70oF and 120o F. Maintain grout above 70oF until used in masonry.
 - 4) 250 F to 200 F:
 - Mortar: Heat mixing water and sand to produce mortar temperatures between 400 F and 1200 F; maintain temperature of mortar on boards above freezing.
 - (b) Grout: Heat grout materials to produce grout temperature between 40 and 1200 F. Maintain grout above freezing until used in masonry. Heat masonry units to 400 F (40 C) prior to grouting.
 - (c) Heat both sides of walls under construction to 40oF..
 - (d) Use windbreaks or enclosures when wind is in excess of 15 mph.
 - 5) 200 F and below:

- (a) Mortar: Heat mixing water and sand to produce mortar temperatures between 400 F and 1200 F.
- (b) Grout: Heat grout materials to produce grout temperature between 70oF and 120o F. Maintain grout above 70oF until used in masonry.
- (c) Masonry Units: heat masonry units to 400 F.
- (d) Provide enclosure and auxiliary heat on both sides of walls under construction to maintain temperatures within the enclosures above 320 F for a period until mortar sets and water is evaporated from mix to a point that mortar will not spall or lose effective strength due to freezing.
- 4. Cold-Weather Protection: When the mean daily temperature is within the limits indicated, provide the following protection:
 - a. 400 F to 250 F: Completely cover masonry with weather-resistant membrane for at least 24 hours after construction. Extend coverage time period to 48 hours for grouted masonry.
 - b. 250 F to 200 F: Completely cover masonry with weather-resistive insulating blankets or provide enclosure and heat for 24 hours after construction to prevent freezing. Extend coverage time period to 48 hours for grouted masonry. Install wind breaks when wind velocity exceeds 15 mph.
 - c. 200 F and below: Provide enclosure and heat to maintain temperatures above 320 F within the enclosure for 24 hours after construction. Extend coverage time period to 48 hours for grouted masonry.
- 5. For clay masonry units with initial rates of absorption (suction) which require them to be wetted before laying, comply with the following requirements:
 - a. For units with surface temperatures above 320 F, wet with water heated to above 70 o F.
 - 1) For units with surface temperatures below 320 F, wet with water heated to above 1300 F.

1.06 SUBMITTALS

- A. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, and masonry accessories.
- B. Samples: Submit two samples of decorative block and facing brick units to illustrate color, texture, and extremes of color range.
- C. Samples for Verification: For the following:
 - 1. Sample boards or boxes of each different exposed masonry unit required, showing the full range of exposed colors, textures, and dimensions to be expected in the completed construction.
 - 2. Full-size units for each different exposed masonry unit required, showing the full range of exposed colors, textures, and dimensions to be expected in the completed construction.
 - 3. Weep holes/vents in color to match mortar color.
 - 4. Accessories embedded in the masonry.
- D. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:
 - 1. Each type of masonry unit required.
 - a. Include size-variation data for brick, verifying that actual range of sizes falls within specified tolerances.
 - 2. Each cement product required for mortar and grout, including name of manufacturer, brand, type, and weight slips at time of delivery.
 - 3. Each material and grade indicated for reinforcing bars.
 - 4. Each type and size of joint reinforcement.
 - 5. Each type and size of anchor, tie, and metal accessory.

1.07 QUALITY ASSURANCE

- A. Testing Agency Qualifications:
 - 1. The Owner will employ an independent agency qualified to perform the testing indicated to verify that the masonry meets the required specification per Chapter 17 of the 2015 International Building Code with KY Amendments. The Owner will be responsible to pay for testing during normal hours of business operation or non-overtime hours. Any testing expense incurred due to overtime work will be paid for by the installing Contractor. The installing Contractor shall notify the testing agency at least 24 hours prior to beginning any work that requires testing. Copies of all reports shall be forwarded to the Owner and Architect.
 - 2. Provide continuous inspection to verify compliance of the following:
 - a. Cleanliness of grout space prior to grouting.
 - b. Placement of grout in reinforced cells.
 - c. Preparation of required grout and mortar specimens.
 - 3. Provide periodic inspection to verify compliance of the following:
 - a. Proportions of site-prepared mortar or grout.
 - b. Construction of mortar joints.
 - c. Quantity, size, location, and support of reinforcing steel.
 - d. Quantity, size, and placement of horizontal joint reinforcement.
 - e. Type, size and location of anchors.
 - f. Protection of masonry during cold or hot weather
 - 4. Verify compressive strength of concrete masonry units, mortar, and coarse grout for every 5,000 sq. ft. of surface area as follows:
 - a. Three (3) concrete masonry units shall be tested in accordance with ASTM C140.
 - b. Six (6) mortar cube specimens shall be tested, three (3) at 7-days and three (3) at 28-days, in accordance with ASTM C109.
 - c. Four (4) coarse grout specimens shall be tested, two (2) at 7-days and two (2) at 28-days, in accordance with ASTM C1019.
 - d. In lieu of individual tests of masonry units, mortar, and grout, perform one (1) prism test (which consists of three prisms) in accordance with ASTM E447.
- B. Fire Rated Assemblies: Conform to applicable code for UL Assembly No. located on the drawings.
- C. 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, through one source from a single manufacturer for each product required.
- D. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source or producer for each aggregate.
- E. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by another means, as acceptable to authorities having jurisdiction.

1.08 MOCK-UP

- A. Construct a masonry wall as a mock-up panel size as provided on the drawing at the end of Section 014000 Quality Requirements, mock-up to include mortar and accessories, structural backup, flashings, and wall insulation.
 - 1. Mockups: Before installing unit masonry, build mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects. Build mockups to comply with the following requirements, using materials indicated for the completed Work.
 - a. Construct mock-up panel as indicated on the drawing following this section of the specifications.

- b. Locate panels in the locations indicated or, if not indicated, as directed by Architect.
- c. Clean exposed faces of panels with masonry cleaner indicated.
- d. Where masonry is to match existing, erect panels adjacent and parallel to existing surface.
- e. Protect approved mockup panels from the elements with weather-resistant membrane.
- f. Maintain sample panels during construction in an undisturbed condition as a standard for judging the completed Work.
- g. Approval of mockup panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing.
 - 1) Approval of mock-up panel does not constitute approval of deviations from the Contract Documents contained in sample panels, unless such deviations are specifically approved by Architect in writing.
- h. Demolish and remove mockup panels when directed.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.
- B. 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.
- 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 aggregates where grading and other required characteristics can be maintained and contamination avoided.
- E. Deliver preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.
- F. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.10 MASONRY PROJECT FORMAN/SUPERINTENDENT CERTIFICATION

A. Both the Masonry Subcontractor Project Foremen and the General Contractor Superintendent shall provide a sworn notarized statement to the Owner and the Architect that the through wall flashing has been fully and installed following industry standards for a permanent watertight integrated system. All means, methods, and labor to perform this integration is fully part of this contract.

PART 2 PRODUCTS

2.01 CONCRETE MASONRY UNITS

- A. Concrete Block: Comply with referenced standards and as follows:
 - 1. Special Shapes: Provide non-standard blocks configured for corners, lintels, headers, control joint edges, jambs, bonding, sash, and other detailed conditions.
 - a. Provide bullnose units for outside corners, unless otherwise indicated.
 - b. Provide solid units at 45 degree angled corners.
 - 2. Size (Width): Manufactured to the following dimensions:
 - a. 4 inches, 3 5/8" actual.
 - b. 6 inches, 5 5/8" actual.
 - c. 8 inches, 7 5/8" actual.

- 12 inches, 11 5/8" actual. d.
- Standard units to have nominal face dimension of 8" x 16" unless otherwise e. indicated.
- 3. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi, but as required to achieve the compressive strength of masonry specified in the structural drawings.
- 4. Non-Load-Bearing and Load-Bearing Units: ASTM C 90, lightweight.
 - Hollow block, as indicated. a.
 - Exposed Faces: Manufacturer's standard color and texture where indicated. b.
- 5. Subject to compliance with requirements, manufacturers offering the following products that may be incorporated into the work include:
 - A. C. Krebs Company a.
 - Lee Brick and Block; www.leebrickandblock.com b.
 - Reading Rock; www.readingrock.com c.
 - Boyle Block/L. Thorn Company; www.boyleblock.com d.
 - Meade Block and Stone; www.meadeconcreteproducts.com e.
 - f. Oberfields LLC; www.oberfields.com
 - Wright Concrete and Construction: www.wrightconcrete.com g.

2.02 CLAY MASONRY UNITS - GENERAL

- A. General: Provide shapes indicated and as follows for each form of brick required:
 - Provide units without cores or frogs and with exposed surfaces finished for ends of sills and 1. caps and for similar applications that would otherwise expose unfinished brick surfaces.
- В. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
 - Provide special shapes for applications where stretcher units cannot accommodate special 1. conditions, including those at corners, movement joints, bond beams, soldier and sailor courses, and turn-backs at window and door sills, jambs, heads and lintels.
 - 2. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.
 - 3. Provide architectural quality brick with finished ends to match face at exposed exterior corners.

2.03 FACE BRICK

- Manufacturers: Subject to compliance with requirements, provide one of the following: A.
 - Basis of Design: Design concept and the drawings indicate the size, profiles, dimensional 1. requirements and aesthetics of the following: a.
 - TBD
- Β. Products by other manufacturers (listed below) may be considered provided deviations in dimensions and profiles are minor and do not change the design concept as judged by the Architect. Additional acceptable manufacturers provided existing brick can be matched include:
 - Equivalent brick matches to the basis of design selection are required to be submitted to 1 Architect for review prior to last addendum for approval.
 - Boral Bricks, Inc: www.boralbricks.com. a.
 - Endicott Clay Products Co: www.endicott.com. b.
 - General Shale Brick: www.generalshale.com. c.
 - Forterra (formerly Hanson Brick): www.forterrabrick.com. d.
 - Sioux City Brick :www.siouxcitybrick.com е
 - Belden Brick:.beldenbrick.com f.
 - Glen-Gery Brick: www.glengerybrick.com g.
 - McAvoy Brick: www.mcavoybrick.com h.
 - Substitutions: See section Division 0; Supplemental Instructions to Bidders; i.
 - Substitution Request During Bidding form.

- C. Facing Brick: ASTM C216, Type FBS Smooth, Grade SW.
 - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 8000 psi.
 - 2. Initial rate of Absorption: Less than 20g/30 sq. in. per minute when tested per ASTM C 67.
 - 3. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
 - 4. All bricks supplied are to be through the body color.
 - 5. Color and texture to match Architect's sample.
 - 6. Nominal Size: Modular; Field Brick 3 1/2 to 3 5/8 inches (89 to 92 mm) wide by 2 1/4 inches (57 mm) high by 7 1/2 to 7 5/8 inches (190 to 194 mm) long.

2.04 MORTAR AND GROUT MATERIALS

- A. Manufacturer: Subject to compliance with requirements, manufacturers offering the following products that may be incorporated into the work include:
 - 1. Standard mortars:
 - a. The Quikrete Companies/Spec Mix Inc.: www.specmix.com
 - b. Cemex; Kosmos Cement: www.cemex.com
 - c. Heidelberg Cement Group; Lehigh Hanson/Essroc; Brixment::
 - www.lehighhanson.com
 - 2. Moisture-Resistant Admixture: Use for all exterior mortars listed above. Water repellent compound designed to reduce capillarity. Admixture for use in mortar at all exterior concrete masonry, brick facing units or any combination included in the project. Concrete masonry products containing integral water repellant by same and/or different manufacturer listed below is acceptable.
 - a. Manufacturer: Subject to compliance with requirements, manufacturers offering the following products that may be incorporated into the work include:
 - 1) W.R. Grace & Co., Construction Products Division; Dry-Block: www.na.graceconstruction.com
 - 2) BASF Construction Chemicals; Rheopel Plus: www.masterbuilders.com
 - 3) RussTech Admixtures, Inc; Russtech Mortarpel-S: www.russtechnet.com
- B. Portland Cement: ASTM C 150, Type I or Type II, except Type III may be used for cold-weather construction.
 - 1. Not more than 0.60 percent alkali.
 - 2. Hydrated Lime: ASTM C 207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 207.
- D. Ready-Mixed Mortar: Materials, water and aggregate complying with requirements specified in this article, combined with set controlling admixtures to produce a ready-mixed mortar complying with ASTM C 270.
- E. Mortar Aggregate: ASTM C 144; except for joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
 - 1. Type as required for mortar to match color mortar selected.
- F. Water: Clean and potable.

2.05 GROUT MATERIALS

- A. Aggregate for Grout: ASTM C 404.
- B. Grout: ASTM C 476. Consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches.
 - 1. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143.

C. Refer to structural sheets for additional grout information.

2.06 REINFORCEMENT AND ANCHORAGE

- A. Manufacturers of Joint Reinforcement and Anchors:
 - 1. Subject to compliance with requirements manufacturers offering the following products that may be incorporated into the work include:
 - a. Dur-O-Wal: www.dur-o-wal.com.
 - b. Heckmann Building Products: www.heckmannbuildingprods.com
 - c. Hohmann & Barnard, Inc (including Dur-O-Wall and Blok-Lok companies): www.h-b.com.
 - d. WIRE-BONDwww.wirebond.com/#sle.
- B. Reinforcing Steel: ASTM A 615/A 615M Grade 60 (420) deformed billet bars; uncoated. Refer to structural drawings for sizes, spacing and placement.
- C. Single Wythe Joint Reinforcement: Truss or ladder type; ASTM A1064/A1064M steel wire, mill galvanized to ASTM A641/A641M, Class 3; 0.1483 inch side rods with 0.1483 inch cross rods; width as required to provide not more than 1 inch and not less than 1/2 inch of mortar coverage on each exposure.
 - 1. Basis of Design: Design concept and the drawings indicate the size, profiles, dimensional requirements and aesthetics of the following:
 - a. Hohmann & Barnard #220 Ladder Type.
 - b. Hohmann & Barnard #120 Truss Type.
- D. Strap Anchors: Bent steel shapes configured as required for specific situations, 1-1/4 in width, 0.105 in thick, lengths as required to provide not more than 1 inch and not less than 1/2 inch of mortar coverage from masonry face, corrugated for embedment in masonry joint, hot dip galvanized to ASTM A 153/A 153M, Class B.
- E. Partition Anchors: Load Bearing to Load Bearing Wall Connection: Steel, ASTM A 366; ASTM A 36, 3/16 inch or greater, hot dip galvanized after fabrication to ASTM A 153/153M, Class B. Anchor to be 1/4 inch thickness, 1-1/2 inch width.
 - 1. Basis of Design: Design concept and the drawings indicate the size, profiles, dimensional requirements and aesthetics of the following:
 - a. Hohmann & Barnard #344 Rigid Partition Anchor.
- F. Wall Ties: Non-Load Bearing to Non-Load Bearing and Non-Load Bearing to Load Bearing Wall Connection: Steel, ASTM A 366; ASTM A 36, 3/16 inch or greater, hot dip galvanized after fabrication to ASTM A 153/153M, Class B. Mesh to be 1/2 inch square x 16 gage..
 - 1. Basis of Design: Design concept and the drawings indicate the size, profiles, dimensional requirements and aesthetics of the following:
 - a. Hohmann & Barnard #MWT Mesh Wall Tie.
- G. Chase Wall Veneer Channel Anchor with Continuous Wire: Install at 4 inch CMU walls over 8 feet in height AFF: Steel, ASTM A 366; ASTM A 36, 3/16 inch or greater, hot dip galvanized after fabrication to ASTM A 153/153M, Class B. Anchor length - refer to wall type, 1-1/4 inch width, 9 gauge continuous wire, 12 gauge anchors and channels. Install at maximum 6 foot AFF increments and 24 inch on center horizontally, for length of wall.
 - 1. Basis of Design: Design concept and the drawings indicate the size, profiles, dimensional requirements and aesthetics of the following:
 - a. Hohmann & Barnard #360 Gripstay Channel and #364-SV Seismic-Notch Gripstay Anchor.
- H. Masonry Veneer Anchors: 2-piece anchors that permit differential movement between masonry veneer and structural cast-in-place concrete backup, hot dip galvanized to ASTM A 153/A 153M, Class B.

- 1. Single screw veneer tie: Dual diameter barrels with EPDM washers to seal both the insulation face and air/vapor barrier and #14 screw, designed for fastening to structural backup through sheathing.
- 2. Wire ties: Trapezoidal shape, 0.1875 inch thick.
- 3. Vertical adjustment: Not less than 1 inches.
- 4. Basis of Design: Design concept and the drawings indicate the size, profiles, dimensional requirements and aesthetics of the following:
 - a. Hohmann & Barnard Concrete Seal Tie.
 - b. Heckman Building Products Pos-I-Tie Brick Veneer Anchoring System with Concrete Screw.
 - c. Wire-Bond Sure Tie Anchoring System with Concrete Tapcon
- I. Joint Stabilizing Anchors: Dur-O-Wal DA2200 or equivalent.
- J. Grout Screen Stop: Dur-O-Wal grout screen stop or equivalent.
- K. Anchor Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153, Class C; of diameter and length indicated and in the following configurations: Headed Bolts.

2.07 FLASHINGS

- A. Rubberized Asphalt Flashing: Self-adhering polymer-modified asphalt sheet; 40 mil minimum total thickness; with cross-linked polyethylene top and bottom surfaces, 18 inch wide roll minimum.
 - 1. For flashing not exposed to the exterior.
 - Due to the UV sensitivity of flexible flashings all flashings, after installation, must be permanently covered within a reasonable amount of time, not to exceed 30 days.
 a. Product is not to be installed where it would be exposed to sunlight.
 - 3. Manufacturers: Subject to compliance with requirements manufacturers offering the following products that may be incorporated into the work include:
 - a. Grace Construction; Product Perm-A-Barrier.
 - b. Hohmann & Barnard; Product Textroflash.
 - c. Dayton Superior; Product Dur-O-Wal.
 - d. IPCO Illinois Products Corporation; Product Self-Adhesive Rubberized Asphalt Flashing: www.illinoisproducts.com
 - e. Mortar-Net USA: www.mortarnet.com
 - f. Advanced Building Products; Product Strip-n- Flash: www.advancedflashing.com
 - g. DuPont: Product Thru-Wall Flashing: www.Construction.Tyvek.com
 - h. BASF: Product Enershield TWF: www.enershield.basf.com
 - i. Wire Bond: Product Aqua Flash 500: www.wirebond.com
 - j. York Flashings: www.yorkmfg.com
- B. Additional flashing system components:
 - 1. Primer, adhesives and seam tape: Provide materials as required by the manufacturer for proper adhesion on the cmu, bituminous dampproofing, fiberglass faced gypsum sheathing, or other substrate.
 - 2. Thru-Wall Flashing Support/Cavity Bridge: "L" shaped, type 304, 27 gauge stainless steel cavity bridge to provide positive support of self-adhered flexible thru-wall flashing across cavity openings. Size to specified cavity wall thickness. Secure to substrate with fasteners through pre-drilled holes.
 - a. Basis of Design: Design concept and the drawings indicate the size, profiles, dimensional requirements and aesthetics of the following:
 - IPCO Illinois Products Corporation; Product Type "L" Cavity Bridge: www.illinoisproducts.com
- C. Flashing Bracket: Contractor's option to use flashing bracket system above openings at exterior metal stud and sheathing walls to receive sprayed-in-place thermal insulation.

- 1. Basis of Design: Design concept and the drawings indicate the size, profiles, dimensional requirements and aesthetics of the following:
 - a. Flash Track Systems, Inc.: Products Flash Trac Wall Bracket, Retaining Rod, External & Internal Corner Returns, and Alignment Clips: www.flashtracsystems.com
- 2. After exterior sheathing has been installed, install flashing brackets continuously along all horizontal locations to receive flashing, using self-tapping fasteners compatible with the sheathing/studs.
- 3. Install flexible flashing after all sprayed-in-place thermal insulation has been applied.

2.08 ACCESSORIES

- A. Preformed Control Joints: Rubber material. Provide with corner and tee accessories, fused joints.
 - 1. Manufacturers: Subject to compliance with requirements manufacturers offering the following products that may be incorporated into the work include:
 - a. Dur-O-Wal: www.dur-o-wal.com.
 - b. Hohmann & Barnard, Inc: www.h-b.com/#sle.
 - c. MasonPro, Inc: www.masonpro.com
 - d. WIRE-BOND: www.wirebond.com/#sle.
- B. Compressible Filler: Cut to fit or premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene, urethane, EPDM, or PVC.
 - 1. Install at tops of non-rated, non-load-bearing CMU walls running perpendicular or parallel to the metal deck . Place a bead of caulk 1/2 inch back from flute opening and on all sides of flute. Compress plug and slide into place.
 - a. Perpendicular to metal deck: Williams Products Inc. EVA 200G or 3000 Series Closure Flute Plugs or Strips: www.williamsproducts.net.
 - Closed Cell plugs and strips per ASTM D-1171, ASTM D-925, ASTM D-412. Density: 12.8 lbs/ft
- C. Bond Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type 1 (No. 15 asphalt felt.)
- D. Cavity Mortar Control: Semi-rigid polyethylene or polyester mesh panels, thickness sized to fit the wall cavity air space, height to be minimum 10 inches, and design to prevent mortar droppings from clogging weeps and cavity vents and allow proper cavity drainage.
 - 1. Mortar Diverter: Semi-rigid mesh designed for installation at flashing locations.
 - a. Manufacturers: Subject to compliance with requirements manufacturers offering the following products that may be incorporated into the work include:
 - 1) Advanced Building Products IncMortar Break:
 - www.advancedflashing.com.
 - 2) Hohmann & Barnard, Inc: Mortar Trap : www.h-b.com
 - IPCO Illinois Products Corporation; Product Mortar Grab: www.illinoisproducts.com
 - 4) Keene Building Envelope Products: KeeneStone Cut: www.keenebuilding.com
 - 5) MasonPro, Inc; ProNet: www.masonpro.com
 - 6) Mortar Net USA, LtdWallDefender: www.mortarnet.com.
 - 7) Archovations,Inc; Cavclear Masonry Mat.
 - 8) Sandell Manufacturing/Hohmann & Barnard Company; Mortar Web: www.h-b.com
 - 9) Mason Pro; ProNet: www.masonpro.com
 - 10) Wire Bond: Cavity Net DT: www.wirebond.com
- E. Weeps: Polyethylene tubing.Contractors option to use either cotton rope or polyethylene tubing.
- F. Type: Molded PVC grilles, insect resistant.

- 1. Provide polyester mesh or cellular, honeycomb polypropylene cavity vents.
 - a. Size: 3/8" x 2 1/2" x 3 5/8".
 - b. Vents to be impervious to water and resistant to UV degradation.
 - c. Color: Architect to select from manufacturers standard color choices. Minimum six colors.

2.09 MASONRY CLEANERS

- A. Cleaning Solution: Consult with brick manufacturer for recommended cleaning procedure and products. Masonry Contractor to match the cleaning method and cleaning solution to the type of brick and type of stain.
 - 1. Prepared solutions: Non-acidic, low odor, water-rinsable solution for use in the final clean up of new masonry.
 - a. Manufacturer: Subject to compliance with requirements, manufacturers offering the following products that may be incorporated into the work include:
 - 1) Carlisle Coatings and Waterproofing: SimpleKleen Heavy Duty: www.carlisleccw.com
 - 2) Diedrich Technologies: 202 New Masonry Detergent: www.diedrichtechnologies.com
 - 3) EaCoChem; NMD 80: www.eacochem.com
 - 4) Miracle Sealants Company: Liquid Poultice: www.miraclesealants.com
 - 5) Price Research Limited: Price Non-Acidic Masonry Cleaner: www.priceresearchltd.com
 - 6) Prosoco: Safety Klean: www.prosoco.com

2.10 MORTAR AND GROUT MIXING

- A. Mortar for Unit Masonry: ASTM C270, using the Property Specification.
 - 1. Extended Life Mortar for Unit Masonry: Mortar complying with ASTM C 1142 may be used instead of mortar specified above at contractor's option.
 - 2. Limit cementitious materials in mortar to portland cement and lime.
 - 3. Loadbearing concrete masonry units below grade and in contact with earth: Type M.
 - 4. Loadbearing concrete masonry units above grade: Type S.
 - 5. Exterior, non-loadbearing masonry veneer units: Type N.
 - 6. Interior, loadbearing concrete masonry units: Type S.
 - 7. Interior, non-loadbearing concrete masonry units: Type N.
 - 8. Interior, non-loadbearing masonry veneer units: Type N.
- B. Mixing: Use mechanical batch mixer and comply with referenced standards.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive masonry.
- B. Verify that related items provided under other sections are properly sized and located.
- C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.02 PREPARATION

- A. Direct and coordinate placement of metal anchors supplied for installation under other sections.
- B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.03 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.
- B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
- C. Concrete Masonry Units:
 - 1. Bond: Running.
 - 2. Coursing: One unit and one mortar joint to equal 8 inches.
 - 3. Mortar Joints: Concave.
- D. Brick Units:
 - 1. Bond: Running.
 - 2. Coursing: Three units and three mortar joints to equal 8 inches.
 - 3. Mortar Joints: Concave.
- E. Cut joints flush for masonry walls to be concealed or to receive plaster or other direct applied finishes (other than paint), unless indicated otherwise.
- F. Walls to receive ceramic wall tile shall have flush struck joints. Any wall found to be unacceptable by the ceramic tile installer will be corrected to meet specified tolerances.

3.04 PLACING AND BONDING

- A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.
- B. Lay hollow masonry units with face shell bedding on head and bed joints.
- C. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.
- D. Remove excess mortar and mortar smears as work progresses.
- E. Interlock intersections and external corners.
- F. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
- G. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
- H. Cut mortar joints flush where wall tile is scheduled or resilient base is scheduled.
- I. Isolate masonry partitions from vertical structural framing members with a control joint as indicated.
- J. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.

3.05 WEEPS AND CAVITY VENTS

- A. Install weeps in vertical head joints in exterior veneer and cavity walls at 24 inches on center horizontally above through-wall flashing, above shelf angles and lintels, at bottom of walls, and above windows, doors, louvers or any other horizontal obstruction of the cavity wall.
- B. Install cavity vents in vertical head joints in exterior veneer and cavity walls at 24 inches on center horizontally above and below shelf angles, above lintels, near tops of walls (coordinate top of wall location with coping/fascia or other roof edge covering) and above all openings with through-wall flashing. Also install at the bottom of any seat, screen and/or retaining walls without through-wall flashing.
- C. Weeps and cavity vents to be alternated at 24 inches on center.
- D. Depending on weep material used:
 - 1. Install cotton wicking through masonry veneer face and turn 8 to 10 inches up, into the cavity, above the height of any mortar droppings. Secure cotton wicking to substrate without

penetrating any through wall flashing membrane. Trim cotton wicking material used in weep holes flush with outside face of wall after mortar has set.

2. Install plastic tubes at an angle in the head joint mortar. Remove plastic tubes used in weep holes from wall after mortar has set.

3.06 CAVITY MORTAR CONTROL

- A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.
- B. For cavity walls, build inner wythe ahead of outer wythe to accommodate accessories.
- C. Install cavity mortar diverter at base of cavity and at other flashing locations as recommended by manufacturer to prevent mortar droppings from blocking weep/cavity vents.
- D. Coat cavity face of backup wythe to comply with Division 7 Section "Bituminous Dampproofing".

3.07 CAVITY WALL INSULATION

A. Sprayed-In-Place Insulation: Comply with Division 7 section "Building Insulation".

3.08 REINFORCEMENT AND ANCHORAGE - GENERAL, SINGLE WYTHE MASONRY, and CAVITY WALL MASONRY

- A. Unless otherwise indicated on drawings or specified under specific wall type, install horizontal joint reinforcement 16 inches on center.
- B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.
- C. Place continuous joint reinforcement in first and second joint below top of walls.
- D. Lap joint reinforcement ends minimum 6 inches.
- E. Reinforce stack bonded unit joint corners and intersections with strap anchors 16 inches on center.
- F. Fasten anchors to structural framing and embed in masonry joints as masonry is laid. Unless otherwise indicated on drawings or closer spacing is indicated under specific wall type, space anchors at maximum of 36 inches horizontally and 24 inches vertically.

3.09 REINFORCED UNIT MASONRY INSTALLATION

- A. Temporary Formwork and Shores: Construct formwork and shores to support reinforced masonry elements during construction.
 - 1. Construct formwork to conform to shape, line, and dimensions shown. Make it 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 temporary loads that may be placed on them during construction.
- B. Placing reinforcement: Refer to Division 5 sections for requirements.

3.10 REINFORCEMENT AND ANCHORAGE - SINGLE WYTHE MASONRY

- A. Install horizontal joint reinforcement 16 inches on center.
- B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.
- C. Place continuous joint reinforcement in first and second joint below top of walls.
- D. Lap joint reinforcement ends minimum 6 inches.

3.11 REINFORCEMENT AND ANCHORAGE - MASONRY VENEER

- A. Install horizontal joint reinforcement 16 inches on center.
- B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.
- C. Place continuous joint reinforcement in first and second joint below top of walls.
- D. Lap joint reinforcement ends minimum 6 inches.
- E. Masonry Back-Up: Embed anchors to bond veneer at maximum 16 inches on center vertically and 36 inches on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches on center.
- F. Stud Back-Up: Secure veneer anchors to stud framed back-up and embed into masonry veneer at maximum 16 inches on center vertically and 24 inches on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches on center.

3.12 REINFORCEMENT AND ANCHORAGES - CAVITY WALL MASONRY

- A. Install horizontal joint reinforcement 16 inches on center.
- B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of openings.
- C. Place continuous joint reinforcement in first and second joint below top of walls.
- D. Lap joint reinforcement ends minimum 6 inches.
- E. Fasten anchors to structural framing and embed in masonry joints as masonry is laid. Space anchors at maximum of 24 inches horizontally and 16 inches vertically.

3.13 MASONRY THROUGH-WALL FLASHINGS

- A. Install through wall flashing above metal step flashings and reglets, shelf angles and lintels, at bottoms of walls, and above windows, doors, louvers or any other horizontal obstruction of the exterior cavity wall.
- B. Whether or not specifically indicated, install masonry through wall flashing to divert water to exterior at all locations where downward flow of water will be interrupted.
 - 1. Extend flashings full width at such interruptions and at least 6 inches, minimum, into adjacent masonry or turn up flashing ends at least 1 inch, minimum, to form watertight pan at non-masonry construction.
 - 2. Remove or cover protrusions or sharp edges that could puncture flashings.
 - 3. Seal lapped ends and penetrations of flashing before covering with mortar.
- C. Where sprayed-in-place thermal insulation will not be installed, secure through wall flashing to substrate with a continuous termination bar. Install continuous sealant at the intersection of the through wall flashing and termination bar.
- D. Extend flashing to the face of the masonry veneer.
- E. Lap end joints of flashings at least 6 inches, minimum, and seal watertight with flashing sealant/adhesive.

3.14 LINTELS

- A. Refer to structural drawings for lintel sizes and additional requirements.
- B. Install loose steel lintels over openings.

- C. Install reinforced unit masonry lintels over openings where steel or precast concrete lintels are not scheduled.
- D. Provide 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.
- E. Provide minimum bearing of 8 inches at each jamb, unless indicated otherwise.

3.15 GROUTED COMPONENTS

- A. Refer to the structural specifications and drawings for additional requirements on grouted masonry.
- B. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.
- C. Place and consolidate grout fill without displacing reinforcing.
- D. At bearing locations, fill masonry cores with grout for a minimum 12 inches either side of opening.
- E. Grouting: Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist grout pressure.
 - 1. Comply with requirements of ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.

3.16 CONTROL AND EXPANSION JOINTS

- A. Do not continue horizontal joint reinforcement through control or expansion joints.
- B. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.
- C. Form expansion joint as detailed on drawings.

3.17 BUILT-IN WORK

- A. As work progresses, install built-in metal door frames and glazed frames and other items to be built into the work and furnished under other sections.
- B. Install built-in items plumb, level, and true to line.
- C. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout.
 - 1. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.
- D. Do not build into masonry construction organic materials that are subject to deterioration.
- E. Install reglets and nailers for flashing and other related construction where they are shown to be built in to masonry.

3.18 TOLERANCES

- A. Maximum Variation from Alignment of Columns: 1/4 inch.
- B. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.
- C. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.
- D. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.
- E. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.
- F. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch.
- G. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.

- H. Maximum Variation for exposed head joints thickness: 1/8 inch.
- I. Maximum Variation for vertical alignment of exposed head joints: 1/4 inch in 10 feet.
- J. Maximum Variation for exposed bed joints thickness: 1/8 inch.
- K. Maximum Variation for conspicuous horizontal lines: 1/4 inch in 20 feet.
- L. Maximum Variation for conspicuous vertical lines: 1/4 inch in 20 feet

3.19 CUTTING AND FITTING

- A. Cut and fit for chases, pipes, conduit, sleeves, and grounds. Coordinate with other sections of work to provide correct size, shape, and location.
- B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.20 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 014000 - Quality Requirements.

3.21 REPAIRING AND POINTING

- 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.
- C. Damaged or chipped concrete masonry units that do not meet the requirements of ASTM C90 for the concrete masonry unit should not be installed. Repair chips, cracks, and other surface damage when visible as viewed in normal lighting conditions at 20 feet. If units incur damage during installation or by other trades, patching of the units shall be with materials compatible with the concrete mix provided in the concrete masonry unit. Provide a finished patch surface texture similar in texture to the concrete masonry unit face being repaired. Do not provide a smooth texture that will result in highlighting the patch when the final paint coats have cured. Patching and repair should be undetectable. Masonry patching by the general contractor, gypsum drywall, painting, or other subcontractor with an incompatible repair product will not be approved.

3.22 IN-PROGRESS CLEANING

- A. Remove excess mortar and mortar droppings. Clean masonry work as the work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- B. Replace defective mortar. Match adjacent work.

3.23 FINAL CLEANING

- A. Comply with guidelines in Brick Industry Association Technical Note #20 Cleaning Brickwork.
- B. Remove excess mortar and mortar droppings.
- C. Replace defective mortar. Match adjacent work.
- D. Clean soiled surfaces with cleaning solution.
- E. Use non-metallic tools in cleaning operations. Remove large mortar particles by hand with wooden paddles.

- F. Test cleaning methods on mock-up wall panel; leave one half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with final cleaning of masonry.
- G. Protect adjacent non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
- H. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing the surfaces thoroughly with clear water.
- I. Clean brick by bucket and brush hand cleaning method or by pressure sprayer using lowest possible pressure for effective cleaning, as described in BIA Technical Note #20.
- J. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2 applicable to type of stain on exposed surfaces. Dry brush walls at the end of each day's work and after final pointing to remove mortar spots and droppings.

3.24 PROTECTION

A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

END OF SECTION 042000

SECTION 047200 - CAST STONE MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Architectural cast stone.

1.02 RELATED REQUIREMENTS

- A. Section 042000 UNIT MASONRY: Installation of cast stone in conjunction with masonry.
- B. Section 079005 Joint Sealers: Materials and execution methods for sealing soft joints in cast stone work.

1.03 REFERENCE STANDARDS

- A. ACI 318 Building Code Requirements for Structural Concrete and Commentary; 2011.
- B. ASTM A185/A185M Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete; 2007.
- C. ASTM A615/A615M Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement; 2015.
- D. ASTM C33/C33M Standard Specification for Concrete Aggregates; 2013.
- E. ASTM C150/C150M Standard Specification for Portland Cement; 2015.
- F. ASTM C173 Standard Test Method for Air Content of Freshly Mixed Concrete by the Volume Method.
- G. ASTM C231 Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
- H. ASTM C260 Standard Specification for Air-Entrained Admixtures for Concrete.
- I. ASTM C270 Standard Specification for Mortar for Unit Masonry; 2014a.
- J. ASTM C494/C494M Standard Specification for Chemical Admixtures for Concrete; 2013.
- K. ASTM C618 Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
- L. ASTM C666 Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing.
- M. ASTM C979/C979M Standard Specification for Pigments for Integrally Colored Concrete; 2010.
- N. ASTM C989 Standard Specification for Ground Granulated Blast Furnace Slag for Use in Concrete.
- O. ASTM C1194 Standard Test Method for Compressive Strength of Architectural Cast Stone.
- P. ASTM C1195 Standard Test Method for Absorption of Architectural Cast Stone.
- Q. ASTM C1364 Standard Specification for Architectural Cast Stone; 2010b.
- R. ASTM D2244 Standard Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.
- S. Cast Stone Institute Technical Manual; Current Edition.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

- B. Manufacturer's Qualification Data: Documentation showing compliance with specified requirements.
- C. Product Data: Test results of cast stone components made previously by the manufacturer.
- D. Shop Drawings: Include elevations, dimensions, layouts, profiles, cross sections, reinforcement, exposed faces, arrangement of joints, anchoring methods, anchors, and piece numbers.
- E. Certification: Submit valid Cast Stone Institute Plant Certification.
- F. Warranty: Submit Cast Stone Institute Member Warranty.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver cast stone components secured to shipping pallets and protected from damage and discoloration. Protect corners from damage.
- B. Number each piece individually to match shop drawings and schedule.
- C. Store cast stone components and installation materials in accordance with manufacturer's instructions.
- D. Store cast stone components on pallets with nonstaining, waterproof covers. Ventilate under covers to prevent condensation. Prevent contact with dirt.
- E. Protect cast stone components during handling and installation to prevent chipping, cracking, or other damage.
- F. Store mortar materials where contamination can be avoided.
- G. Schedule and coordinate production and delivery of cast stone components with unit masonry work to optimize on-site inventory and to avoid delaying the work.

1.07 WARRANTY

A. Cast Stone Institute Member Warranty: CSI member warrants that its manufactured architectural cast stone will correspond in all material respects to the specifications and will be free from defects in material and workmanship for ten (10) years from the date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Architectural Cast Stone:Subject to compliance with requirements, manufacturers offering the following products that may be incorporated into the work include;
 - 1. Advanced Cast Stone: www.advancedcaststone.com
 - 2. ACS Architectural Cast Stone: www.triadcompanies.com
 - 3. Capitol Cast Stone: www.capitolcaststone.com
 - 4. Continental Cast Stone Manufacturing: www.caststone.net
 - 5. County Materials Corporation; Heritage Cast Stone: www.countymaterials.com
 - 6. Custom Cast Stone: www.customcaststone.com
 - 7. Edwards Cast Stone Company: www.edwardscaststone.com
 - 8. MidWest Cast Stone: ww.midwestcaststone.com

2.02 ARCHITECTURAL CAST STONE

- A. Architectural concrete product manufactured to simulate appearance of natural limestone, complying with ASTM C1364.
 - 1. Compressive Strength: ASTM C 1194: 6,500 psi minimum for products at 28 days.

- 2. Absorption: ASTM C 1195: 6% maximum for cold water method, or 10% maximum by the boiling method for products at 28 days.
- 3. Air Content: ASTM C 173 or C 231, for wet cast product shall be 4 8 % for units exposed to freeze-thaw environments. Air entrainment is not required for VDT products.
- 4. Freeze-Thaw Resistance: Demonstrated by laboratory testing in accordance with ASTM C 1364. The CPWL shall be less than 5% after 300 cycles of freezing and thawing.
- 5. Linear Shrinkage: ASTM C 426, shrinkage shall not exceed 0.065%
- 6. Surface Texture: Fine grained texture similar to natural stone, with no bugholes, air voids in excess of 1/32 inch and the density of such voids shall be less than 3 occurences per any 1 inch squared, or other surface blemishes not obviously visible in direct daylight illumination from distance of 5 feet.
 - a. Minor chipping resulting from shipment and delivery shall not be obvious under direct daylight illumination from a 20 foot distance.
 - b. Location: wall caps, water tables, column surrounds.
 - c. Refer to the drawings for sizes.
- 7. Surface Texture: Smooth.
- 8. Color: Selected by Architect from manufacturer's full range.
- 9. Remove cement film from exposed surfaces before packaging for shipment.
- B. Shapes: Provide shapes indicated on drawings.
 - 1. Variation from Any Dimension, Including Bow, Camber, and Twist: Maximum of plus/minus 1/8 inch or length divided by 360, whichever is greater, but not more than 1/4 inch.
 - 2. Unless otherwise indicated on drawings, provide:
 - a. Wash or slope of 1:12 on exterior horizontal surfaces.
 - b. Drips on projecting components, wherever possible.
- C. Reinforcement: Provide reinforcement as required to withstand handling and structural stresses; comply with ACI 318.
 - 1. Reinforcement shall be noncorrosive where faces exposed to weather are covered with less than 1.5 inches of concrete material. All reinforcement shall have minimum coverage of twice the diameter of the bars.
 - 2. Units greater than 24 inches in one direction shall be reinforced in that direction. Units less than 24 inches in both their length and width dimension shall be non-reinforced unless otherwise specified.
 - 3. Welded wire fabric shall not be used in dry cast products.

2.03 MATERIALS

- A. Portland Cement: ASTM C150/C150M.
 - 1. For Units: Type I or II, white.
 - 2. For Mortar: Type I or II, except Type III may be used in cold weather.
- B. Coarse Aggregate: ASTM C33/C33M, except for gradation; granite, quartz, or limestone.
- C. Fine Aggregate: ASTM C33/C33M, except for gradation; natural or manufactured sands.
- D. Pigments: ASTM C979, inorganic iron oxides; do not use carbon black.
- E. Admixtures: Comply with the following:
 - 1. ASTM C 260 for air-entraining admixtures.
 - 2. ASTM C494/C494M Types A G for water reducing, retarding, accelerating and high range admixtures.
 - 3. ASTM C 989 granulated blast furnace slag may be used to improve physical properties. tests are required to verify these features.
- F. Water: Potable.

- G. Reinforcing Bars: ASTM A615/A615M deformed bars, Grade 40 or 60 steel galvanized or epoxy coated where cover is less than 1.5 inches.
- H. Steel Welded Wire Reinforcement: ASTM A185/A185M, galvanized or epoxy coated where applicable for wet cast units.
- I. Embedded Anchors, Dowels, and Inserts: Type 304 stainless steel, of type and size as required for conditions.
- J. Mortar: Portland cement-lime, ASTM C270, Type N; do not use masonry cement.
- K. Sealant: As specified in Section 079005.
- L. Cleaner: General-purpose cleaner designed for removing mortar and grout stains, efflorescence, and other construction stains from new masonry surfaces without discoloring or damaging masonry surfaces; approved for intended use by cast stone manufacturer and by cleaner manufacturer for use on cast stone and adjacent masonry materials.

2.04 CURING

- A. Cure units in a warm curing chamber approximately 100 degrees F at 95% relative humidity for approximately 12 hours or cure in a 95% moist environment at a minimum 70 degrees F for 16 hours after casting.
- B. Additional yard curing at 95% relative humidity shall be 350 degree-days or 5 days at 70 degrees F prior to shipping.
- C. Form cured units shall be protected from moisture evaporation with curing blankets or curing compounds after casting.

2.05 FABRICATION

- A. Cross section dimensions shall not deviate by more than 1/8 inch +/- from approved dimensions.
- B. Length of units shall not deviate by more than length/360 or 1/8 inch +/-, whichever is greater, not to exceed 1/4 inch.
 - 1. Maximum length of any unit shall not exceed 15 times the average thickness of such unit.
- C. Warp, bow or twist if units shall not exceed /360 or 1/8 inch +/-, whichever is greater.
- D. Location of dowel holes, anchor slots, flashing grooves, false joints and similar features: On formed sides of unit, 1/8 inch, on unformed sides of unit, 3/8 inch maximum deviation.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine construction to receive cast stone components. Notify Architect if construction is not acceptable.
- B. Do not begin installation until unacceptable conditions have been corrected.

3.02 INSTALLATION

- A. Install cast stone components in conjunction with masonry, complying with requirements of Section 042000.
- B. Setting:
 - 1. Drench cast stone components with clear, running water immediately before installation.
 - 2. Set units in a full bed of mortar unless otherwise indicated.
 - 3. Fill vertical joints with mortar.
 - 4. Fill dowel holes and anchor slots completely with mortar or non-shrink grout.

3.03 CLEANING

- A. Clean completed exposed cast stone after mortar is thoroughly set and cured.
 - 1. Wet surfaces with water before applying cleaner.
 - 2. Apply cleaner to cast stone in accordance with manufacturer's instructions.
 - 3. Remove cleaner promptly by rinsing thoroughly with clear water.
 - 4. Do not use acidic cleaners.

3.04 PROTECTION

A. Protect completed work from damage.

B. Clean, repair, or restore damaged or mortar-splashed work to condition of new work. **END OF SECTION 047200**

SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.1 RELATED SECTIONS

- A. Division 1 Sections
- B. Section 052100 Steel Joist Framing.
- C. Section 053100 Steel Decking.

1.2 REFERENCES

AISC – Steel Construction Manual, 13th Edition.

AISC 303 - Code of Standard Practice for Steel Buildings and Bridges.

AISC 341-05 - Seismic Provisions for Structural Steel Buildings, including Supplement No. 1 dated 2006.

AISC 360-05 – Specification for Structural Steel Buildings.

AISC – Specification for Structural Joints Using ASTM A325 or A490 Bolts prepared by the Research Council on Structural Connections.

AWS D1.1 – Structural Welding Code.

AWS A5.1 – Specification for Carbon Steel Electrodes for Shield Metal Arc Welding.

AWS A5.5 - Specification for Low-Alloy Steel Covered Arc Welding Electrodes.

AWS A5.17 - Specification for Carbon Steel Electrodes and Fluxes for Submerged Arc Welding.

AWS A5.20 - Specification for Carbon Steel Electrodes for Flux Cored Arc Welding.

SSPC - Steel Structures Painting Manual.

ASTM A6 – Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling.

ASTM A36 - Standard Specification for Carbon Structural Steel.

ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

ASTM A307 – Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

ASTM A325 – Standard Specification for Structural Bolts, Heat Treated, 120/105 KSI Minimum Tensile Strength.

ASTM A490 – Standard Specification for Structural Bolts, Alloy Steel, Heat-Treated, 150 KSI Minimum Tensile Strength.

ASTM A500 – Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

ASTM A501 – Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.

ASTM A563 – Standard Specification for Carbons and Alloy Steel Nuts

ASTM A572 – Standard Specification for High-Strength Low-Alloy Columbium Vanadium Structural Steel.

ASTM A780 – Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.

ASTM A992 – Standard Specification for Structural Steel Shapes.

ASTM F436 – Standard Specification for Hardened Steel Washers.

ASTM F844 - Standard Specification for Washers, Steel, Plain (Flat), Unhardened for General Use.

ASTM F1554 – Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-Ksi Yield Strength.

ASTM F1852 – Standard Specification for "Twist Off" Type Tension Control Structural Bolt/Nut/Washer Assemblies, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.

1.3 SUBMITTALS

- A. Refer to Structural Quality Assurance Plan in the Structural Drawings for additional submittal requirements.
- B. Shop Drawings:
 - 1. Contact Structural Engineer's Construction Administrator prior to detailing structural steel shop drawings.
 - 2. Shop drawings shall be submitted on a 24" x 36" sheet minimum.
 - 3. Shop drawings shall clearly indicate the profiles, sizes, ASTM Grade, spacing and locations of structural steel members, including connections, attachments, anchorages, framed openings, sizes and types of fasteners, method of tightening fasteners, cambers, and the number, type and spacing of the stud shear connectors and headed studs.
 - 4. Beam sizes shall be shown on the erection drawings (plans).
 - 5. Submit shop drawings for review.
 - 6. Reproduction of Structural Drawings for shop drawings is not permitted. Electronic drawing files will not be provided to the Contractor.
- C. Maintain at construction office written welding procedures for each type of welded joint used in accordance with AWS D1.1.
- D. Submit certification that the fabricator meets the required qualifications and ultrasonic testing reports for complete penetration welds. If fabricator has an independent testing agency inspect fabrication as required by these specifications, submit the name and qualifications of the independent testing agency.
- E. Upon request, submit the erection sequence and procedures to be used by the steel erector.

1.4 QUALITY ASSURANCE

A. Refer to the Structural Quality Assurance Plan in the Structural Drawings.

1.5 FABRICATOR'S QUALIFICATIONS

A. Steel fabricator shall meet the requirements in the Structural Quality Assurance Plan in the Structural Drawings.

1.6 STORAGE

A. Store materials off ground to permit easy access for inspection and identification. Store steel members and packaged items in a manner that provides protection against contact with deleterious materials.

PART 2 PRODUCTS

2.1 ANCHOR RODS

- A. Anchor Rods: Headed rod or a threaded rod with a heavy hexagonal nut and plate washer welded to the bottom of the threaded rod conforming to ASTM F1554.
- B. Nuts and Washers: Two hexagonal nuts and two plate washers conforming to ASTM A36 for each anchor rod assembly.

2.2 ROLLED STEEL SHAPES, PLATES, AND BARS

A. Rolled Steel Shapes, Plates, and Bars: ASTM A36; ASTM A572, Grade 50; or ASTM A992 as indicated by the Structural Drawings. ASTM A572, Grade 50 may be substituted for ASTM A992.

2.3 ROUND STRUCTURAL STEEL TUBING

A. Round Structural Steel Tubing: ASTM A501, 36 ksi minimum yield strength.

2.4 SHAPED STRUCTURAL STEEL TUBING

A. Shaped Structural Steel Tubing: ASTM A500, Grade B, 46 ksi minimum yield strength.

2.5 NON-HIGH-STRENGTH FASTENERS

- A. Non-High-Strength Bolts: ASTM A307, Grade A, 60 ksi minimum, where noted on the Structural Drawings.
- B. Hardened Steel Washers: ASTM F436.

2.6 HIGH-STRENGTH FASTENERS

- A. High-Strength Bolts: ASTM A325 or ASTM A490 as noted on the Structural Drawings. 3/4-inch minimum diameter.
- B. Hardened steel washers shall conform to ASTM F436.
- C. Spline-Type Tension Control Bolts: ASTM spline-type tension control bolts with plain hardened washers and suitable nuts are an acceptable alternate design bolt assembly.

D. Do not use load indicating washers.

2.8 HEADED STUDS

A. Headed Studs: Comply with AWS D1.1. Provide studs with the diameter shown on the Structural Drawings.

2.9 EXPANSION ANCHORS

A. Expansion Anchors: See Structural Notes.

2.10 ADHESIVE ANCHORS

A. Adhesive Anchors: See Structural Notes.

2.11 SCREW ANCHORS

A. Screw Anchors: See Structural Notes.

2.12 WELD ELECTRODES

- A. Weld Electrodes: AWS A5.1, A5.5, A5.17, or A5.20 E-70 series low hydrogen electrodes.
- B. Provide E-70 series, low hydrogen electrodes with a minimum Charpy V-Notch (CVN) toughness of 20 ft.lb. at -20 degrees Fahrenheit and 40 ft.-lb. at 70 degrees Fahrenheit for demand critical welds. Refer to the Structural Drawings for locations of demand critical welds.
- C. Properly store electrodes to maintain flux quality.

2.13 PAINT

- A. Oxide Primer: AISC Specifications, Code of Standard Practice, and SSPC Steel Structure Painting Manual, unless indicated otherwise.
- B. Paint Primer: Free of lead and chromate and comply with State and Federal volatile organic compound (VOC) requirements.
- C. Paint Primer: Compatible with finish coating.

2.14 GALVANIZE

- A. Galvanized Coating: ASTM A123.
- B. Galvanize Bolts, Nuts, and Washers: ASTM A153 when used to connect steel members that are specified to be galvanized.
- C. Expansion Anchors, Adhesive Anchors, or Screw Anchors: Where specified to be galvanized, anchors shall be mechanically galvanized in accordance with ASTM B695, Class 65, Type I.

PART 3 EXECUTION

3.1 GENERAL

- A. Fabricate and erect structural steel in accordance with AISC Specifications and Code of Standard Practice.
- B. Notify Architect/Structural Engineer and Structural Testing/Inspection Agency at least 48 hours prior to structural steel fabrication and erection.

3.2 ANCHOR ROD SETTING

- A. Provide templates for setting anchor rods. Position anchor rods by using templates with two nuts to secure in place prior to placement of concrete.
- B. Do not erect steel where anchor rod nuts will not have full threads.

3.3 CONNECTIONS

- A. Provide a minimum of two fasteners at each bolted connection.
- B. Ensure fasteners are lubricated prior to installation.
- C. Provide high-strength bolted connections in accordance with AISC Specifications for Structural Joints using ASTM A325 or A490 Bolts.
- D. Provide connections for expansion and contraction where steel beams connect to concrete walls or concrete columns and at expansion joints. Secure nuts on bolts against loosening. (Dent threads with a chisel.)

3.4 FASTENER INSTALLATION

- A. Bolts shall be installed in holes of the connection and brought to snug tight condition. Tighten connection progressing systematically from the most rigid part to the free edges of the connection to minimize relaxation of the bolts.
- B. High-strength bolts installed shall have a hardened washer under the element turned in tightening.
- C. Installation and tightening of bolts shall conform to the AISC Specifications for Structural Joints.

3.6 HEADED STUDS

- A. Headed studs shall be installed in accordance with AWS D1.1 with the resulting in-place length after burnoff as shown on the Structural Drawings.
- B. Do not locate headed studs closer than 1-1/4 inches from the edge of embedded steel member to the centerline of the stud.
- C. Remove ceramic arc shields after welding studs.

3.7 EXPANSION ANCHOR INSTALLATION

- A. Install in accordance with manufacturer's recommendation and the ICC ESR report for the particular anchor used.
- B. Minimum Embedment: See Structural Notes on Drawings.

3.8 ADHESIVE ANCHOR INSTALLATION

- A. Install in accordance with manufacturer's recommendation and the ICC ESR report for the particular anchor used.
- B. Minimum Embedment: See Structural Notes on Drawings.

3.9 SCREW ANCHOR INSTALLATION

- A. Install in accordance with manufacturer's recommendation and the ICC ESR report for the particular anchor used.
- B. Minimum Embedment: See Structural Notes on Drawings.

3.10 WELDING

- A. Comply with AWS D1.1. Use prequalified weld procedures.
- B. Provide end returns where fillet welds terminate at ends or sides. Returns shall be continuous for a distance of not less than two times the nominal size of the weld.
- C. Complete penetration joints shall be backgouged to sound metal before the second side is welded or have 1/4-inch root opening with 3/16 x 1 inch backing bar. Access holes are required. Filling access holes is not required.
- D. Remove all slag and weld splatter from deposited weld metal.

3.11 SPLICING

- A. Splice members only where indicated unless authorized in writing by Structural Engineer.
- B. Provide shim plates at bottom flange splice at continuous beam splices with different depths.

3.12 CUTTING

- A. Do not use flame cutting to correct errors unless authorized in writing.
- B. Re-entrant corners shall have a minimum radius of one inch and be free of notches. Notches and gouges resulting from flame cutting shall be finished to a smooth appearance.

3.13 MILL SCALE

A. Remove loose mill scale.

3.14 BOLT HOLES

A. Cut, drill, or punch holes perpendicular to metal surfaces. Do not enlarge holes by burning. Drill or punch holes in bearing plates. Remove burrs.

3.15 PAINTING

A. Paint steel that is not encased in concrete, plaster, or sprayed fireproofing. Do not shop paint in areas to be field welded, contact surfaces of slip critical connections, or areas to receive special finishes.

B. Field paint as required steel that has been welded or that is unpainted after connections have been tightened.

3.16 GALVANIZING

- A. Galvanize shelf angles that support the exterior building veneer, for example brick shelf angles.
- B. Galvanize environmentally exposed steel, for example mechanical equipment supports.
- C. Touch-up welds and abrasions in galvanized members in accordance with ASTM A780.

END OF SECTION

SECTION 052100 - STEEL JOIST FRAMING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Section includes the design, manufacture, and erection of steel joists shown in the Structural Drawings.

1.2 RELATED SECTIONS

- A. Division 1 Sections
- B. Section 051200 Structural Steel Framing.
- C. Section 053100 Steel Decking.

1.3 REFERENCES

ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

AWS D1.1 – Structural Welding Code.

OSHA – Safety and Health Regulations for Construction, Steel Erection, Open Web Steel Joists, Part 1926.757.

SJI – Standard Specifications for Open Web Steel Joists, K-Series.

SJI – Standard Specifications for Longspan Steel Joists, LH-Series, and Deep Longspan Steel Joists, DLH-Series.

SSPC – Paint 15 Steel Joist Shop Primer.

1.4 DESIGN REQUIREMENTS

- A. Steel joists and bridging shall be designed by a Structural Engineer licensed in the project state in accordance with the Steel Joist Institute (SJI) Standard Specifications.
- B. Refer to Structural Drawings for special design requirements, if any.

1.5 SUBMITTALS

- A. Refer to Structural Quality Assurance Plan in the Structural Drawings for additional submittal requirements.
- B. Shop Drawings:
 - 1. Shall include the following:
 - a. Plan of joist layout showing mark, number, type, location, bracing, and spacing of joists.
 - b. Connection and seat details.
 - c. Bridging requirements.
 - 2. Shall be signed and sealed by an Engineer licensed in the Project state.
- C. Upon request, submit the erection sequence and procedures to be used by the steel erector.

1.6 QUALITY ASSURANCE

STEEL JOIST FRAMING

A. Refer to the Structural Quality Assurance Plan in the Structural Drawings.

1.7 QUALIFICATIONS

A. Manufacturer shall be a member of the Steel Joist Institute.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store and handle joists as recommended in SJI Standard Specifications.

PART 2 PRODUCTS

2.1 ROLLED STEEL PLATES, SHAPES, AND BARS

A. Steel: Steel in accordance with SJI Standard Specifications.

2.2 UNFINISHED BOLTS, WASHERS, AND NUTS

A. Unfinished Bolts: ASTM A307, Grade A, 60 ksi minimum tensile strength. Provide compatible hexagonal nuts and plain washers.

2.3 WELD ELECTRODES

- A. Weld Electrodes: E-70 series low hydrogen electrodes conforming to AWS A5.1 or A5.5, A5.17 or A5.20.
- B. Provide proper storage for electrodes to maintain flux quality.

2.4 PAINT

A. Primer shall conform to Steel Structures Painting Council Specification SSPC – Paint 15.

PART 3 EXECUTION

3.1 MANUFACTURE AND ERECTION

- A. Manufacture and erect joists in accordance with SJI Standard Specifications and OSHA Steel Erection Standards.
- B. Members shall have parallel top and bottom chords unless otherwise indicated.
- C. Provide for connections of kickers and hangers to members.
- D. Provide bottom chord extensions at columns and as indicated by the Construction Drawings. Weld bottom chords to members after dead loads have been applied.
- E. Provide ceiling extensions in areas having ceilings attached directly to joist bottom chord (not suspended ceilings). Extend ends to within 1/2 inch of the finished wall surface unless otherwise indicated.
- F. Camber joists according to recommendations in the SJI Standard Specifications, unless noted otherwise on Structural Drawings. Negative camber and bent joists are unacceptable.
- G. Do not erect joists until supporting work is secured.

STEEL JOIST FRAMING

H. Provide bridging complying with SJI Standard Specifications. Provide for connections where bridging terminates.

3.2 CONCENTRATED LOADS ON JOISTS

A. Do no place concentrated loads on the joists that are not shown in the Structural Drawings without receiving written consent from the steel joist manufacturer. Reinforcement required for concentrated loads applied to either the top or bottom chord shall be designed by joist manufacturer.

3.3 HEADER UNITS

A. Provide header units to support openings in floor or roof system not framed with steel shapes.

3.4 SHOP PAINTING

- A. Remove loose scale, heavy rust, and other foreign materials from joists and accessories before application of shop paint.
- B. Apply one shop coat of steel joist primer paint to joists and accessories, by spray, dipping, or other method to provide a continuous dry paint film thickness of not less than 1.50 mil.

3.5 BEARING

- A. Extend ends of steel joists not less than 4 inches over masonry and concrete supports. Extend ends of joists not less than 2¹/₂ inches over steel supports. Positive attachment to support shall be made by welding or bolting. In such cases where a shorter end bearing length must be used, such condition must be designed.
- B. Fabricate sloped bearing seats where indicated on Drawings or where slope of joist exceeds ¹/₄ inch per foot.

3.6 WELDING

- A. Perform welding in accordance with AWS D1.1 "Structural Welding Code". Use AWS Certified Welders.
- B. Weld ends of joists resting on steel supports with the minimum weld specified by the SJI standard specifications, unless otherwise indicated in the Structural Drawings.
- C. Remove all slag and weld splatter from deposited weld material.

3.7 BRIDGING INSTALLATION

- A. Permanently fasten bridging before the application of loads. Secure to steel beams or CMU walls where possible; otherwise terminate bridging with X-bracing to joists top chord.
- B. In areas where joists will be exposed to view, align bridging in straight rows to create uniform appearance.

3.8 PROTECTION

- A. Provide means for adequate distribution of concentrated loads so that carrying capacity of joists is not exceeded during construction.
- B. Provide temporary bridging, bracing, connections, and anchors to ensure lateral stability during construction.

STEEL JOIST FRAMING

C. Joists damaged during construction shall be replaced or repaired with procedures submitted by the joist manufacturer.

3.9 CUTTING

A. Do not field cut or apply heat to joists unless authorized in writing.

3.10 REPAIRS OR MODIFICATIONS

A. If a steel joist is damaged or its bearing condition must be modified, Contractor shall have the joist supplier provide a sketch showing the required repairs or modifications.

END OF SECTION

SECTION 053100 - STEEL DECKING

PART 1 GENERAL

1.1 RELATED SECTIONS

- A. Division 1 Sections
- B. Section 051200 Structural Steel Framing.
- C. Section 052100 Steel Joist Framing.

1.2 REFERENCES

AISI – Specifications for the Design of Cold-Formed Steel Structural Members.

AWS D1.1 – Structural Welding Code.

AWS A5.5 – Specifications For Low Alloy Steel Covered Arc-Welding.

SDI 31 – Design Manual for Composite Decks, Form Decks, and Roof Decks

SDI RDCH1 – Roof Deck Construction Handbook

SDI DDMO3 – Diaphragm Design Manual, Third Edition

ASTM A653 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

ASTM A1008 – Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.

1.3 SUBMITTALS

- A. Notify the Structural Engineer prior to detailing shop drawings.
- B. Submit detailed shop drawings showing layout and types of deck panels, weld sizes, weld patterns and conditions requiring closure panels, supplementary framing, sump pans, cant strips, cut openings, special jointing or other accessories.
- C. Submit manufacturer's information including section properties, deck gage, material yield strength, etc. for each type of steel deck required. The submittal shall demonstrate that the deck complies with the minimum section and material properties indicated in the structural notes and this Specification.
- D. Submit supporting documentation and manufacturer's information for deck that does not comply with the minimum section and material properties specified. Deck shall be designed for the design criteria outlined herein and the submittal shall be stamped and signed by an Engineer licensed in the project state.
- E. Upon request, submit mill certification that the steel supplied meets these Specifications.
- F. Upon request, submit written welding procedures.

STEEL DECKING

G. Submit manufacturer's certification of compliance with supplementary framing, sump pans, cant strips, curb openings, special jointing and other accessories.

1.4 QUALITY ASSURANCE

- A. Refer to the Structural Quality Assurance Plan in the Structural Drawings.
- B. Welders shall be certified by AWS for the welding process involved.

1.5 STORAGE

A. Store materials off ground to permit easy access for inspection and identification. Store steel members and packaged items in a manner that provides protection against contact with deleterious materials.

PART 2 PRODUCTS

2.1 GENERAL

A. Provide steel deck sheets of three spans minimum wherever possible.

2.2 DECK ATTACHMENT

- A. Use E-60 series electrodes conforming to AWS A5.5.
- B. Provide weld washers for material thinner than 22 gage.

2.4 PERMANENT FORM DECK

- A. Permanent Form Deck: Steel sheets, minimum yield strength of 60,000 pounds per square inch, ASTM A653, gage as indicated on Drawings.
- B. Finish: Galvanized, G60 coating.

2.5 ROOF DECK

- A. Roof Deck: Steel sheets, minimum yield strength of 33,000 pounds per square inch, ASTM A653, Grade 33 or higher, deck types and gages as indicated on Drawings.
- B. Finish: Galvanized, G60 coating.
- C. End and Side Laps: 2-inch flush, nested unless otherwise indicated or specified.
- D. Acoustical roof deck: Where indicated on the Drawings with sound absorption values as indicated by the Architect.
- E. Vented deck: Provide vented deck for the lightweight insulating concrete system.

2.6 ROOF SUMP PANS

A. Roof Sump Pans: Single piece of 14 gage galvanized sheet steel with level bottoms and sloping sides to direct water flow to drain, when required by Architect. Size to receive roof drains and with bearing flanges not less than 3 inches wide

PART 3 EXECUTION

3.1 GENERAL

- A. Installer must examine the areas and conditions under which metal decking is to be installed and notify the Contractor in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.
- B. Steel deck shall be installed in accordance with the approved shop drawings, requirements of the Steel Deck Institute, the manufacturer's recommendations, and any applicable regulatory, safety guidelines.

3.2 PLACEMENT

A. Place steel deck units on supporting steel framework and adjust to final position before permanently fastening. Install deck units and accessories in accordance with manufacturer's recommendations and the Drawings, and as specified herein.

3.3 CUTTING

A. Cut holes in deck indicated by the Drawings. Other holes required shall be supplied by those requiring them. Obtain written authorization for additional holes and cutting not indicated on erection drawings.

3.4 WELDING

- A. Perform welding in accordance with AWS Structural Welding Code.
- B. Install weld washers for deck thinner than 22 gage.

3.5 CONCENTRATED LOADS

A. Concentrated loads suspended from the steel deck shall not exceed 50 pounds. No more than one suspended load shall be located in the sheet width in any span.

3.6 DECK SUPPORTS

A. Fasten deck to steel framework at ends and at each intermediate support by welding according to manufacturer's specifications unless indicated otherwise on structural drawings or otherwise specified herein. Do not weld deck in place until all bolted and welded connections for the structural frame are complete. A minimum of one floor over the area to be decked is to be bolted and welded prior to welding deck in place.

3.8 PERMANENT FORMS

- A. Place forms in straight alignment for the entire length of the run of the sheets. Lap ends of sheets two inches.
- B. Attach side laps of deck with screws spaced at a maximum of 24 inches on center for spans greater than 4'-0 unless, unless shown otherwise on the Drawings.
- C. Weld deck in place with ¹/₂-inch puddle welds and weld washers with welds on each side of the sheet plus two intermediate welds at each support, unless shown otherwise on the Drawings.

3.9 ROOF DECK

- A. Place roof deck in straight alignment. Lap ends of sheets two inches.
- B. Attach side laps of roof deck with screws spaced at a maximum of 24 inches on center for spans greater than 4 feet unless shown otherwise on the Drawings.
- C. Weld roof deck in place by welding with 5/8-inch puddle welds spaced 12 inches on center at each support, unless shown otherwise by the Drawings.

3.10 ROOF SUMP PANS

A. Recess pans not less than 1½ inches below roof deck surface, unless otherwise shown or required by deck configuration. Holes for drains will be cut in the field.

END OF SECTION

SECTION 055100 - METAL STAIRS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Stairs with concrete treads.
- B. Structural steel stair framing and supports.
- C. Pan treads to receive concrete fill, and landings.

1.02 RELATED REQUIREMENTS

- A. Section 013000 Administrative Requirements: Submittal procedures.
- B. Section 033000 Cast-in-Place Concrete: Concrete fill in stair pans.
- C. Section 055213 Pipe and Tube Railings: Metal handrails for the stairs specified in this section.
- D. Section 099000 Painting: Paint finish.

1.03 REFERENCE STANDARDS

- A. ASTM A36/A36M Standard Specification for Carbon Structural Steel; 2014.
- B. ASTM A53/A53M Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.
- C. ASTM A500/A500M Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2013.
- D. ASTM A501/A501M Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2014.
- E. ASTM A1008/A1008M Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2015.
- F. ASTM A1011/A1011M Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2014.
- G. AWS D1.1/D1.1M Structural Welding Code Steel; 2015.
- H. SSPC-SP 2 Hand Tool Cleaning; 1982 (Ed. 2004).

1.04 SUBMITTALS

- A. See Section 013300 Submittal Procedures, for submittal procedures.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.
- C. Structural Design Data: Where installed metal fabrications are indicated or required to comply with certain design loadings, include structural computations, material properties, and other information needed for review of structural analysis. Computations and analysis shall be stamped by a structural engineer licensed to practice in Kentucky.
- D. Welders' Certificates.

1.05 QUALITY ASSURANCE

- A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located, or personnel under direct supervision of such an engineer.
- B. Welder Qualifications: Show certification of welders employed on the Work, verifying AWS qualification within the previous 12 months.

PART 2 PRODUCTS

2.01 METAL STAIRS - GENERAL

- A. Metal Stairs: Provide stairs of the design specified, complete with landing platforms, vertical and horizontal supports, railings, and guards, fabricated accurately for anchorage to each other and to building structure.
 - 1. Regulatory Requirements: Provide stairs and railings complying with the most stringent requirements of local, state, and federal regulations; where requirements of the contract documents exceed those of regulations, comply with the contract documents.
 - 2. Structural Design: Provide complete stair and railing assemblies complying with the applicable local code.
 - 3. Dimensions: As indicated on drawings.
 - 4. Shop assemble components; disassemble into largest practical sections suitable for transport and access to site.
 - 5. No sharp or rough areas on exposed travel surfaces and surfaces accessible to touch.
 - 6. Separate dissimilar metals using paint or permanent tape.
 - 7. Recycled Content: Provide steel having a minimum 30% recycled content which is locally recovered.
- B. Metal Jointing and Finish Quality Levels:
 - Architectural: All joints as inconspicuous as possible, whether welded or mechanical.
 - a. Welded Joints: Continuously welded and ground smooth and flush.
 - b. Mechanical Joints: Butted tight, flush, and hairline; concealed fastenings only.
 - c. Exposed Edges and Corners: Eased to small uniform radius.
 - d. Metal Surfaces to be Painted: Sanded or ground smooth, suitable for highest quality gloss finish.
- C. Fasteners: Same material or compatible with materials being fastened; type consistent with design and specified quality level.
- D. Anchors and Related Components: Same material and finish as item to be anchored, except where specifically indicated otherwise; provide all anchors and fasteners required.

2.02 METAL STAIRS WITH CONCRETE TREADS

- A. Jointing and Finish Quality Level: Architectural, as defined above.
- B. Risers: Closed.

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- C. Treads: Metal pan with field-installed concrete fill.
 - 1. Concrete Depth: 1-1/2 inches, minimum.
 - 2. Tread Pan Material: Steel sheet.
 - 3. Tread Pan Thickness: As required by design; 12 gage, .109 inch minimum.
 - 4. Pan Anchorage to Stringers: Continuously welded, from top or bottom.
 - 5. Concrete Reinforcement: None.
 - 6. Concrete Finish: For resilient floor covering.
- D. Risers: Same material and thickness as tread pans.
 - 1. Riser/Nosing Profile: Sloped riser with rounded nosing of minimum radius.

- 2. Nosing Depth: Not more than 1 inch overhang.
- 3. Nosing Return: Flush with top of concrete fill, not more than 1 inch wide.
- E. Stringers: Rolled steel channels.
 - 1. Stringer Depth: 10 inches.
 - 2. End Closure: Sheet steel of same thickness as risers welded across ends.
- F. Landings: Same construction as treads, supported and reinforced as required to achieve design load capacity.
- G. Railings: Steel picket railings.
- H. Finish: Shop- or factory-prime painted.

2.03 HANDRAILS AND GUARDS

- A. Wall-Mounted Rails: Round pipe or tube rails unless otherwise indicated.
 - 1. Outside Diameter: 1-1/4 inch, minimum, to 1-1/2 inches, maximum.
- B. Guards: 1.
 - Top Rails: Round pipe or tube rails unless otherwise indicated.
 - a. Outside Diameter: 1-1/4 inch, minimum, to 1-1/2 inches, maximum.
 - 2. Infill at Picket Railings: Vertical pickets.
 - a. Horizontal Spacing: Maximum 4 inches on center.
 - b. Material: Solid steel bar.
 - c. Shape: Square.
 - d. Size: 1/4 inch square.
 - e. Top Mounting: Welded to underside of top rail.
 - f. Bottom Mounting: Welded to top surface of stringer.
 - 3. End and Intermediate Posts: Same material and size as top rails.
 - a. Horizontal Spacing: As indicated on drawings.
 - b. Mounting: Welded to top surface of stringer.

2.04 MATERIALS

- A. Steel Sections: ASTM A 36/A 36M.
- B. Steel Tubing: ASTM A500/A500M or ASTM A501/A501M structural tubing, round and shapes as indicated.
- C. Steel Tubing: ASTM A 500, Grade B cold-formed structural tubing.
- D. Steel Plates: ASTM A 283.
- E. Pipe: ASTM A 53/A 53M, Grade B Schedule 40, black finish.
- F. Ungalvanized Steel Sheet: Hot- or cold-rolled, except use cold-rolled where finished work will be exposed to view.
 - 1. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Designation CS (commercial steel).
 - 2. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Designation CS (commercial steel).
- G. Ungalvanized Steel Sheet: ASTM A 1008/A 1008M, Designation SS, Grade 33, Type 1.
- H. Concrete Fill: Type specified in Section 033000.

2.05 SHOP FINISHING

- A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- B. Do not prime surfaces in direct contact with concrete or where field welding is required.
- C. Prime Painting: Use specified shop- and touch-up primer.
 - 1. Preparation of Steel: In accordance with SSPC-SP 2, Hand Tool Cleaning.

2. Number of Coats: One.

2.06 COMPONENTS

- A. Metal Pan Stair Treads: Concrete in metal pan; 1-1/2 inch deep; smooth surface; non-slip edge.
- B. Concrete: Type specified in Section 033000.

2.07 FABRICATION - GENERAL

- A. Fit and shop assemble components in largest practical sections, for delivery to site.
- B. Fabricate components with joints tightly fitted and secured.
- C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- D. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
- E. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.
- F. Fabricate components accurately for anchorage to each other and to building structure.

2.08 FABRICATION - PAN STAIRS AND LANDINGS

- A. Form treads and risers with minimum 12 gage sheet steel stock.
- B. Secure tread pans to stringers with clip angles; welded in place.
- C. Form stringers with rolled steel channels, 10 inches deep. Weld fascia plates to channels using 12 gage steel sheet across channel toes.
- D. Form landings with minimum 12 gage sheet stock. Reinforce underside with channels to attain design load requirements.
- E. Prime paint components.

2.09 FINISHING

- A. Prepare surfaces to be primed in accordance with SSPC-SP 2.
- B. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- C. Do not prime surfaces in direct contact with concrete or where field welding is required.
- D. Prime paint items with one coat.
- E. Joint Finish: Provide joints with finish #2, completely sanded joints, some underwitting and pinholes per NOMMA Technical Committee guidelines.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. When field welding is required, clean and strip primed steel items to bare metal.

3.03 INSTALLATION

A. Install components plumb and level, accurately fitted, free from distortion or defects.

- B. Provide anchors, plates, angles, hangers, and struts required for connecting stairs to structure.
- C. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- D. Provide welded field joints where specifically indicated on drawings. Perform field welding in accordance with AWS D1.1/D1.1M.
- E. Other field joints may be either welded or bolted provided the result complies with the limitations specified for jointing quality levels.
- F. Obtain approval prior to site cutting or creating adjustments not scheduled.
- G. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

3.04 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch.

END OF SECTION 055100

SECTION 055213 - PIPE AND TUBE RAILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Interior and exterior wall mounted handrails in steel.
- B. Interior and exterior stair railings and guardrails in steel.
- C. Exterior guardrail in aluminum.

1.02 RELATED REQUIREMENTS

- A. Section 013000 Administrative Requirements: Submittal procedures.
- B. Section 033000 Cast-in-Place Concrete: Placement of anchors in concrete.

1.03 REFERENCE STANDARDS

- A. AAMA 611 Voluntary Specification for Anodized Architectural Aluminum; 2012.
- B. ASTM B211 Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire; 2012.
- C. ASTM B241/B241M Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube; 2012.
- D. ASTM B429/B429M Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube; 2010.
- E. ASTM B483/B483M Standard Specification for Aluminum and Aluminum-Alloy Drawn Tubes for General Purpose Applications; 2013.
- F. ASTM E935 Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings; 2013.
- G. ASTM E985 Standard Specification for Permanent Metal Railing Systems and Rails for Buildings; 2000 (Reapproved 2006).

1.04 SUBMITTALS

- A. See Section 013000 Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.
- C. Submit designation of the percentages of post-consumer and pre-consumer recycled-content in steel materials.
- D. Samples: Submit one, six inch long samples of handrail representing actual color and finish of products to be installed. Submit one samples of elbow, wall bracket, and end stop.
- E. Submit painting and coating product data.
- F. Structural Design Data: Where installed metal fabrications are indicated or required to comply with certain design loadings, include structural computations, material properties, and other information needed for review of structural analysis. Computations and analysis shall be stamped by a structural engineer licensed to practice in Kentucky.
- G. Submit LEED data and forms on all products contained in system as specified herein.

1.05 QUALITY ASSURANCE

A. Aluminum Handrails and Railings:

- 1. Manufacturer's Qualifications: Company specializing in manufacturing the aluminum non-welded pipe railing specified in this section with a minimum five years documented experience.
- 2. Installer/Fabricator Qualifications: Company specializing in assembling and installing the manufactured aluminum non-welded pipe railing system specified in this section with a minimum five years documented experience.
 - a. Specified aluminum railing is to be provided as a railing system from one of the manufacturers listed, or approved substitution prior to bidding. Fabricated replication of the specified manufactured railing system will not be accepted.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Deliver railing systems and related components in protective packaging.
 - 1. Upon delivery open cartons and inspect for damage.
 - 2. Maintain material in original packaging until installation.
 - 3. Store components to avoid damage from moisture, abrasion, and other construction activities.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Aluminum Handrails and Railings: Subject to compliance with requirements manufacturers offering the following products that may be incorporated into the work include:
 - 1. Basis of Design: Design concept and the drawings indicate the size, profiles, dimensional requirements and aesthetics of the following:
 - a. Superior Aluminum Products, Series 500 Aluminum Non-Welded Pipe Railing.
 - 2. Products by other manufacturers (listed below) may be considered, provided deviations in dimensions and profiles are minor and do not change the design concept as judged by the Architect.
 - a. C. R. Laurence Co., Inc: www.crlaurence.com.
 - b. Hollaender Railing: www.hollaender.com
 - c. Kane Sterling: www.kanescreens.com.
 - d. Superior Aluminum Products: www.superioraluminum.com
 - e. The Wagner Companies; ____: www.wagnercompanies.com/#sle.

2.02 RAILINGS - GENERAL REQUIREMENTS

- A. Design, fabricate, and test railing assemblies in accordance with the most stringent requirements of ASTM E985 and applicable local code.
- B. Design railing assembly, wall rails, and attachments to resist lateral force of 75 lbs at any point without damage or permanent set. Test in accordance with ASTM E 935.
- C. Structural Performance of Handrails and Railings: Provide handrails and railings capable of withstanding the following structural loads without exceeding allowable design working stresses of materials for handrails, railings, anchors, and connections:
 - Top Rail of Guards: Capable of withstanding the following loads applied as indicated:
 - a. Concentrated load of 200 lbf (890 N) applied at any point and in any direction.
 - b. Uniform load of 50 lbf/ft. (730 N/m) applied horizontally and concurrently with uniform load of 100 lbf/ft. (1460 N/m) applied vertically downward.
 - c. Concentrated and uniform loads above need not be assumed to act concurrently.
 - 2. Infill Area of Guards: Capable of withstanding a horizontal concentrated load of 200 lbf (890 N) applied to 1 sq. ft. (0.09 sq. m) at any point in system, including panels, intermediate rails, balusters, or other elements composing infill area.
 - a. Load above need not be assumed to act concurrently with loads on top rails in determining stress on guard.
- D. Allow for expansion and contraction of members and building movement without damage to connections or members.

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- E. Dimensions: See drawings for configurations and heights.
 - 1. Top Rails and Wall Rails: 1-1/2 inches diameter, nominal round. (1.900 inches Outside Diameter)
 - 2. Intermediate Rails: 1-1/2 inches diameter, nominal round. (1.900 inches Outside Diameter)
 - 3. Posts: 1-1/2 inches diameter, nominal round. (1.900 inches Outside Diameter)
- F. Provide anchors and other components as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.
- G. Exterior Use Grout: Non-shrink Portland cement-based hydraulic grout mixed and applied in accordance with manufacturer's instructions. Gypsum based material is not acceptable.
 - 1. Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating.

2.03 ALUMINUM MATERIALS

- A. Primary Horizontal and Support Aluminum Pipe: Schedule 40; ASTM B 429/B 429M, ASTM B 241/B 241M, or ASTM B 483/B 483M.
- B. Aluminum Tube for Rails and Posts: Aluminum extrusions; alloy and temper 6063-T4. Minimum wall thickness of 0.127 inch; ASTM B 429/B 429M, ASTM B 241/B 241M, or ASTM B 483/B 483M.
- C. Base Flanges, Anchors, and Railing Accessories: ASTM B 247. Manufacturer's standard 713 aluminum alloy cast bases or solid aluminum 6063 stock.
- D. Sleeves: ASTM A 120 or ASTM A 53 pipe.
- E. Fasteners: Provide concrete anchorage for fastening in aluminum or stainless steel.
- F. Exposed Fasteners: No exposed bolts or screws.

2.04 STEEL RAILING SYSTEM

- A. Recycled content: Provide steel products having a minimum 30% recycled content.
- B. Steel Tube: ASTM A500/A500M, Grade B cold-formed structural tubing.
- C. Steel Pipe: ASTM A 53/A 53M, Grade B Schedule 40, black finish.
- D. Galvanizing: In accordance with requirements of ASTM A123/A123M.
 - 1. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I Inorganic.
 - 2. All railings for exterior use are to be galvanized.
- E. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.05 FABRICATION - ALUMINUM RAIL

- A. Configuration: Size and space members in compliance with applicable codes. All posts shall be unspliced single pipe length. Lower rails shall be a single unspliced length between posts. All top rails shall be continuous.
 - 1. Vertical posts spacing not to exceed 6'-0" center-to-center.
 - 2. Open tube ends or sections are not allowed.
- B. All posts grouted in concrete to have one nominal 1/4 inch diameter weep hole, 1/2 inch nominal above post collar in the plane of the rail.
- C. Provide all posts with a minimum 19 inch hollow rod for internal reinforcing.

- D. Fit, shape and assemble components in largest practical sizes, for delivery to job site. Fabricate components with joints tightly fitted and secured.
 - 1. All pipe cuts shall be square and accurate for minimum joint-gap. Cuts shall be clean and free of chamfer, from deburring, nicks and burrs.
 - 2. Drill holes of proper size for a tight fit of rivets and screws.
- E. Expansion Joints: Provide expansion joints for continuous spans in excess of 40 feet. Construct joints by deleting structural adhesive from one end of the spliced joint so that it is free to move in or out of the pipe. If a joint is provided every 30 feet, the width of the gap should allow 1/8 inch expansion for each 40 degrees F of expected temperature rise.

2.06 ALUMINUM FINISHES

A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

- A. Supply items required to be cast into concrete or embedded in masonry with setting templates, for installation as work of other sections.
- B. Apply one coat of bituminous paint to concealed aluminum surfaces that will be in contact with cementitious or dissimilar materials.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install components plumb and level, accurately fitted, free from distortion or defects, with tight joints.
- C. Anchor railings securely to structure.
- D. Sleeve Mounting:
 - 1. Arrange for casting of sleeves or core drill insitu concrete to provide holes for railing uprights.
 - 2. After setting, fill holes with hydraulic grout; brace members until grout is cured.

3.04 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch per floor level, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch.
- C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION 055213

SECTION 061000 - ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Roof-mounted curbs.
- B. Roofing nailers.
- C. Miscellaneous framing and sheathing.
- D. Communications and electrical room mounting boards.
- E. Wood nailers and curbs for roofing and items installed on roof.
- F. Concealed wood blocking, nailers, and supports.
- G. Installation of wood doors and hardware.

1.02 RELATED REQUIREMENTS

- A. Section 013000 Administrative Requirements: Submittal procedures.
- B. Section 092116 Gypsum Board Assemblies: Fiber -glass faced gypsum-based sheathing.

1.03 REFERENCE STANDARDS

- A. AF & PA National Design Specification for Wood Construction. Include supplements.
- B. ALSC American Lumber Standards Committee: Softwood Lumber Standards.
- C. APA PRP-108 Performance Standards and Qualification Policy for Structural-Use Panels (Form E445); 2001.
- D. ASTM D2559 Standard Specification for Adhesives
- E. PS 1 Structural Plywood; 2009.
- F. PS 20 American Softwood Lumber Standard; 2010.
- G. SPIB (GR) Grading Rules; 2014.

1.04 SUBMITTALS

- A. See Section 013000 Administrative Requirements, for submittal procedures.
- B. Product Data: Provide technical data on wood preservative materials and application instructions.
- C. Manufacturer's Certificate: Certify that wood products supplied for rough carpentry meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

A. Lumber: Comply with PS 20 and approved grading rules and inspection agencies.

1.06 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
- 1. If no species is specified, provide any species graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.
- 2. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
- B. Lumber fabricated from old growth timber is not permitted.
- C. Grade Stamps: Provide lumber with each piece factory marked with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing, and mill.

2.02 DIMENSION LUMBER

- A. Grading Agency: Southern Pine Inspection Bureau, Inc; SPIB (GR).
- B. Sizes: Nominal sizes as indicated on drawings, S4S.
- C. Moisture Content: S-dry or MC19.
- D. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
 - 1. Lumber: S4S, No. 2 or Standard Grade.
 - 2. Boards: Standard or No. 3.

2.03 MISCELLANEOUS LUMBER

- A. General: Provide lumber for support or attachment of other construction including rooftop equipment curbs and support bases, cant strips, bucks, nailers, blocking, furring, grounds, stripping, and similar members.
- B. Fabricate miscellaneous lumber from dimension lumber of sizes indicated and into shapes shown.
- C. Moisture Content: 19 percent maximum for lumber items not specified to receive wood preservative treatment.
- D. Grade: "Standard" grade light framing size lumber of any species or board-size lumber as required. "Standard" grade boards per WWPA rules or "No. 2 Boards" per SPIB rules.

2.04 CONCEALED PERFORMANCE-RATED CONSTRUCTION PANELS

- A. General: Where construction panels are indicated for the following concealed type sof applications, provide APA Performance-Rated Panels complying with requirements designated under each application for grade designation, span rating, exposure durability classification, edge detail (where applicable) and thickness.
- B. Construction Panel Standards: Comply with PS 1 "U.S. Product Standard for Construction and Industrial Plywood" for plywood construction panels and, for products not manufactured under PS 1 provisions, with APA PRP-108
- C. Trademark: Furnish construction panels that are factory-marked with APA trademark evidencing compliance with grade requirements.
- D. Wall/Roof Parapet Sheathing: APA Rated Sheathing.
 - Contractor to coordinate with roof manufacturer of roof system furnished on whether the use of plywood sheathing or fiber-glass faced gypsum based sheathing meets specified roof system warranty.
 - a. Exposure Durability Classification: Exposure 1.
 - b. Span Rating: As required to suit stud spacing indicated.
 - c. Thickness: Refer to drawings.

1

2.05 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacturer.
 - 1. Where rough carpentry is exposed to weather, in ground contact, in contact with preservative treated lumber, or humidity, provide fasteners with hot dip zinc coating per ASTM A 153 or of AISI Type 304 stainless steel.
 - 2. Nails, Wire, Brads, and Staples: FS FF-N-105.
 - 3. Power Driven Fasteners: National Evaluation Report NER-272.
 - 4. Wood Screws: ANSI B18.6.1.
 - 5. Screws to Cold-Formed Metal Framing: Corrosion-resistant coated, self drilling, self threading steel drill screws with low-profile head.
 - 6. Lag Bolts: ANSI B18.2.1.
 - 7. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and where indicated, flat washers.

2.06 METAL FRAMING ANCHORS

- A. General: Provide metal framing anchors of type, size, metal, and finish indicated that comply with requirements specified including the following:
 - 1. Current Evaluation/Research Reports: Provide products for which model code evaluation/research reports exist that are acceptable to authorities having jurisdiction and that evidence compliance of metal framing anchors for application indicated with the building code in effect for this project.
 - 2. Allowable Design Loads: Provide products for which manufacturer publishes allowable design loads that are determined from empirical data or by rational engineering analysis and that are demonstrated by comprehensive testing performed by qualified independent testing laboratory.
- B. Galvanized Steel Sheet: Steel sheet zinc-coated by hot-dip process on continuous lines prior to fabrication to comply with ASTM A 525 for Coating Designation G185 and with ASTM A 446, Grade A (structural quality); ASTM A 526 (Commercial quality); or ASTM A 527 (lock-forming quality); as standard with manufacturer for type of anchor indicated.
 - 1. Use galvanized steel framing anchors for rough carpentry exposed to weather, in ground contact, in contact with preservative treated lumber, or in area of high relative humidity, and where indicated.

2.07 CONSTRUCTION PANELS

A. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

- A. Discard units of material with defects that impair quality of rough carpentry construction and that are too small to use in fabricating rough carpentry with minimum joints or optimum joint arrangement.
- B. Set rough carpentry to required levels and lines, with members plumb and true to line and cut and fitted.
- C. Fit rough carpentry to other construction; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds, and similar supports to allow attachment of other construction.
- D. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated.

- E. Countersink nail heads on exposed carpentry work and fill holes.
- F. Use common wire nails, unless otherwise indicated. Use finishing nails for finishing work. Select fasteners of size that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting of wood; predrill as required.

3.02 BLOCKING, NAILERS, AND SUPPORTS

- A. Install solid wood grounds, nailers, blocking, and sleepers as required for support of wall and ceiling mounted items.
 - 1. Plywood strips and/or metal strapping will not be accepted as sutiable blocking material.
- B. Contractor option to use a flexible wood backing plate system in lieu of solid wood blocking as specified in this section.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include:
 - a. Clark Dietrich Building Systems Danback Flexible Wood Backing Plate: www.clarkdietrich.com
 - b. Equivalent submitted to Architect prior to issuance of last addendum.
- C. In metal stud walls, provide continuous solid wood blocking around door and window openings for anchorage of frames, securely attached to stud framing.
- D. In walls, provide solid wood blocking attached to studs as backing and support for wall-mounted items,
- E. Where ceiling-mounting is indicated, provide solid wood blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.
- F. Provide the following non-structural framing and solid wood blocking, but not limited to the following locations:
 - 1. Cabinets, shelf, and countertop supports.
 - 2. Wall mounted cabinets.
 - 3. Wall brackets.
 - 4. Handrails and guardrails.
 - 5. Fire extinguisher cabinets, brackets, and valve cabinets.
 - 6. Grab bars.
 - 7. Toilet and bath accessories.
 - 8. Toilet and urinal partitions.
 - 9. Wall-mounted door hardware and stops.
 - 10. Chalkboards, tackboards, and marker boards.
 - 11. Wall paneling and trim.
 - 12. Joints of rigid wall coverings that occur between studs.
 - 13. Locker base and wall attachment.
 - 14. Interior and exterior wall openings to receive metal frame system; window, door, etc.
 - 15. Access panels.
 - 16. Framed openings.
 - 17. Plumbing fixtures.
 - 18. Ceiling mounted projection screens and projector mounts.
 - 19. Wall mounted projection screens and projector mounts.
 - 20. Wall and ceiling mounted items indicated as N.I.C. and/or Owner provided and Owner installed.

3.03 WOOD FRAMING, GENERAL

A. Framing Standard: Comply with N.F.P.A. "Manual for House Framing," unless otherwise indicated.

- B. Framing with Engineered Wood Products: Install framing composed of engineered wood products to comply with manufacturers directions.
- C. Install framing members of size and spacing indicated.
- D. Anchor and nail as shown, and to comply with the following:
 - 1. National Evaluation Report No. NER-272 for pneumatic or mechanical driven staples, P-nails, and allied fasteners.
 - 2. Published requirements of manufacturer of metal framing anchors.
 - 3. Recommended Nailing Schedule of referenced framing standard and with N.F.P.A. "National Design Specification for Wood Construction."
 - 4. Table No. II Recommended Nailing Schedule of the Uniform Building Code.
 - 5. Table 2304.9.1 of the Kentucky Building Code.
 - 6. Table 2306.1 Fastening Schedule of the Standard Building code.
- E. Do not splice structural members between supports.

3.04 INSTALLATION OF ACCESSORIES AND MISCELLANEOUS WOOD

- A. Curb roof openings except where prefabricated curbs are provided. Form corners by alternating lapping side members.
- B. Coordinate curb installation with installation of decking and support of deck openings.

3.05 INSTALLATION OF CONSTRUCTION PANELS

- A. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches on center on all edges and into studs in field of board.
 - 1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
 - 2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
 - 3. Install adjacent boards without gaps.

3.06 TOLERANCES

- A. Framing Members: 1/4 inch from true position, maximum.
- B. Variation from Plane (Other than Floors): 1/4 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

3.07 CLEANING

A. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.

B. Prevent sawdust and wood shavings from entering the storm drainage system. **END OF SECTION 061000**

SECTION 071300 - UNDERSLAB SHEET WATERPROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Underslab sheet membrane vapor barrier.
 - 1. Vapor barrier is to be installed beneath the entire interior area of first floor new concrete slab construction except in areas where underslab semi-rigid sheet waterproofing is required.

1.02 RELATED REQUIREMENTS

- A. Section 013000 Administrative Requirements: Submittal procedures.
- B. Section 076200 Sheet Metal Flashing and Trim: Metal parapet, coping, and counterflashing.
- C. Section 079005 Joint Sealers: Sealant for joints in substrates.
- D. Section 312323 Fill.
- E. Section 334600 Subdrainage.

1.03 REFERENCE STANDARDS

- A. ASTM D570 Standard Test Method for Water Absorption of Plastics; 1998 (Reapproved 2010).
- B. ASTM D746 Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact; 2014.
- C. ASTM D882 Standard Test Method for Tensile Properties of Thin Plastic Sheeting; 2012.
- D. ASTM D1709 Standard Test Method for Impact Resistance of Plastic Film by the Free-Falling Dart Method.
- E. ASTM E96/E96M Standard Test Methods for Water Vapor Transmission of Materials; 2014.
- F. ASTM E154/E154M Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover; 2008a (Reapproved 2013).
- G. ASTM E 1643 Standard Specification For Installation of Plastic Water Vapor Retarder Used in Contact with Soil or Granular Fill Under Concrete Slabs.
- H. ASTM E 1745 Standard Specification For Plastic Water Vapor Retarder Used in Contact with Soil or Granular Fill Under Concrete Slabs Class A.
- I. NRCA ML104 The NRCA Roofing and Waterproofing Manual; Fifth Edition, with interim updates.

1.04 SUBMITTALS

- A. Product Data: Provide data for vapor barrier and sheet waterproofing membranes, tape, sealants and other system components.
- B. Product Test Reports: From a qualified independent testing agency indicating and interpreting test results of waterproofing and vapor barrier for compliance with requirements, based on testing of current waterproofing formulations.
- C. Shop Drawings: Indicate special joint or termination conditions and conditions of interface with other materials.
- D. Certificate: Certify that products meet or exceed specified requirements.
- E. Samples: 4" x 4" square of vapor barrier and waterproofing sheet.
- F. Installer Certificates: Signed by manufacturers certifying that installers comply with requirements.

G. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with NRCA Roofing and Waterproofing Manual.
- B. Membrane Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.
- C. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.
- D. Source Limitations: Obtain products through one source from a single manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver liquid and sheet material to Project site in original packages with seals unbroken, labeled with manufacturers name, product brand name and type, date of manufacture, and directions for storing and mixing other components.
- B. Store liquid materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by manufacturer.
- C. Remove and replace liquid materials that cannot be applied within thief stated shelf life.
- D. Store sheets and rolls according to manufacturers written instructions.
- E. Protect stored materials from direct sunlight.

1.07 FIELD CONDITIONS

- A. Maintain ambient temperatures above 40 degrees F for 24 hours before and during application and until liquid or mastic accessories have cured.
- B. Do not apply to a damp or wet substrate.
- C. Do not apply in snow, rain, fog or mist.

1.08 WARRANTY

- A. Contractor shall correct defective Work within a five year period after Date of Substantial Completion; remove and replace materials concealing waterproofing at no extra cost to Owner.
- B. Special Installer's Warranty: Written waterproofing Installer's warranty, signed by the Installer. covering work of this section, for warranty period of two years.

PART 2 PRODUCTS

2.01 MEMBRANE MATERIALS

- A. CLEAR, OR WHITE, POLYETHYLENE SHEET PLASTIC WILL NOT BE ACCEPTED UNDER ANY CIRCUMSTANCES.
- B. Manufacturers
 - 1. Underslab Vapor Barrier: Subject to compliance with requirements, manufacturers offering the following products that may be incorporated into the work include:
 - a. Basis of Design: Design concept and the drawings indicate the size, profiles, dimensional requirements and aesthetics of the following:
 - 1) W.R. Meadows, Inc. Perminator Class A.
 - b. Products by other manufacturers may be considered provided deviations in dimensions and profiles are minor and do not change the design concept as judged by the Architect.

- 1) Floor Seal Technology, Inc. TruBarrier 10 mil: www.floorseal.com
- 2) Insulation Solutions, Inc; Viper II 10 mil: www.insulation solutions.com
- 3) Inteplast Group: Barrier Bac IntePlus XF VB-250: www.barrierbac.com
- 4) Raven Industries; VaporBlock 10 mil: www.ravenefd.com
- 5) Stego Industries LLC; Stego Wrap 10 mil: www.stegoindustries.com
- 6) Tex-Trude, LP: Xtreme 10 mil: www.tex-trude.com
- 7) W.R. Meadows; Perminator: www.wrmeadows.com
- C. Product Requirements
 - Vapor Barrier: 10 mil vapor retarder.
 - a. Vapor transmission rate: 0.027 or less.
 - b. Puncture resistance: ASTM D1709, Minimum 2700 grams.
- D. Materials

1.

- 1. General: Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.
 - a. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.
- 2. Joint Sealing Compounds: Low-viscosity, two component, asphalt-modified sealer. All protrusions (pipes, etc.) Shall have a premolded collar surround to be sealed in place.
- 3. Mastic, Adhesives, and Tape: Liquid mastic and adhesives, and adhesive tapes recommended by waterproofing manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions are acceptable prior to starting this work.
- B. Verify substrate surfaces are durable; free of matter detrimental to adhesion or application of waterproofing system.
- C. Verify items that penetrate surfaces to receive waterproofing are securely installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Protect adjacent surfaces from damage not designated to receive waterproofing.
- B. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions; vacuum substrate clean.
- C. Do not apply waterproofing to surfaces unacceptable to membrane manufacturer.
- D. Seal cracks and joints with sealant using depth to width ratio as recommended by sealant manufacturer.
- E. Surfaces for Adhesive Bonding: Apply surface conditioner at a rate recommended by manufacturer, and protect conditioner from rain or frost until dry.

3.03 INSTALLATION - VAPOR BARRIER

- A. Install vapor barrier in accordance with manufacturer's instructions.
- B. Roll out membrane, and minimize wrinkles and bubbles.
- C. Membrane to cover entire pour area.
- D. All vapor barrier joint/seams, both lateral and butt, are to be be overlapped minimum 6 inches and taped using minimum 4 inch wide tape provided by the manufacturer.

- 1. Tape area of adhesion to be free from dust, dirt and moisture to allow maximum adhesion of tape.
- E. Vapor barrier is to be turned up on all vertical foundation walls the full thickness of the concrete slab on grade. Adhere to the walls with an adhesive provided by the manufacturer of the waterproofing sheet.
- F. Per manufacturers requirements create collars, made from the vapor barrier material, to seal around all pipe, duct, rebar and conduit/wire penetrations. Tape collars completely.
- G. In the event that the vapor barrier is damaged during or after installation, repairs must be made. Cut a pice of vapor barrier material large enough to cover the damage by a minimum overlap of 6 inch in all directions. Clean all adhesive areas and tape.

3.04 PROTECTION

A. Do not permit traffic over unprotected or uncovered membrane. **END OF SECTION 071300**

SECTION 071400 - FLUID-APPLIED WATERPROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fluid-Applied Waterproofing:
- B. Above-grade waterproofing accessories.
- C. Below-grade waterproofing accessories.
- D. The extent of fluid applied waterproofing includes the face of all below grade walls which have interior finished spaces on the other side of the wall and exterior retaining walls tied into interior walls. This work includes the elevator pit. Coordinate waterproofing installation with foundation drainage.

1.02 RELATED REQUIREMENTS

- A. Section 013000 Administrative Requirements: Submittal procedures.
- B. Section 079005 Joint Sealers: Sealant for joints in substrates.

1.03 REFERENCE STANDARDS

- A. 40 CFR 59, Subpart D National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.
- B. AATCC Test Method 30 Antifungal Activity, Assessment on Textile Materials: Mildew and Rot Resistance of Textile Materials; 2004.
- C. ASTM C836/C836M Standard Specification for High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course; 2012.
- D. ASTM D412 Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2006a (Reapproved 2013).
- E. ASTM D5385/D5385M Standard Test Method for Hydrostatic Pressure Resistance of Waterproofing Membranes; 1993 (Reapproved 2014).
- F. ASTM E96/E96M Standard Test Methods for Water Vapor Transmission of Materials; 2014.
- G. NRCA ML104 The NRCA Roofing and Waterproofing Manual; Fifth Edition, with interim updates.

1.04 SUBMITTALS

- A. See Section 013000 Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data for membrane, surface conditioner, flexible flashings, joint cover sheet, and joint and crack sealants, self stick insulation anchors.
- C. Shop Drawings: Show locations and extent of waterproofing. Indicate details for special joint, crack, penetrations, inside and outside corners, tie-ins with adjoining waterproofing or other termination conditions and conditions of interface with other materials.
- D. Samples:
 - 1. 4 inch x 4 inch square of waterproofing.
 - 2. 4 inch x 4 inch square of protection board.
 - 3. 4 inch x 4 inch square of drainage panel.
 - 4. Self-stick insulation anchor and safety cap.
- E. Certificate: Certify that products meet or exceed specified requirements.

- F. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention, and acceptable installation temperatures.
- G. Manufacturer's Qualification Statement.
- H. Installer's Qualification Statement.
- I. Installer Certificates: Signed by manufacturers certifying that installers comply with requirements.
- J. Product test Reports: From a qualified independent testing agency indicating and interpreting test results of waterproofing for compliance with requirements, based on comprehensive testing of current waterproofing formulations.
- K. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with NRCA Waterproofing and Dampproofing Manual.
- B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.
- C. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.
- D. Source Limitations: Obtain all components that make up the total waterproofing system; waterproofing membrane, protection board and drainage panel, through one source from a single manufacturer.

1.06 PRE-INSTALLATION CONFERENCE

- A. Pre-installation conference is to be conducted before the waterproofing system installation begins. The General Contractor/Construction Manager, waterproofing contractor, waterproofing system manufacturers representative and the Architect are to attend this meeting.
- B. After the pre-installation meeting, a mock-up wall with complete system installation shall be constructed for review. The mock-up wall shall be done in a "shingle" or stepped method so that each step of installation can be observed in its finished state.
- C. The waterproofing system installation is to be observed by the Architect at each of the following phases:
 - 1. After patching of the concrete wall and prior to the membrane installation
 - 2. After installation of the membrane and prior to the insulation/protection board installation
 - 3. After installation of the insulation/protection board and prior to and during the first run of drainage panel installation
 - 4. Prior to and during the installation of the drainage piping and initial backfill

1.07 PROJECT CONDITIONS

A. Maintain ambient temperatures above 40 degrees F for 24 hours before and during application and until cured.

1.08 WARRANTY

- A. See Section 017800 Closeout Submittals, for additional warranty requirements.
- B. Contractor shall correct defective Work within a five year period after Date of Substantial Completion; remove and replace materials concealing waterproofing at no cost to Owner.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering the following products that may be incorporated into the work include,
 - 1. Design concept and the drawings indicate the size, profiles, dimensional requirements and aesthetics of the following:
 - a. Waterproofing System based on W.R. Meadows: Mel-Rol LM Waterproofing Membrane, PC-2 Protection Course and Mel-Drain Drainage Panel.
 - 2. Waterproofing system by other manufacturers may be considered provided deviations in dimensions and profiles are minor and do not change the design concept as judged by the Architect.
 - a. Carlisle Corporation, Carlisle Coatings & Waterproofing Div.; CCW-525, CCW MiraDrain 6000, CCW Protection Board-V: www.carlisle-ccw.com
 - b. W.R. Grace & Co.: www.na.graceconstruction.com
 - c. W. R. Meadows: www.wrmeadows.com
 - d. Mar-FlexWaterproofing & Building Products: www.mar-flex.com
 - e. Pecora Corporation.: www.pecora.com
 - f. Premium Liquid Rubber: www.sprayrubber.com
 - 3. Self-stick insulation anchors are to be 12 gauge, galvanized, low carbon steel with safety cap. Length is to be sufficient for fastening of the insulation board, drainage panel and safety cap. Approved manufacturers/suppliers include:
 - a. Stud Welding Equipment and Accessories.
 - b. Continental Stud Welding, Ltd..
 - c. S.F. Products.
 - d. Sunbelt Stud Welding.
 - e. Midwest Fasteners, Inc..

2.02 SPRAY-ON WATERPROOFING

- A. Physical Properties: As follows, measure per standard test methods referenced:
 - 1. Single component, water based, polymer-modified, cold applied, waterproofing membrane
 - 2. Wet Mil Application Thickness: Coverage rate of 20-25 ft. 2/gallon providing a minimum thickness of 60 wet mils.
 - 3. Dry/Cured Thickness: Minimum 45 mils dry.
 - 4. Color: Brown to Black.
 - 5. Solids: 70%.
 - 6. Total Cure Time: 16-24 hours.
 - 7. Shore "00" Hardness, ASTM C836: Passes.
 - 8. Adhesion to Concrete, ASTM C836: Exceeds.
 - 9. Low Temperature Flex and Crack Bridging, ASTM C836: Passes.
 - 10. Stability, ASTM C836:Exceeds.
 - 11. Elongation, ASTM D412: + 1000% to 1500%.
 - 12. Water Absorption, ASTM D1970: 0.7%.
 - 13. Water Vapor Transmission, ASTM E96 (Method B): 0.01 to 0.03 perms/sq. ft.

2.03 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. Primer: Liquid primer recommended for substrate by manufacturer of waterproofing material.

- C. Surface Conditioner: Liquid, waterborne surface conditioner recommended for substrate by manufacturer of waterproofing material.
- D. Sheet Strips: Self-adhering, rubberized-asphalt composite sheet strips of same material and thickness as waterproofing.
- E. Substrate Patching Membrane: Low-viscosity, two-component, asphalt-modified coating.
- F. Mastic, Adhesives, and Tape: Liquid mastic and adhesives, and adhesive tapes recommended by waterproofing manufacturer for adhesion of the waterproofing, insulation/protection board and drainage panel system.
- G. Self-stick insulation anchors may be used in conjunction with the adhesive system above for securing the insulation/protection board and drainage panels to the wall system.
- H. Protection Courses: Due to differences in manufacturers protection course's the following types are acceptable in the fluid waterproofing total system:
 - 1. Protection Course: (W. R. Meadows system) Semirigid sheets of fiberglass or mineral-reinforced-asphaltic core, pressure laminated between two asphalt-saturated fibrous liners and as follows:
 - a. Thickness: 1/8 inch (3 mm), nominal.
 - b. Adhesive: Rubber-based solvent type recommended by waterproofing manufacturer for type of protection course.
 - 2. Protection Course: (Carlisle system) Lightweight, high density, rigid, extruded polystyrene foam vertical protection board.
 - 3. Protection Course: Where waterproofing system is to be applied on a below grade wall that has inhabited/conditioned space on the opposite side, in lieu of the protection courses listed above provide 2 inch thick extruded polystyrene board insulation meeting ASTM C578 Type IV and specified in Section 072100.

2.04 MOLDED-SHEET DRAINAGE PANELS

- A. Description: Prefabricated, composite drainage panels, made with drainage core and filter fabric, for use as part of foundation drainage system.
- B. Drainage Core: 3-Dimensional, non-biodegradable, molded-plastic-sheet material designed to effectively conduct water to foundation drainage system under maximum soil pressures.
 - 1. Minimum Flow Rate: 15 gpm/foot (3.1 l/s/1000 mm) at one hydraulic gradient and 3600 psf (172 kPa) normal pressure when tested according to ASTM D 4716.
 - 2. Film Backing: Plastic, protective-film, backing sheet attached to surface building wall.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify substrate surfaces are free of frozen matter, dampness, loose particles, cracks, pits, projections, penetrations, or foreign matter detrimental to adhesion or application of waterproofing system.
- C. Verify that substrate surfaces are smooth, free of honeycomb or pitting, and not detrimental to full contact bond of waterproofing materials.
- D. Verify items that penetrate surfaces to receive waterproofing are securely installed.

3.02 PREPARATION

A. Protect adjacent surfaces from damage not designated to receive waterproofing.

- B. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions. Ensure that all bug holes, honeycombing or other concrete imperfections have been repaired and prepared to receive the membrane primer and membrane.
- C. Do not apply waterproofing to surfaces unacceptable to waterproofing manufacturer.
- D. Seal cracks and joints with sealant using methods recommended by sealant manufacturer.
- E. Install cant strips at inside corners and at base of wall at the footing.

3.03 INSTALLATION

- A. Apply waterproofing in accordance with manufacturer's instructions to specified minimum thickness. A two coat installation is preferred over a single coat installation.
 - 1. Back brush/back drag the coating if it begins to sag or drip.
- B. Conform to NRCA Waterproofing and Dampproofing Manual drawing details.
- C. Apply primer or surface conditioner at a rate recommended by manufacturer, and protect conditioner from rain or frost until dry.
- D. At joints and cracks less than 1/2 inch in width including joints between horizontal and vertical surfaces, apply 12 inch wide strip of joint cover sheet.
- E. At joints from 1/2 to 1 inch in width, loop joint cover sheet down into joint between 1-1/4 and 1-3/4 inch. Extend sheet 6 inches on either side of expansion joint.
- F. Center joint cover sheet over joints. Roll sheet into 1/8 inch coating of waterproofing material. Apply second coat over sheet extending minimum of 6 inches beyond sheet edges.
- G. Apply waterproofing in accordance with manufacturer's instructions to specified minimum thickness.
- H. Extend membrane over cants and up intersecting surfaces at membrane perimeter minimum 6 inches above horizontal surface for first ply and 6 inches at subsequent plies laid in shingle fashion.
- I. Apply extra thickness of waterproofing material at corners, intersections, and angles.
- J. Extend waterproofing 12-inches across the top of the footing.
- K. Extend waterproofing across the brick ledge and up the face of wall to the elevation of the thru-wall flashing.
- L. Flexible Flashings: Seal items watertight that penetrate through waterproofing membrane with flexible flashings.
- M. Extend waterproofing material and flexible flashing into drain clamp flange, apply adequate coating of liquid membrane to ensure clamp ring seal, and coordinate with drain installation requirements specified in Section 221006.
- N. Seal membrane and flashings to adjoining surfaces.

3.04 INSTALLATION - DRAINAGE PANEL and PROTECTION BOARD

- A. After the membrane has cured, place insulation/protection board directly against membrane, butt joints tightly, place to encourage drainage downward. Scribe and cut boards around projections, penetrations, and interruptions. Prime membrane prior to insulation/protection board installation as recommended by the system manufacturer. Ensure that the primer will not adversely affect the insulation/protection board.
- B. Place drainage panel over and directly against the insulation/protection board. Butt vertical joints and adhere a 12-inch wide filter fabric patch centered over the vertical joint. Butt horizontal joints and ensure that there is a minimum of 6-inches of filter fabric overlap from the upper panel over the lower

panel. The top section of drainage panel is to have the drainage core removed for 6-inches to create a 6-inch wide flap of filter fabric that can be wrapped over the top of the panel and tucked and between the panel and the insulation/protection board. In lieu of cutting the drainage core, a 12-inch wide section of filter fabric can be adhered and wrapped similar to the vertical joints.

C. Adhere insulation / protection board and drainage panel to substrate with compatible adhesive. Supplement the adhered system with self-stick insulation anchors as necessary to ensure that any part of the system will not pull loose from the wall.

3.05 PROTECTION

- A. Do not damage or permit traffic over unprotected or uncovered membrane.
- B. Backfill against drainage panel as soon as practical to prevent damage to the panel. Any damage to the system is to be repaired to new condition.

END OF SECTION 071400

SECTION 072100 - THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Board insulation at perimeter foundation wall.
- B. Sprayed-in-place thermal insulation (2 lb.) air barrier system at all exterior cavity wall construction.

1.02 RELATED REQUIREMENTS

- A. Section 013000 Administrative Requirements: Submittal procedures.
- B. Section 042000 Unit Masonry: Supporting construction for insulation.
- C. Section 071400 -Fluid-Applied Waterproofing: Rigid insulation/protection course over membrane waterproofing.
- D. Section 075200 Modified Bituminous Membrane Roofing: Installation requirements for board insulation over low slope roof deck specified in this section.
- E. Section 092116 Gypsum Board Assemblies: Acoustic insulation inside walls and partitions.
- F. Sections 23 in regards to duct, equipment and pipe insulation.

1.03 REFERENCE STANDARDS

- A. ASTM C578 Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2015a.
- B. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- C. ASTM E2357 Standard Test Method for Determining Air Leakage of Air Barrier Assemblies.

1.04 SUBMITTALS

- A. See Section 013000 Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.
 - 1. Submit designation of the percentages of post-consumer and pre-consumer recycled-content in insulating materials.
- C. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Sprayed-in-Place Thermal Insulation:
 - 1. Provide data on product characteristics, product testing, product performance criteria, and product limitations.
 - a. Provide specific data that product is approved for direct application on cmu substrate as part of cmu/masonry veneer cavity wall and/or exterior sheathing as part of the metal stud/sheathing/masonry veneer cavity wall construction.
 - b. Provide product data on all auxiliary components; primer, seam tape and transition strip materials.
 - c. Provide specific data that product has been tested and is approved for use as an air barrier.
 - d. Provide hydrostatic water resistance pressure test results.
 - e. Shop Drawings: Indicate locations and extent of sprayed-in-place thermal insulation air barrier system assemblies and details of all typical conditions, intersections with other envelope assemblies and materials, membrane counter-flashings, and details showing how gaps in construction will be bridged, how inside and outside corners are negotiated, how materials that cover the insulation are secured, how air-tight

conditions are maintained, and how miscellaneous penetrations such as conduits, pipes, electric boxes and similar items are sealed.

- 2. Quality Assurance Program: Provide evidence of current accreditation of the subcontractor and certification of installers under the Air Barrier Association of America's (ABAA) Quality Assurance Program. Provide accreditation and certification information on the form included in the Form of Proposal.
- F. Manufacturer certificate, located in the FOP, to be submitted with the bid, for the proposed sprayed-in-place thermal insulation system confirming that the sprayed-in-place thermal insulation system installer is approved to install the proposed sprayed-in-place thermal insulation system.

1.05 FIELD CONDITIONS

A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

1.06 SEQUENCING

A. Sequence work to ensure fireproofing and firestop materials are in place before beginning work of this section.

1.07 COORDINATION

A. Coordinate the work with Section 072500 for installation of vapor retarder.

1.08 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of building insulation through one source.
- B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
 - 1. Surface Burning Characteristics: ASTM E 84.
 - 2. Fire Resistance Ratings: ASTM E 119.
 - 3. Combustion Characteristics: ASTM E 136.
- C. Sprayed-In-Place Thermal Insulation: Current accreditation of the subcontractor and certification of installers in accordance with the Air Barrier Association of America's (ABAA) Quality Assurance Program.
 - 1. Install in accordance with ABAA and training requirements outlined in ULC S705.2-05 Installation Standard.
- D. Sprayed-In-Place Thermal Insulation Field Quality Control:
 - 1. ABAA Site Inspections: ABAA to verify conformance with the manufacturers instructions, the ULC S705.2 Installation Standard, the ABAA Quality Assurance Program and requirements of this specification.
 - a. Inspections and testing shall be carried out at 50 percent of sprayed-in-place thermal insulation completion. Forward written inspection reports to the Architect within 10 working days of the inspection and test being performed.
 - b. If the tests reveal any defects, promptly remove and replace defective work at no additional expense to the Owner.
 - 1) If the preliminary or final written inspection report indicates the system will not or has not passed then an additional ABAA inspection shall be conducted to ensure defects and defciencies have been corrected and a passing ABAA report can be obtained.

1.09 PRE-INSTALLATION MEETING

- A. Preinstallation Meeting: Per Section 042000 Unit Masonry the general contractor/construction manager will conduct a preinstallation conference prior to the masonry installation occuring. The sprayed-in-place thermal insulation installer is to attend this preinstallation conference too coordinate the installation of the sprayed-in-place insulation with the masonry subcontractor.
 - 1. Review foreseeable methods and procedures related to sprayed-in-place thermal insulation installation, including but not necessarily limited to the following:
 - a. Protection of through wall flashing.
 - b. Spray around horizontal reinforcing eyes.
 - c. Hot and cold weather protection.
 - d. Protection of work in process and installed.
 - e. Sequencing of work with masonry installation.
 - f. Review percentages of completion when ABAA testing will be conducted.
 - Has the project been registered with the ABAA for testing?
 - 1) If registered has the ABAA testing agent been notified?

1.10 MOCK-UP

A. Sprayed-in-place thermal insulation to be included in the mock-up wall construction.

PART 2 PRODUCTS

2.01 FOAM BOARD INSULATION MATERIALS

g.

- A. Extruded Polystyrene (XPS) Board Insulation: Complies with ASTM C578 with either natural skin or cut cell surfaces.
 - 1. Flame Spread Index (FSI): Class A 0 to 25, when tested in accordance with ASTM E84.
 - 2. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
 - 3. Type and Thermal Resistance, R-value: Type IV, 5.0 (0.88) per 1 inch thickness at 75 degrees F mean temperature.
 - 4. R-value; 1 inch of material at 72 degrees F: 5, minimum.
 - 5. Board Thickness at Foundation Wall: 2 inches.
 - 6. Board Edges: Square.
 - 7. Thermal Conductivity (k factor) at 25 degrees F: 0.18.
 - 8. Thermal Resistance: R of 7.5 for 1-1/2 inch.
 - 9. Compressive Resistance: 25 psi.
 - 10. Board Density: 1.6 lb/cu ft.
 - 11. Water Absorption, Maximum: 0.3 percent, by volume.
 - 12. Manufacturers: Subject to compliance with requirements, manufacturers offering the following products that may be incorporated into the work include;
 - a. Certainteed Saint Gobain: www.certainteed.com
 - b. Dow Chemical Company: www.dow.com.
 - c. Kingspan Insulation LLC; GreenGuard XPS TYPE IV 25 PSI: www.trustgreenguard.com/#sle.
 - d. Owens Corning Corporation; FOAMULAR Extruded Polystyrene (XPS) Insulation: www.ocbuildingspec.com/#sle.

2.02 SPRAYED-IN-PLACE THERMAL INSULATION

- A. Manufacturers: Subject to compliance with requirements, manufacturers offering the following products that may be incorporated into the work include:
 - 1. Basis of Design: Design concept and the drawings indicate the size, profiles, dimensional requirements and aesthetics of the following:
 - a. NCFI Polyurethanes, Division of BMC: InsulBloc 2 lb. Spray Foam System 11-017.

- 2. Products by other manufacturers (listed below) may be considered, provided deviations in dimensions, profiles, and formulations are minor and do not change the design concept as judged by the Architect.
 - a. NCFI Polyurethanes, Division of BMC: InsulBloc 2 lb. Spray Foam System 11-017: www.ncfi.com
 - b. Accella Polyurethane Systems, Inc.: EcoBay Closed Cell: www.accellapolyurethane.com
 - c. BASF Polyurethane Foam Enterprises, LLC: Walltite 2 lb.Air Barrier System: www.basf-pfe.com
 - d. Demilec USA, LLC: Heatlok Soy 200 Plus: www.demilecusa.com
 - e. Gaco Western: Gaco WallFoam 183M 2 lb.: www.gaco.com
 - f. Henry Company: Permax 2.0: www.henry.com
 - g. Icynene Inc.: ProSeal MD-C-200 2 lb. Spray Foam Insulation: www.icynene.com
 - h. JohnsManville Insulation Systems: JM Corbond III 2 lb.: www.jm.com
- B. Spray applied closed cell, 2 lb. polyurethane foam insulation, air seal and water repellent treatment for CMU cavity wall and cold formed metal stud framed walls throughout the project.
 - 1. Physical material properties shall be:
 - 2. Core Density 1.9-2.2 lb/ft per ASTM D-1622
 - 3. Water Vapor Transmission <1.0 @ 2" thick /perms per ASTM E-96
 - 4. R-Value 6.7 minimum at 1 inch thick per ASTM C-518
 - 5. R-Value Aged: 6.4 minimum at 1 inch thick per ASTM C-1029
 - 6. Compressive Strength 25 (min) psi per ASTM D-1621
 - 7. Flame Spread <25 per ASTM E-84
 - 8. Smoke Developed <450 per ASTM E-84
 - 9. Air Leakage Infiltration: 0.00 @ 1.57 psf/cfm/ft2 per ASTM E-283
 - 10. Air Leakage Exfiltration: 0.00 @ 1.57 psf/cfm/ft2 per ASTM E-283
 - 11. Air Barrier System Test: ASTM E 2357 and NFPA 285
 - 12. Tensile Bond Strength >45 for masonry psi per ASTM D-1623
 - 13. Hydrostatic Water Pressure Resistance Test: No failure at 56.5 feet head pressure per AATCC 127-1998.
- C. Refer to the wall types on the A0.1 drawing sheet for thickness of spray polyurethane material required.
- D. Apply spray polyurethane foam directly to the masonry block or exterior sheathing in accordance with the manufacturers installation instructions. All surfaces to be sprayed with foam must be free of moisture and ice.
- E. Do not apply spray polyurethane foam during inclement weather or when ambient temperatures and humidity are outside the ranges prescribed by the manufacturer.
 - 1. Optimum Adhesion: Sprayed-In-Place Thermal Insulation Installer to determine appropriate grade of adhesive material to be used on project based on; project type, substrate type, time of year of installation, average daily temperatures forcasted during installation, and other factors, as determined by the sprayed-in-place thermal insulation manufacturer to maintain the specified requirements. No additional compensation will be considered, or due, the sprayed-in-place thermal insulation contractor if the sprayed-in-place thermal insulation manufacturer requires a tack coat, or the type or grade of adhesive, originally bid, to be changed due to project type, environmental and/or temperature factors, to maintain the specified requirements and construction schedule.
- F. Materials:
 - 1. Transition Strip and Seam Tape Primer:
 - a. Primer to facilitate adhesion of flashings to fiberglass faced sheathing, concrete and masonry substrates.

- 1) Manufacturers: Subject to compliance with requirements, manufacturers offering the following products that may be incorporated into the work include:
 - (a) Grace Construction Products: Perm-A-Barrier WB Primer
 - (b) W. R. Meadows, Inc.: Mel-Prime
 - (c) Product approved for use by sprayed-in-place thermal insulation manufacturer.
- 2. Seam Tape:
 - a. Self-adhered flashing with cross-laminated, high density polyethylene sheet backed with pressure-sensitive rubberized asphalt adhesive.
 - 1) Manufacturers: Subject to compliance with requirements, manufacturers offering the following products that may be incorporated into the work include:
 - (a) Grace Construction Products: Vycor Plus
 - (b) W. R. Meadows, Inc.: Air-Sheild 25 mil Flashing Tape
 - (c) Product approved for use by sprayed-in-place thermal insulation manufacturer.
- 3. Transition Strip Materials:
 - a. Contractor option to use self-adhered sheet product or fluid applied product for the transition strip materials.
 - b. Self-adhered Transition Strip Material: Minimum 1 mm self-adhered flashing sheet with cross-laminated, high density polyethylene sheet backed with pressure-sensitive rubberized asphalt adhesive. Install transition strip materials at all wall openings, transitions in substrate and connections to adjacent elements:
 - 1) Manufacturers: Subject to compliance with requirements, manufacturers offering the following products that may be incorporated into the work include:
 - (a) Carlisle Coatings and Waterproofing: CCW-705 TWF
 - (b) Grace Construction Products: Perm-A-Barrier Flashing
 - (c) Henry: Blueskin SA
 - (d) Protective Coatings Technology, Inc.: Poly-Wall Crack Guard
 - (e) Tremco, Inc.; ExoAir 110
 - (f) W. R. Meadows, Inc.: Air Shield
 - c. Fluid-applied Transition Strip Material System: One component rubberized air barrier material. Suitable for spray, roller or brush application direct to substrate. Install by roller/brush in two minimum 13 mil wet thickness applications, or one 26 mil wet thickness application by spray. Provide all additional auxiliary materials necessary to complete the entire system: Reinforced, nonwoven, polyester sheathing joint fabric with preformed corners, polyester-faced 30-mil thick, self-sealing, rubberized asphalt membrane, and water-based primer.
 - 1) Manufacturers: Subject to compliance with requirements, manufacturers offering the following products that may be incorporated into the work include:
 - (a) BASF: Enershield-1, Quick Corner 6, TF Membrane, WS Flashing Primer: www.enershield.basf.com
 - (b) Prosoco R-Guard Fast Flash
 - (c) W. R. Meadows, Inc.: Air Shield LM

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.

B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.02 BOARD INSTALLATION AT FOUNDATION PERIMETER

- A. Adhere a 6 inch wide strip of polyethylene sheet over construction, control, and expansion joints with double beads of adhesive each side of joint.
 - 1. Tape seal joints.
 - 2. Extend sheet full height of joint.
- B. Install boards horizontally on foundation perimeter.
 - 1. Place boards to maximize adhesive contact.
 - 2. Install in running bond pattern.
 - 3. Butt edges and ends tightly to adjacent boards and to protrusions.
- C. Extend boards over expansion joints, unbonded to foundation on one side of joint.
- D. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.
- E. Immediately following application of board insulation, place protective boards over exposed insulation surfaces.

3.03 SPRAYED-IN-PLACE THERMAL INSULATION AIR BARRIER SYSTEM

- A. Equipment used to spray insulation shall comply with ABAA ULC S705.2 and the manufacturer's recommendations.
- B. Record equipment settings daily as required by the ABAA ULC S705.2 installation standard.
- C. Apply in consecutive passes as recommended by manufacturer and thickness indicated on drawings. Passes shall not be less than 1/2 inch and not greater than 2 inches.
- D. Install within manufacturer's tolerances, but not more than minus 1/4 inch or plus 1/2 inch.
 - 1. The total average thickness, tested and provided on the final ABAA Audit Report, for the sprayed insulation installed on the wall in the field shall be the minimum thickness indicated, for the various wall types, as shown on the drawings.
- E. Surface of foam insulation to be free of voids and embedded foreign objects.
- F. Remove masking materials and overspray from adjacent areas immediately after foam surface has hardened. Ensure cleaning methods do not damage work performed by other sections.
- G. Trim as required, any excess thickness that would interfere with the application of cladding/covering system by other trades.
- H. Complete connections to other components and repair any gaps, holes or other damage using material which conforms to ABAA ULC S710.1 or ABAA ULC S711.1 and installed in accordance with ABAA ULC S710.2 or ABAA ULC S711.2 as applicable.
- I. Fill exterior metal stud boxed/beam headers, jambs, and sills at all openings completely with 0.5 lb. spray insulation.
- J. Transition Strip and/or Fluid-Applied Material Installation: Install transition strip/fluid-applied materials to provide continuity throughout the building envelope. Install materials in accordance with manufacturer's recommendations and the following:
 - 1. Priming, seam tape/fluid-applied material, and transition strips are required by RossTarrant whether or not they are required by a manufacturer to meet the ABAA air leakage requirements of ASTM E2357.
 - 2. Apply primer for seam tape and transition strips. Allow primer to dry completely before transition strip application. Apply as many coats as necessary for proper adhesion.

- 3. Position subsequent sheets of transition strips applied above so that membrane overlaps the membrane sheet below by a minimum of 2 inches, unless greater overlap is required by manufacturer. Roll into place with roller.
- 4. Overlap horizontally adjacent pieces of transition strips a minimum of 2 inches, unless greater overlap is required. Roll seams with roller.
- 5. Seal around all penetrations with a transition strip or other procedure.
- 6. At changes in substrate plane, provide transition material to make a smooth transition from one place to another.
- 7. Provide mechanically fastened non-corrosive metal sheet to span gaps in substrate plane and to make a smooth transition from one plane to another. Membrane shall be continuously supported by substrate.
- 8. At through-wall flashings, provide an additional 6 inch wide strip of membrane counterflashing to seal top of through-wall flashing to membrane. Seal exposed top edge of strip with bead of mastic.
- 9. At deflection and control joints, provide backup for the membrane to accommodate anticipated movement.
- 10. At expansion and seismic joints provide transition to the joint assemblies.
- 11. At the top of parapet walls, provide transition material over top of parapet to transition with roof membrane.
- 12. Do not allow materials to come into contact with chemically incompatible materials.
- 13. Do not expose transition membrane to sunlight longer than recommended by manufacturer.
- 14. Inspect installation prior to enclosing assembly and repair damaged areas with sprayed-in-place thermal insulation air barrier system.

3.04 **PROTECTION**

A. Do not permit installed insulation to be damaged prior to its concealment. **END OF SECTION 072100**

SECTION 075200 - MODIFIED BITUMINOUS MEMBRANE ROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Two-ply modified bituminous roofing membrane, conventional application.
- B. Hot roofing asphalt (base sheet) and/or cold adhesive (cap sheet).
- C. Insulation, flat and tapered.
- D. Base flashings.
- E. Roofing cant strips, accessories, and walkway pads.

1.02 RELATED REQUIREMENTS

- A. Section 013000 Administrative Requirements: Submittal procedures.
- B. Section 015000 Temporary Facilities and Controls: Exterior enclosure.
- C. Section 061000 Rough Carpentry: Wood nailers and curbs.
- D. Section 077100 Roof Specialties . Fascia.
- E. Section 079005 Joint Sealers.
- F. Refer to Mechanical, electrical and plumbing sections for roof penetrations and roof drains.

1.03 DEFINITIONS

- A. Roofing Terminology: Refer to ASTM D 1079 for definitions of terms related to roofing work not otherwise defined in this Section.
- B. Hot Roofing Asphalt: Roofing asphalt heated to its equiviscous temperature, the temperature at which its viscosity is 125 centipoise for mop-applied roofing asphalt and 75 centipoise for mechanical spreader-applied roofing asphalt within a range of plus or minus 25 deg F (14 deg C) measured at the mop cart or mechanical spreader immediately before application.
- C. Thermal Resistivity (r-value) is the reciprocal of thermal conductivity (k-value) which is the rate of heat flow through a homogenous material exactly 1 inch thick. Thermal resistivity (r-value) is expressed by the temperature difference in degrees F between two parallel surfaces required to cause 1 Btu to flow through 1 sq. ft. of a homogenous material exactly 1 inch thick per hour at the mean temperature indicated.
- D. Thermal Resistance (R-value) is the reciprocal of thermal conductance (C-value) which is the rate of heat flow through a material of the thickness indicated. Thermal resistance (R-value) is expressed by the temperature difference in degrees F between the two exposed faces required to cause 1 Btu to flow through 1 sq. ft. per hour at the mean temperature indicated.

1.04 REFERENCE STANDARDS

- A. ASCE/SEI 7-10 Minimum Design Loads for Buildings and Other Structures: Wind design.
- B. ASTM C728 Standard Specification for Perlite Thermal Insulation Board; 2013.
- C. ASTM C1289 Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2014.
- D. ASTM D312/D312M Standard Specification for Asphalt Used in Roofing; 2015.
- E. ASTM D5147/D5147M Standard Test Method for Sampling and testing Modified Bituminous Sheet Material; 2014

- F. ASTM D6630 Standard Guide for Low Slope Insulated Roof Membrane Assembly; current edition.
- G. ASTM E108 Standard Test Methods for
- H. UL (DIR) Online Certifications Directory; current listings at database.ul.com.
- I. UL (FRD) Fire Resistance Directory; current edition.
- J. UL 580 Tests for Uplift Resistance of Roof Assemblies ; current edition.
- K. UL 1897 Uplift Tests for Roof Covering Systems; current edition.

1.05 SYSTEM PERFORMANCE REQUIREMENTS

- A. General: Install a watertight, modified bituminous membrane roofing and base flashing system with compatible components that will not permit the passage of liquid water and will withstand wind loads, thermally induced movement, and exposure to weather without failure.
- B. ASCE 7-10: Provide cap sheet, base flashings, and component materials that meet the wind design requirements a as part of a roofing system, as applicable.
 - 1. Refer to the structural drawings for wind speeds, building exposure, and building risk category.
- C. UL Listing: Provide modified bituminous sheet roofing system and component materials that have been tested for application and slopes indicated and are listed by Underwriters Laboratories, Inc. (UL) for Class A external fire exposure.
 - 1. Provide roof-covering materials bearing UL Classification Marking on bundle, package, or container indicating that materials have been produced under UL's Classification and Follow-up Service.
 - 2. Provide modified bitumen sheet roofing system that has been tested in accordance with UL 580 or UL 1897.
- D. Insulation Fire-Performance Characteristics: Provide insulation materials that are identical to materials whose fire-performance characteristics have been determined for the assemblies of which the insulation materials are a part, per test method listed below, by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Surface Burning Characteristics: ASTM E 84.
 - 2. Fire Resistance Ratings: ASTM E 119.
- E. All material, the installation thereof shall meet or exceed the minimum criteria of the Kentucky State Building Code.

1.06 SUBMITTALS

- A. Product Data: Provide manufacturer's catalog data for membrane and bitumen materials, base flashing materials, insulation, vapor retarder, surfacing, and any other accessories.
- B. Product Test Reports: Based on evaluation of tests performed by manufacturer and witnessed by a qualified independent testing agency, indicate compliance of components of roofing system with requirements based on comprehensive testing of current product compositions.
- C. Evaluation Reports: Evidence of roofing system's compliance with building code in effect for Project from a model code organization to authorities having jurisdiction.
- D. Maintenance Data: For roofing system to include in the Operation and Maintenance Manuals specified in Division 1.
- E. Shop Drawings: Indicate joint or termination detail conditions, conditions of interface with other materials, setting plan for tapered insulation, mechanical fastener layout, and all accessories.

- 1. Shop drawings to depict the coordination and integration of the wall systems. The Contractor will submit shop drawings showing the flashing, termination and system intersection conditions of all roofing and wall systems.
- 2. Base flashings, cants and membrane terminations, at edges, parapets and high walls.
- 3. Tapered insulation, including slopes.
- 4. Crickets, saddles, and tapered edge strips, including slopes.
- F. Samples: Submit two samples 4 x 4 inches in size illustrating granule surfaced sheet, insulation, and base ply, metal-foil-surfaced flashing sheet.
- G. Manufacturer's Qualification Statement.
- H. Installer's Qualification Statement.
 - 1. Submit written certification from manufacturer of modified bituminous sheet roofing system certifying that Installer is approved by manufacturer to install specified roofing system and required warranty will be provided. Refer to Form of Proposal for certification form to be turned in within 2 hours of the bid opening.
- I. Manufacturer's Installation Instructions: Indicate special procedures.
- J. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
 - 1. Signed by roofing system manufacturer certifying that the roofing system complies with requirements specified in the "Performance Requirements" Article. Upon request, submit evidence of complying with requirements.
- K. Manufacturer's Roof System Assembly Letter: Letter describing each roof assembly listing; deck type, insulation, fastening methods, and membrane.
- L. Manufacturer's Field Reports: Indicate procedures followed.
- M. Qualification Data: For firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- N. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.
 - A copy of the unexecuted roofing warranty is to be submitted on bid day for review and approval by the Owner prior to award of contract.
- O. Inspection: Letter from the proposed primary roofing materials manufacturer confirming that the final inspection will be performed by a trained, technical representative. Sales personnel or agents will not be considered eligible to perform final inspection.
- P. Inspection Report: Copy of roofing system manufacturer's inspection report of completed roof installation.
- Q. Wind Uplift Design: Provide wind uplift calculation that include wind uplift performance tested per ASCE 7-10 Envelope Procedure. Calculations to include:
 - 1. Minimum Design Wind-Resistance Loads: Include field of roof, perimeter, and corner uplift pressures for each applicable roof area.
 - 2. Fastener pattern, spacing, and/or enhanced adhesive requirements.
 - 3. Additional wind uplift safety factors required by the building area, size or shape, and manufacturers requirements to meet the specified warranty requirements.
- R. Manufacturer certificate, located at the end of this Section, to be submitted with the bid, for the proposed modified bituminous roof system confirming that the roof system installer is approved to install the proposed modified bituminus roof system.

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1.07 SUBMITTAL OF EQUIVALENTS

- A. Substitutions: Division 0; Supplemental Instructions to Bidders; Substitution Request During Bidding Form.
- B. Submittals for primary roof systems to be considered as equivalents to the specified roof system shall be made no less than ten (10) days prior to bid date. Primary roof systems which have been reviewed and accepted as equivalents to the specified roof system will be listed in an addendum prior to bid date; only then will equivalents be accepted at bidding. Submittals of equivalents prior to bid shall include:
 - 1. Two (2) eight (8) inch by ten (10) inch samples of the primary roofing and flashing sheets.
 - 2. Latest edition of the roofing system manufacturer's specifications and installation instructions.
 - 3. Descriptive list of the materials proposed for use.
 - 4. Evidence of Underwriter's Laboratories Class A acceptance of the proposed roofing and flashing membrane system (including mopping asphalt or cold adhesive) without additional requirements for gravel or coatings. No other testing agency approvals for accepted.
 - 5. Evidence of ASCE 7-10 Testing for the proposed membrane system.
 - a. The roof configuration (including fastening of base sheet, insulation, etc.) shall be designed per wind uplift calculations.
 - 6. Complete list of materials physical properties for each sheet including: low temperature flexibility bend; elongation at room temperature; and recovery properties; weights and thickness.
 - 7. Sample copy of the specified warranty, including a listing of items not covered by the warranty.

1.08 SUBMITTALS PRIOR TO PROJECT CLOSEOUT

- A. Certificate of Analysis from the testing laboratory of the primary roofing materials manufacturer, confirming the physical and mechanical properties of the roofing membrane components. Testing shall be in accordance with the parameters published in ASTM D5147 and UEAtc* and indicate Quality Assurance/Quality Control data as required to meet the specified properties. A separate Certificate and Analysis for each production run of material shall indicate the following information:
 - 1. Material type.
 - 2. Lot number.
 - 3. Production date.
 - 4. Dimensions and Mass (indicate the lowest values recorded during the production run);
 - a. length.
 - b. Width.
 - c. Selvage width.
 - d. Total thickness.
 - e. Thickness at selvage.
 - f. Weight.
 - 5. Physical and Mechanical Properties;
 - a. Low temperature flexibility.
 - b. Maximum load.
 - c. Elongation at 5% Maximum load.
 - d. Dimensional stability.
 - e. High temperature stability.
 - f. Granule embedment.
 - g. Resistance to thermal shock* (foil faced products).

1.09 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 - 1. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten years of documented experience.

- 2. Obtain primary products, including each type of roofing sheet, bitumen, membrane flashings, and vapor retarder (if any), from a single manufacturer. Provide secondary products as recommended by manufacturer of primary products for use with roofing system specified.
- 3. Roof membrane manufacturer is to have an indemnity arrangement with the selected lightweight insulating concrete manufacturer to meet the special project full system roof warranty as specified.
- B. Installer Qualifications: Engage an experienced installer to perform Work of this Section who has specialized in installing roofing that is required for this Project; who is approved, authorized, or licensed by the roofing system manufacturer to install manufacturer's product; and who is eligible to receive the project specific full system roofing manufacturer's warranty as specified. A minimum of four (4) years experience with the manufacturer and the specified system is required.
 - 1. Installer's Field Supervision: Require Installer to maintain a full-time supervisor/foreman on job site during times that modified bituminous sheet roofing work is in progress and who is experienced in installation of roofing systems similar to type and scope required for this Project. A minimum of four (4) years experience with the manufacturer and the specified system is required.
- C. Fire-Test Response Characteristics: Provide roofing materials with fire-test-response characteristics indicated as determined by testing identical products per test method indicated below by UL, FM, or other testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
 - 1. Fire-test Exposure: Class A; complying with ASTM E 108, for application and slopes indicated.

1.10 PRE-INSTALLATION MEETING

- A. Convene one week before starting work of this section.
- B. Review preparation and installation procedures and coordinating and scheduling required with related work.
- C. Preliminary Roofing Conference: Before starting roof deck construction, conduct conference at project site. Meet with Installer (Roofer), installers of substrate construction (roof decks) and other work adjoining roof system including penetrating work and roof accessories, Architect, Owner, and representatives of other entities directly concerned with performance of roofing system including (as applicable) Owner's insurers and test agencies. This meeting must be attended by the on site Foreman overseeing the work.
 - 1. Review requirements (Contract Documents), submittals, status of coordinating work, availability of materials, and installation facilities and establish preliminary installation schedule. Review requirements for inspections, testing, certifications, forecasted weather conditions, governing regulations, insurance requirements, and proposed installation procedures.
 - 2. Discuss roofing system protection requirements for construction period extending beyond roofing installation. Discuss possible need for temporary roofing.
 - 3. Record discussion, including agreement or disagreement on matters of significance; furnish copy of recorded discussions to each participant. If substantial disagreements exist at conclusion of conference, determine how disagreements will be resolved and set date for reconvening conference.
- D. Preapplication Roofing Conference: Approximately 2 weeks before scheduled commencement of modified bitumen sheet roofing installation and associated work, meet at Project site with Installer, installer of each component of associated work, installers of roof drains, installers of deck or substrate construction to receive roofing work, installers of rooftop units and other work in and around roofing that must precede or follow roofing work (including mechanical work if any), Architect, Owner, roofing system manufacturer's representative, and other representatives directly concerned with performance of the Work, including (where applicable) Owner's insurer s, test agencies, and governing authorities.

- 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 foreseeable methods and procedures related to roofing work, including but not necessarily limited to the following:
 - a. Tour representative areas of roofing substrates (decks), inspect and discuss condition of substrate, roof drains, curbs, penetrations, and other preparatory work performed by other trades.
 - b. Review structural loading limitations of steel deck and inspect deck for loss of flatness and for required mechanical fastening.
 - c. Review roofing system requirements (drawings, specifications, and other contract documents).
 - d. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
 - e. Review required submittals, both completed and yet to be completed.
 - f. Review flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing.
 - g. Review and finalize construction schedule related to roofing work and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - h. Review required inspection, testing, certifying, and material usage accounting procedures.
 - i. Review temporary protection requirements for roofing system during and after installation.
 - j. Review weather and forecasted weather conditions and procedures for coping with unfavorable conditions, including possibility of temporary roofing (if not a mandatory requirement).
 - k. Review of roof observation and repair procedures after roofing installation.
- 3. Record (Contractor) discussions of conference, including decisions and agreements (or disagreements) reached, and furnish copy of record to each party attending. If substantial disagreements exist at conclusion of conference, determine how disagreements will be resolved and set date for reconvening conference.

1.11 COMPLETION MEETING

A. A meeting shall be held at the completion of the project and attended by all parties that were present at the pre-job conference. A punch list of items required for completion shall be compiled by the Contractor and the Manufacturer's representative. The Contractor shall complete all punch list items and acquire Manufacturer's warranty for final submittal to Architect.

1.12 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in manufacturer's original containers, dry and undamaged, with seals and labels intact.
- B. Store products in weather protected environment, clear of ground and moisture.
- C. Ensure storage and staging of materials does not exceed static and dynamic load-bearing capacities of roof decking.
- D. Store roofing materials in a dry, well-ventilated, weathertight location to ensure no significant moisture pickup and maintain at a temperature exceeding roofing system manufacturer's written instructions. Store rolls of felt and other sheet materials on end on pallets or other raised surfaces. Do not double-stack rolls.
 - 1. Handle and store roofing materials and place equipment in a manner to avoid significant or permanent damage to deck or structural supporting members.

- 2. Cover all materials using a breathable cover such as canvas. Polyethylene or other non-breathable plastic coverings are not acceptable.
- E. Do not leave unused felts and other sheet materials on the roof overnight or when roofing work is not in progress unless protected from weather and moisture and unless maintained at a temperature exceeding 50 deg F (10 deg C).
- F. Deliver and store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer.
- G. Any materials that are found to be damaged or stored in any manner other than stated above shall be automatically rejected and shall be removed and replaced at the Contractor's expense.
- H. Protect roofing 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.

1.13 PROJECT CONDITIONS

- A. Coordinate the work with installation of associated flashings and counterflashings installed by other sections as the work of this section proceeds.
- B. Do not apply roofing membrane when environmental conditions are outside the ranges recommended by manufacturer.
- C. Do not apply roofing membrane during unsuitable weather.
- D. Do not apply roofing membrane when ambient temperature is below 40 degrees F.
- E. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.
- F. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.
- G. Temperature Restrictions Asphalt: At ambient temperatures of forty (40) degrees F and below, special precautions must be taken to ensure that the specified Type IV asphalt maintains a minimum acceptable 400 degrees F temperature at the point of sheet application. The asphalt must not be overheated to compensate for cold conditions. The use of insulated handling equipment is strongly recommended. Hot luggers, mop carts, and kettle-to-roof supply lines should be insulated. Hand mops should be constructed with a smaller yarn head to facilitate short moppings. Luggers and mop carts should never be more than half filled at all times.
- H. Temperature Restrictions Cold Adhesive: At low temperatures, the specified cold adhesive becomes more viscous, making even distribution more difficult. The cold adhesive should be stored in a warm place immediately prior to use. A shop squeegee should be used to assist in an even distribution of the adhesive (cut notches out of the rubber blade of the squeegee). Application should be suspended in situations where the adhesive cannot be kept at temperatures allowing for even distribution.
- I. Temporary Roofing: When adverse job or weather conditions prevent permanent roofing system from being installed according to requirements and Contractor determines that roofing cannot be delayed because of need for job progress or protection of other work, install temporary roofing. Engage roofing Installer to provide temporary roofing and to remove it prior to proceeding with permanent roofing work.
- J. Membrane Protection: Protection against staining and mechanical damages shall be provided for newly applied roofing and adjacent surfaces throughout this project.
- K. Site Condition: All job site clean-up including building exterior and landscaping, where affected by the construction, shall be completed to the Owner's satisfaction. All debris shall be removed daily from the project site and shall be taken to a legal dumping area authorized to receive such materials.

1.14 SEQUENCING AND SCHEDULING

- A. Sequence installation of modified bituminous sheet roofing with related units of Work specified in other Sections to ensure that roof assemblies, including roof accessories, flashing, trim, and joint sealers, are protected against damage from effects of weather, corrosion, and adjacent construction activity.
- B. Sequence removal of existing roofing materials and installation of new roofing system including temporary roofing, insulation and SBS roofing, to ensure roof is in a weathertight condition at the end of each day.
- C. Schedule work to ensure drainage of roof is maintained at all times.

1.15 WARRANTY

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- A. See Section 017800 Closeout Submittals, for additional warranty requirements.
- B. General Warranty: The warranties 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. Three executed copies of all warranties must be submitted to the Architect.
- C. Special Project Full System Warranty
 - The entire installation from the metal deck up, including but not limited to insulation, fasteners, asphalt, roofing membranes, edge metals, copings, and base flashings, shall be warranted against defects in material and workmanship as evidenced by leaks, flashing membrane deterioration, blisters, splits, etc., as required to maintain roofing system in a watertight condition for the period stated below starting from the date of final acceptance by the Owner. Should leak occur, the Manufacturer shall repair or replace the roof materials as required, to provide a watertight condition, at its own expense, with no dollar limit or prorated amount. The warranty shall cover fully and completely the entire roofing system and the requirements as specified herein. Particularly warranty shall not include language releasing manufacturer of responsibility if not installed by approved roofing Contractor or in accordance with manufacturer's responsibility to know by whom and how roofing was installed to eliminate this. The guarantee is for a complete system and shall not be limited by any previous work accomplished on the roof prior to this contract and elected to remain as a part of the system herein specified:
 - a. Total Systems Warranty shall be for a period of twenty (20) years NDL from the date of substantial completion.
 - b. This warranty shall be jointly signed by the Manufacturer of the primary roofing material and the authorized installer.
 - c. Repairs and replacements required because of events beyond the Contractor's/Installer's/ Manufacturer's control and beyond the limits specified herein shall be completed by the Contractor/Installer and paid for by the Owner.
 - d. The Manufacturer shall provide interim inspection of the roof surface after two (2) years of service at no cost to the Owner to identify potential problems prior to damage and allow for a maintenance recommendation. Written reports of these inspections must be made and shared with the Owner and Architect.
- D. Installer shall provide a typed certificate stating the following:
 - 1. Type of roof.
 - a. Installer.
 - b. Installer's address and telephone number.
 - c. Manufacturer.
 - d. Manufacturer's address and telephone number.
 - e. Who to contact in case of roof failure.

- f. Warranty period with beginning and ending dates. Certificate shall be framed and bolted (not hung) on the wall as directed by Architect. Copies of certificate shall be included with manufacturer's written warranty and submitted to Architect.
- g. Any representative who inspects roof must copy all inspection reports to the office of Ross-Tarrant Architects, Inc. for the life of the roof.
- E. Contractor's Warranty: Roofing contractor shall provide a written two (2) year warranty for materials and workmanship commencing with the date of substantial completion. The warranty shall cover all labor and all material necessary to maintain complete water tightness, including that required to repair and all roof leaks and water infiltration through the roof, flashings, and wall copings in any configuration including standing water at no additional cost to the Owner.
- F. Warranty Work: All warranty and/or maintenance work shall be documented by the individual performing the work with before and after pictures of the work and a detailed breakdown of cost. Submit to the Owner and the Architect. Time spent by the Architect for manufacturer warranty problems shall be billed to the manufacturer
- G. Recommended Maintenance: In addition to the guarantee, the Contractor shall furnish to the Owner the Manufacturer's printed recommendations for proper maintenance of the specified roof system including inspection frequencies, penetration addition policies, temporary repairs, and leak call procedures.
 - 1. Arrange for a meeting of the Owner, Architect, Manufacturer, and Installer to review procedure for general maintenance by the Owner that will not void warranty, as well as procedure for reporting roof problems, maintenance, and/or warranty problems to manufacturer.
 - 2. All warranty and/or maintenance work shall be documented by the individual performing the work with before and after pictures of the work and detailed breakdown of cost. Submit to Owner and Architect time spent by Architect for manufacturer's warranty problems shall be billed to the manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Membrane Materials:
 - 1. Subject to compliance with requirements, manufacturers offering the following products that may be incorporated into the work include:
 - a. Firestone Building Products Company: www.firestonebpco.com.
 - b. GAF/ Siplast: www.siplast.com.
 - c. Johns Manville. www.jm.com
 - d. Soprema: www.soprema.us
 - e. Substitutions: Refer to submittal of equivalents information listed in previous paragraphs.
- B. Roofing Membrane Assembly: The roof membrane assembly shall consist of two (2) plies of a prefabricated, fiberglass or polyester reinforced, Styrene-Butadiene-Styrene (SBS) block copolymer modified asphalt membrane, secured to a prepared substrate. The assembly shall possess waterproofing capability, such that a phased roof application, with only the modified bitumen base ply in place, can be achieved for prolonged periods of time without detriment to the watertight integrity of the entire roof system. The modified bitumen first ply shall be hot mopped to the modified bitumen base ply. The modified bitumen second ply/cap sheet can be adhered in cold adhesive or hot mopped. Each sheet of the roof assembly shall meet the following physical requirements as a minimum, but no less than as required for providing stated warranty.
 - 1. Basis of Design: Johns Manville 2FID

2.02 SHEET ROOFING MATERIALS

- A. Roofing Membrane Base Sheet: ASTM D 6163, Grade S, Type I, glass-fiber-reinforced, SBS-modified asphalt sheet; smooth surfaced; suitable for application method specified.
 - 1. Basis of Design: Design concept and the drawings indicate the size, profiles, dimensional requirements and aesthetics of the following:
 - a. JM DynaBase
 - b. Siplast Paradiene 20
 - c. Firestone SBS Base
 - 2. Properties:
 - a. Roof Covering Classification: Class A.
 - b. Thickness (avg.) 90 mils-2.3 mm (ASTM D 5147).
 - c. Thickness (min.) 87 mils-2.2 mm (ASTM D 5147).
 - d. Weight (min. per 100 ft² of coverage) $62 \text{ lb.-} 3.0 \text{ kg/m}^2$.
 - e. Filler content in elastomeric blend-less than 35% by weight.
 - f. Low temperature flexibility at -13 degrees Fahrenheit (-25 degrees Celsius) PASS (ASTM D 5147).
 - g. Maximum load (avg.) at 73 degrees Fahrenheit 30 lbf/inch (ASTM D 5147).
 - h. Maximum load (avg.) at 0 degrees Fahrenheit 70 lbf/inch (ASTM D 5147).
 - i. Elongation at 5% Maximum Load (avg.) at 73 degrees Fahrenheit 50% (ASTM D 5147).
 - j. Dimensional Stability (max.) 0.5% (ASTM D 5147).
 - k. High Temperature Stability (min.) 250 degrees Fahrenheit (121° C).
 - 1. Approvals UL Class listed, FM Approved (products shall bear seals of approval)
 - m. Reinforcement fiberglass mat or other meeting the performance criteria.
- B. Roofing Membrane Cap Sheet: ASTM D 6163, Grade G, Type I or II, glass-fiber-reinforced, SBS-modified asphalt sheet; granular surfaced; suitable for application method specified.
 - 1. Basis of Design: Design concept and the drawings indicate the size, profiles, dimensional requirements and aesthetics of the following:
 - a. JM DynaGlas FR
 - b. Siplast Paradiene 30 FR
 - c. Firestone SBS Glass FR
 - 2. Properties:
 - a. Roof Covering Classification: Class A.
 - b. Thickness (avg.): 130 mils 3.3 mm.
 - c. Thickness at selvage (avg.): 98 mils 2.5 mm (ASTM D 5147).
 - d. Thickness at selvage (min.): 94 mils 2.4 mm (ASTM D 5147).
 - e. Weight (min. per 100 ft² of coverage) 90 lb. 4.4 kg/m^2 .
 - f. Filler content in elastomeric blend less than 35% by weight.
 - g. Low temperature flexibility at -13 degrees Fahrenheit (-25 degrees Celsius) PASS (ASTM D 5147).
 - h. Maximum Load (avg.) at 73 degrees Fahrenheit 30 lbf/inch (ASTM D 5147).
 - i. Maximum Load (avg.) at 0 degrees Fahrenheit 70 lbf/inch (ASTM D 5147).
 - j. Elongation at 5% Maximum Load (avg.) at 73 degrees Fahrenheit 55% (ASTM D 5147).
 - k. Dimensional Stability (max.) 0.5% (ASTM D 5147).
 - High Temperature Stability (min.) 250 degrees Fahrenheit (121° C) (ASTM D 5147).
 - m. Granule Embedment (max. loss) 2.0 grams per sample (ASTM D 5147).
 - n. Approvals UL Class listed, FM Approved (products shall bear seals of approval).
 - o. Reinforcement fiberglass mat or other meeting the performance criteria.
 - p. Surfacing ceramic granules; white.

- C. Roofing Membrane Flashing Sheet: ASTM D 6298, glass-fiber-reinforced, SBS-modified asphalt sheet; metal-foil surfaced; suitable for application method specified, and as follows:
 - Basis of Design: Design concept and the drawings indicate the size, profiles, dimensional requirements and aesthetics of the following:
 - a. JM DynaClad
 - b. Siplast Veral Aluminum
 - c. Firestone Metal Flash-Al
 - 2. Properties:

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- a. Thickness (avg.) 142 mils 3.6 mm (ASTM D 5147).
- b. Thickness (min.) 138 mils 3.5 mm (ASTM D 5147).
- c. Weight (min. per 100 ft² of coverage) 92 lb. 4.5 kg/m^2 .
- d. Filler content in elastomeric blend less than 35% by weight.
- e. Low temperature flexibility at 0 degrees Fahrenheit (-18 degrees Celsius) PASS (ASTM D 5147).
- f. Maximum Load (avg.) at 73 degrees Fahrenheit 85 lbf/inch (ASTM D 5147).
- g. Maximum Load (avg.) at 0 degrees Fahrenheit 180 lbf/inch (ASTM D 5147).
- h. Elongation at 5% Maximum Load (avg.) at 73 degrees Fahrenheit 45% (ASTM D 5147).
- i. Dimensional Stability (max.) 0.5% (ASTM D 5147) (ASTM D 5147).
- j. High Temperature Stability (min.) 225 degrees Fahrenheit (107° C) (ASTM D 5147).
- k. Thermal Shock Resistance (maximum) 0.2% (UEAtc standard).
- 1. Approvals UL Approved, FM Approved (products shall bear seals of approval).
- m. Reinforcement fiberglass scrim mat or other meeting the performance criteria.
- n. Surfacing aluminum metal foil.
- o. Reinforcing Ply: Same as roof system base ply.
- p. Base Sheet: ASTM D 4601, Type II non-perforated, asphalt-impregnated and -coated, glass-fiber sheet, with a polyolefin film backing. Minimum weight: 20 lb/100 sq. ft.

2.03 ROOFING ACCESSORIES

- A. Roofing Adhesives
 - 1. Mopping Asphalt: Certify asphalt for full compliance with the requirements for Type IV asphalt listed in Table I, ASTM D 312-15. Each container or bulk shipping ticket shall indicate the equiviscous temperature, EVT, the finished blowing temperature, FBT, and the flash point, FP.
 - a. Base sheet installation.
 - b. Acceptable Products: Subject to compliance with requirements, manufacturers offering the following products that may be incorporated into the work include:
 - 1) Firestone Building Products Co: www.firestonebpco.com.
 - 2) Siplast: www.siplast.com.
 - Owens Corning Roofing & Asphalt, LLC: Trumbull Built-up Roofing Asphalt - Low VOC: www.owenscorning.com
 - 2. Cold Application Adhesive: Two component, elastomeric, cold application adhesive, consisting of an asphalt base material. Product to meet ASTM 3019 Type III, Grade 2. Provide products acceptable to roof system manufacturer.
 - a. Cap sheet installation.
 - b. Acceptable Products: Subject to compliance with requirements, manufacturers offering the following products that may be incorporated into the work include:
 - 1) Firestone Building Products Co: www.firestonebpco.com.
 - 2) Siplast: www.siplast.com.
 - 3) Johns Manville: www.jm.com

B. Bituminous Cutback Materials

- 1. Primer: A high flash, quick drying, asphalt solvent blend which meets or exceeds ASTM D 41-85 requirements.
- Mastics: An asphalt cutback mastic, reinforced with non-asbestos fibers, used as a base for setting metal flanges and conforming to ASTM D 4586-86 Type II and FED SPEC NO.SS-C-153, TYPE I requirements.
- C. Base Sheet Fasteners: Roof manufacturers ASCE 7-10 approved system fasteners to meet wind uplift pressures. A one-piece specially coated galvanized steel fastener with a spilt wedge leg designed for use into lightweight insulating concrete to provide a minimum of 40 lbs pullout resistance.
 - Acceptable base sheet fasteners manufacturers:
 - a. ES Product Inc.

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- b. Simplex Nail and Manufacturing Company Tube-Lok Nail
- c. NTB Inc. NTB Fastener
- d. Firestone LWC Base Ply Fastener
- D. Caulking/Sealants. A single component, high performance, elastomeric sealant. Acceptable types are as follows:ASTM C920, FED SPEC NO.TTS 0023C TYPE II C
 - 1. Black Jack No. 1010 by Gibson-Homans; Twinsburg, OH (216) 425-3255.
 - 2. Approved Equivalents.
- E. Ceramic Granules. No.11 Grade Specification Ceramic granules of color scheme matching the granule surfacing of the finish ply.
- F. Metallic Powder. A finely graded metal dust as supplied or approved by the membrane manufacturer, used for covering of bitumen overruns over the foil surfaced membrane.
- G. Tapered Perlite Edge Strip: Provide perlite on top of blocking at parapets with fascia. Material to have 2 hour water absorption of 1.5 max and to comply with ASTM C 209, C 165, and C 203.
 1. Basis of Design: Johns Manville Tapered Fesco Edge Strip.
- H. Tapered and Flat Polyisocyanurate Board at Roof Drain Sumps: Provide tapered and flat polyisocyanurate insulation in the roof drain sump. Tapered and flat panels composed of closed cell polyisocyanurate, which are bound with fiber glass reinforced facers on both sides. Provide panels that are in full compliance with ASTM C 1289, Type II, Class 1, Grade 2, 20 psi. The tapered panels shall provide for a slope of one quarter (1/4) inch per foot.
- I. Cant Strip Asphalt impregnated wood fiberboard, compatible with roofing materials; cants formed to 45 degree angle.
- J. Pipe Flashing: Soft metal pipe flashing approved per manufacturer:
 1. Sheet lead, minimum 2-1/2 lb/per sq. ft. or soft sheet copper, minimum 16 oz.
- K. Roof Drain Flashing: Soft metal flashing approved per manufacturer:
 1. Sheet lead, minimum 2-1/2 lb/per sq. ft. or 16 oz. soft sheet copper.
- L. Walkway Pads: Provide walkway pads in locations as shown on the drawings. Provide modified bitumen sheet material with an asphalt impregnated, puncture resistant polyester fabric core, coated with a polymer modified bitumen and topped with a ceramic-coated granule wearing surface. Color of walkway pads to contrast with selected roof color. Minimum walkway pad size to be 32" x 32". If roll products are used then the max length of each pad is to be 32" x 4'-0" in length. Provide space between each pad to allow for water drainage. The pad should be set in hot asphalt. All four corners are to be adhered.
 - 1. Basis of Design: Design concept and the drawings indicate the size, profiles, dimensional requirements and aesthetics of the following:
 - a. JM DynaTred
 - b. Siplast ParaTread
 - c. Firestone SBS Cap
- M. Sealants: As recommended by membrane manufacturer.

2.04 THERMAL INSULATION

- A. General: Rigid roof insulation used for this project shall be UL and FM approved. Each type of insulation used shall be approved in writing by the insulation manufacturer for intended use, and for use with the specified roof assembly.
- B. Polyisocyanurate Board Insulation: Rigid cellular foam, complying with ASTM C1289, Type II,
 - Class 1, cellulose felt or glass fiber mat both faces; Grade 2, and with the following characteristics: 1. Compressive Strength: 20 psi
 - 2. Board Size: 48" x 48" inch. Maximum panel size listed shall be maintained where insulation is installed in hot asphalt.
 - 3. Board Thickness: 2 inch.
 - 4. Layers: Provide two layers.
 - 5. Thermal Resistance: Aged R-value of minimum 5.7 per inch. ASTM C518 aged "R" value at 75 degrees F (or RIC/TIMA Conditioning Procedure 281-1).
 - 6. Board Edges: Square.
 - 7. Joints: Joints in second layer shall not coincide with joints of the first layer. The course shall be staggered to ensure this.
 - 8. UL : Class A.
 - 9. Manufacturers: Subject to compliance with requirements, manufacturers offering the following products that may be incorporated into the work include ;
 - a. Atlas Roofing Corporation: www.atlasroofing.com.
 - b. Dow Chemical Company: www.dow.com.
 - c. Carlisle SynTec: www.carlislesyntec.com
 - d. Hunter Panel: www.hpanels.com
 - e. Johns Manville: www.jm.com.
 - f. Firestone Building Products Company: www.firestonebpco.com
 - g. R-Max.: www.rmaxinc.com
 - h. Other manufacturers approved by roofing manufacturer to meet full system warranty requirements.
- C. Tapered Insulation Board: Roof insulation system of tapered panels composed of closed cell polyisocyanurate, which are bound with fiber glass reinforced facers on both sides. Provide panels that are in full compliance with ASTM C 1289, Type II, Class 1, Grade 2, 20 psi. The panels shall provide for a roof slope of one quarter (1/4) inch per foot.
 - 1. Panels installed in hot asphalt shall have maximum panel size of four (4) feet by four (4) feet.
 - 2. At contractor's option, provide tapered perlite panels meeting ASTM C728.
- D. Tapered Pre-Cut Crickets: Roof insulation system of tapered panels composed of a foam core which are bound with fiber glass reinforced facers on both sides. Provide panels that are in full compliance with ASTM C 1289, Type II, Class 1, Grade 2, 20 psi. . The panels shall provide for a roof slope of one quarter (1/4) inch per foot.
 - 1. At contractor's option, provide tapered and standard perlite panels meeting ASTM C728.

2.05 INSULATION OVERLAY BOARD

- A. Insulation Overlay Board: Overlay board as required by the roofing membrane manufacturer to meet specified warranty requirements. Contractor to coordinate roof blocking thickness with overlay board selected. Contractor option to provide perlite, perlite based, wood fiber, or glass mat gypsum roof board as the insulation overlay board as follows. Deletion of the cover board is not allowed, even if manufacturers warranty requirements do not require a cover board.
 - 1. Perlite Overlay Board: Expanded perlite mineral aggregate, ASTM C728, Type 1, with the following characteristics:
 - a. Board Size: 48 x 48 inch.
 - b. Board Thickness: 1 inch.
 - c. Board Edges: Square.

- d. Manufacturers:
 - 1) Basis of Design: Design concept and the drawings indicate the size, profiles, dimensional requirements and aesthetics of the following:
 - (a) JM Fesco Board: www.jm.com
 - (b) Additional Manufacturers: Provide perlite overlay board as approved by the roof manufacturer to meet the total system roof warranty requirements.
- 2. Perlite Based Overlay Board: Coated, expanded perlite and reinforcing cellulosic fibers, ASTM C728, Type 2, with the following characteristics:
 - a. Board Size: 48 x 48 inch.
 - b. Board Thickness: 1/2 inch.
 - c. Board Edges: Square.
 - d. Manufacturers:
 - 1) Basis of Design: Design concept and the drawings indicate the size, profiles, dimensional requirements and aesthetics of the following:
 - (a) JM Retro-Fit Board: www.jm.com
 - (b) Additional Manufacturers: Provide perlite based overlay board as approved by the roof manufacturer to meet the total system roof warranty requirements.
- 3. Wood Fiber Overlay Board: High-density wood fiber board, ASTM C 208, Type II, grade 2, with the following characteristics:
 - a. Board Size: 48 x 48 inch.
 - b. Board Thickness: 1/2 inch
 - c. Board Edges: Square.
 - d. Manufacturers:
 - 1) Basis of Design: Design concept and the drawings indicate the size, profiles, dimensional requirements and aesthetics of the following:
 - (a) Siplast Wood Fiberboard: www.siplast.com
 - (b) Firestone Fibertop: www.firestonebpco.com
 - (c) Additional Manufacturers: Provide wood fiber overlay board as approved by the roof manufacturer to meet the total system roof warranty requirements.
- 4. Glass Mat Gypsum Roof Overlay Board: Fiberglass faced non-combustible gypsum core board manufactured to meet ASTM C1177. Flame Spread 0 and Smoke Developed 0 per ASTM E84. Meets UL 790 for Class A roof assemblies.
 - a. Acceptable Products: Subject to compliance with requirements, manufacturers offering the following products that may be incorporated into the work include::
 - 1) Georgia Pacific DensDeck Prime Roof Board
 - 2) USG Securock Gypsum-Fiber Roof Board
 - 3) Additional Manufacturers: Provide glass mat gypsum overlay board as approved by the roof manufacturer to meet the total system roof warranty requirements.

2.06 INSULATION ATTACHMENT

- A. General: Provide insulation fasteners and plates that are FM approved and/or approved by the manufacturer of the primary roofing products. The insulation fasteners shall provide attachment required to meet the specified uplift performance and to restrain the insulation panels against the potential for digging, etc. The fastening pattern for each insulation panel to be used shall be as recommended by the insulation manufacturer and approved by the manufacturer of the primary roofing products.
- B. Metal Decks: Provide insulation mechanical fasteners and metal plates for metal decks that have been factory coated for corrosion resistance, and when subjected to 30 Kesternich cycles, must show less than 100% red rust, conforming to Factory Mutual 4470. Acceptable insulation fasteners types for metal decks are listed below:

- 1. A single unit, precision formed, fluorocarbon coated screws type roofing fastener having a minimum of one hundred seventy-two thousandths (.172) inch diameter shank and a minimum two hundred-twenty-thousandths (.220) inch diameter thread. All plates used with fastener shall be a metal type having a minimum three (3) inch diameter as supplied by the fastener manufacturer.
 - a. Manufacturers: Subject to compliance with requirements, manufacturers offering the following products that may be incorporated into the work include;
 - 1) ITW Buildex Roofgrip with Buildex Metal Plates.
 - 2) Construction Fasteners, Inc. Dekfast #12 with Dekfast Hexagonal Plates.
 - 3) Olympic Fasteners #12 Standard Roofing fastener.

PART 3 EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

- A. Cooperate with inspection and test agencies engaged or required to perform services in connection with installing modified bitumen sheet roofing system.
- B. Protect other work from spillage of modified bitumen roofing materials, and prevent liquid materials from entering or clogging drains and conductors. Replace or restore other work damaged by installation of modified bituminous sheet roofing system work.
- C. Insurance/Code Compliance: Where required, install and test modified bitumen sheet roofing system to comply with governing regulations and specified insurance requirements.
- D. Coordinate installing roofing system components so that insulation and roofing plies are not exposed to precipitation or left exposed overnight and allow precipitation to flow freely from the roof. Provide cut offs at end of each day's work to cover exposed ply sheets and insulation with a course of coated felt with joints and edges sealed with roofing cement. Avoid phasing of installation creating and "insulation jam" with the potential of ponding water on the roof, at the close of the work day. Remove cut offs immediatly before resuming work.
- E. Cutoffs: At end of each day's roofing installation, protect exposed edge of incomplete work, including ply sheets and any insulation. Provide temporary covering of two plies of No. 15 roofing felt set in full moppings of hot bitumen; remove at beginning of next day's work.

3.02 EXAMINATION

- A. Examine substrate surfaces to receive modified bitumen sheet roofing system and associated work and conditions under which roofing will be installed. Do not proceed with roofing until unsatisfactory conditions have been corrected in a manner acceptable to Installer.
- B. Verify that surfaces and site conditions are ready to receive work.
- C. Verify deck is supported and secure.
- D. Verify deck is clean and smooth, flat, free of depressions, waves, or projections, properly sloped and suitable for installation of roof system. Verify that the flatness of the lightweight insulating concrete deck comply with installation tolerances specified in Division 3 section "Lightweight Insulating Concrete".
- E. Verify deck surfaces are dry and free of snow or ice.
- F. Verify that roof openings, curbs, and penetrations through roof are solidly set, and cant strips, nailing strips, and reglets are in place.
- G. Verify that nailers and blocking match thickness of the roof insulation.
- H. Verify that roof drains are securely clamped in place.
3.03 PREPARATION

- A. Tear off existing roof membrane, insulation and flashings down to the structural wood fiber deck.
- B. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to the roofing system manufacturer's written instructions. Remove sharp projections.
- C. 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.

3.04 METAL DECK PREPARATION

- A. Install deck sheathing on metal deck:
 - 1. Lay with long side at right angle to flutes; stagger end joints; provide support at ends.
 - 2. Cut sheathing cleanly and accurately at roof breaks and protrusions to provide smooth surface.

3.05 INSULATION INSTALLATION

- A. Attachment of Insulation:
 - 1. Mechanically fasten first layer of insulation to deck in accordance with roofing manufacturer's instructions and ASCE requirements.
 - 2. Embed second layer of insulation into flood coat mopping of hot bitumen in accordance with roofing and insulation manufacturers' instructions.
 - 3. Embed cover board into flood coat mopping of hot bitumen in accordance with roofing and board manufacturers' instructions.
- B. Roof Insulation:
 - 1. Lay subsequent layers of insulation with joints staggered minimum 6 inch from joints of preceding layer.
 - 2. Place tapered insulation to the required slope pattern in accordance with manufacturer's instructions.
 - 3. On metal deck, place boards parallel to flutes with insulation board edges bearing on deck flutes.
 - 4. Lay boards with edges in moderate contact without forcing. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.
 - 5. Do not apply more insulation than can be covered with membrane in same day.
- C. Roof Drain Sump Insulation:
 - 1. At roof drains, use factory-tapered boards to slope down to roof drains over a distance of 24 inches.
- D. Roof Insulation Metal Deck
 - 1. Mechanically fasten first layer of insulation to deck in accordance with roofing manufacturer's instructions .
 - 2. Adhere subsequent layers of insulation with joints staggered minimum 6 inch from joints of preceding layer in accordance with roofing manufacturer's instructions and Factory Mutual requirements.
 - 3. Adhere cover board with joints staggered minimum 6 inch from joints of preceding layer in accordance with roofing manufacturer's instructions and Factory Mutual requirements.
 - 4. Place tapered insulation to the required slope pattern in accordance with manufacturer's instructions.
 - 5. On metal deck, place boards parallel to flutes with insulation board edges bearing on deck flutes.
 - 6. Lay boards with edges in moderate contact without forcing. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.

- 7. Tape joints of insulation in accordance with roofing and insulation manufacturers' instructions.
- 8. Do not apply more insulation than can be covered with membrane in same day.

3.06 MEMBRANE APPLICATION

- A. Apply membrane in accordance with manufacturer's instructions.
- B. Apply membrane; lap and seal edges and ends permanently waterproof.
- C. Apply smooth, free from air pockets, wrinkles, fish-mouths, or tears. Ensure full bond of membrane to substrate.
- D. At end of day's operation, install waterproof cut-off. Remove cut-off before resuming roofing.
- E. At intersections with vertical surfaces:
 - 1. Extend membrane over cant strips and up a minimum of 8 inches onto vertical surfaces.
 - 2. Apply flexible flashing over membrane.
- F. Around roof penetrations, mop in and seal flanges and flashings with flexible flashing.
- G. Coordinate installation of roof drains and sumps and related flashings.
- H. Asphalt Bitumen Heating: Heat and apply bitumen according to EVT Method as recommended by NRCA. Do not raise temperature above minimum normal fluid-holding temperature necessary to attain EVT (plus 5 deg F or 14 deg C, at point of application) more than 1 hour prior to time of application. Determine flash point, finished blowing temperature, EVT, and fire-safe handling temperature of bitumen either by information from manufacturer or by suitable tests. Do not exceed recommended temperature limits during bitumen heating. Do not heat bitumen to a temperature higher than 25 deg F (14 deg C) below flash point. Discard bitumen that has been held at temperature exceeding finished blowing temperature (FBT) for more than 3 hours. Keep kettle lid closed except when adding bitumen. Comply with manufacturer's recommendations where more stringent.
- I. Bitumen Mopping Weights: For interply mopping, apply bitumen at the rate of 25 lb of asphalt per roof square (plus or minus 25 percent on a total-job average basis).
- J. Substrate Joint Penetrations: Do not allow bitumen to penetrate substrate joints and enter building or damage insulation, vapor barriers (retarders), or other construction. Where mopping is applied directly to a substrate, tape joints or, in the case of steep asphalt, hold mopping back 2 inches from both sides of each joint.

3.07 ROOF MEMBRANE INSTALLATION

- A. General: Application of roofing shall be in accordance with roofing system manufacturer's instructions and the following requirements. Each SBS sheet shall be manufactured as an independent waterproofing layer, allowing for phased construction between layers.
- B. Aesthetic Considerations The overall appearance of the finished roof application is a standard requirement for this project. The contractor shall make necessary preparations, utilize recommended application techniques, apply the specified materials (i.e. granules, metallic powder, etc.), and exercise care in ensuring that the finished application is acceptable to the Owner.
- C. Shingling Plies: Shingle in proper direction to shed water on each large area of roofing.
- D. Cant Strips/Tapered edge Strips: Install preformed 45-degree cant strips at junctures of modified bituminous sheet roofing system membrane with vertical surface. Provide preformed, tapered edge strips at perimeter edges of roofs that do not terminate at vertical surfaces.
- E. Priming. Prime metal flanges (all jacks, edge metal, lead drain flashings, etc.) and concrete and masonry surfaces with a uniform coating of asphalt primer ASTM D 41-85.

- F. Kettles and Tankers. Kettles and tankers shall be equipped with accurate, fully readable thermometers. Asphalt shall not be heated to or above its flash point. Avoid heating at or above the FBT, should conditions make this impractical, heating must be no more than 25 degrees below the EVT and no more than 25 degrees F above EVT.
- G. Asphalt Temperatures. If the EVT information is not provided, the following asphalt temperature shall be observed. Maximum heating temperature shall be 525 degrees F. Minimum application temperature shall be 400 degrees F. Thermometers shall be on the job at all times; one at the kettle and one on the roof at the mop.
- H. Asphalt Moppings. Ensure that all moppings do not exceed a maximum of 25 pounds/square. Mopping shall be total in coverage, leaving no breaks or voids.
- I. Bitumen Consistency. Cutting or alterations of bitumen, primer, and sealants will not be permitted.
- J. Roofing Application. Apply all layers of roofing free of wrinkles, creases or fishmouths. Exert sufficient pressure on the roll during application to ensure prevention of air pockets. Lap seams in the base ply layer should not coincide with the lap seams of the finish ply layer. The courses should be staggered to ensure this.
 - 1. Apply all layers of roofing perpendicular to the slope of the deck.
 - 2. Base Sheet: Fully bond the base ply to the prepared substrate, having a minimum of three (3) inch side and end laps. Each sheet shall be applied directly behind the asphalt applicator. Stagger end labs a minimum of three (3) feet.
 - 3. Top Sheet: Fully bond the finish ply to the base ply, having a minimum of three (3) inch side and end laps. Each sheet shall be applied directly behind the asphalt or cold adhesive applicator. Stagger end laps of the finish ply a minimum of three (3) feet. Stagger side laps of the finish ply a minimum of twelve (12) inches from side laps in the underlying base ply. Stagger end laps of the finish ply a minimum of three (3) feet from end laps in the underlying base ply.
 - a. Extend modified bituminous sheet to top edge of cant strip and terminate.
 - b. Nail edges of membrane to wood blocking at perimeter edges of roof prior to installing metal gravel stops/fascias. Space nails at minimum 3 inches o.c.
 - 4. Maximum sheet lengths and special fastening of the specified roof membrane system may be required at various slope increments where the roof deck slope exceeds one-half (½) inch per foot. The manufacturer shall provide acceptable sheet lengths and the required fastening schedule for all roofing sheet applications to applicable roof slopes.
- K. Granule Embedment. Broadcast mineral granules over all bitumen overruns on the finish ply surface, while the bitumen is still hot, to ensure a monolithic surface color.
- L. Set on Accessories: Comply with manufacturers recommendations as required for specified warranty.

3.08 MEMBRANE FLASHING AND STRIPPING

- A. General: Install modified bituminous flashing at cant strips and other sloping and vertical surfaces, at roof edges, and at penetrations through roof in accordance with manufacturers printed specifications and details.
- B. Flashing Application Masonry. Flashing shall be accomplished using the reinforcing sheet and metal foil flashing membrane. The reinforcing sheet shall have minimum three (3) inch laps, extending a minimum of three (3) inches onto the base ply surface and three (3) inches up the parapet wall above the cant. Adhere the reinforcing sheet by mopping/torching; ensuring full adhesion. Never coincide with the laps of the metal foil flashing layer with the lap seams in the reinforcing layer. After the finish ply has been applied to the top of the cant, prepare the surface area that is to receive flashing coverage by torch heating granular surfaces or application of asphalt primer to foil surfaces; allowing primer to dry thoroughly. Torch apply the metal foil flashing into place using three foot lengths (cut from the end of roll) and using the factory selvage edge for laps, extending a minimum of four (4) inches beyond the toe of the cant onto the prepared surface of the finished roof. Exert pressure on the

flashing sheet during application to ensure complete contact with the wall/roof surfaces, preventing air pockets; this can be accomplished by using a damp sponge or shop rag. Check and seal all loose laps and edges. Nail the top edge of the flashing on nine (9) inch centers.

- C. Use of Metallic Powder. Broadcast metallic powder over all bitumen overruns on the metal foil membrane surface while the bitumen is still hot to ensure a monolithic surface color.
- D. Water Cut-Off. At end of day's work, or when precipitation is imminent, construct a water cut-off at all open edges. Cut-offs can be built using asphalt or plastic cement and roofing felts, constructed to withstand protracted periods of service. Cut-offs must be completely removed prior to the resumption of roofing.
- E. Allow for expansion of running metal flashing and edge trim that adjoins roofing. Do not seal or bond membrane or modified bituminous flashing or stripping to metal flanges over 3 feet in length.

3.09 ROOF SYSTEM INTERFACE WITH RELATED COMPONENTS

- A. General: Incorporate flanged components not the system between the application of the base ply and the finish ply. The flange must be primed with a uniform coating of approved ASTM D41-85 asphalt primer and allowed to dry thoroughly; all flanges must be set in approved mastic.
- B. Counter-Flashings: Counter-flashings, cap flashings, expansion joints, and similar work to be coordinated with modified bitumen roofing work are specified in other Sections.
- C. Edge Metal. Completely prime metal flanges and allow to dry prior to installation. Turn the base ply down two (2) inches past the roof edge and over the nailer. After the base ply and continuous cleat (if applicable) have been installed, set the flange in mastic and stagger nail every three (3) inches on center. Strip-in the flange using the base ply material, extending a minimum of four (4) inches beyond the edge of the flange. The finish ply shall then be applied, terminating at the gravel-stop rise of the edge metal.
- D. Lead Pipe Flashings. Completely prime the lead flanges and allow to dry prior to installation. After the base ply has been applied, set the flange in mastic and strip-in the flange using the base ply material, extending a minimum of four (4) inches beyond the edge of the flange. The finish ply shall then be applied, terminating at the flange-sleeve juncture of the pipe flashing.
- E. Lead Roof Drain Flashings. Completely prime the lead drain flashing and allow to dry prior to installation. After the base ply has been applied, set the lead flashing sheet in mastic and form to turn down inside of the drain bowl. Ply-in the perimeter of the lead flashing using and additional layer of the base ply material, overlapping the perimeter of the lead a minimum of four (4) inches. The finish ply shall then be applied, extending beyond the clamping ring seal. Install the clamping ring with all clamps, bolts, etc., in place.
- F. Metal Pipe Flashings. Completely prime the metal pipe flanges and allow to dry prior to installation. After the base ply has been applied, set the flanges in mastic and strip-in the flange using the base ply material, extending a minimum of four (4) inches beyond the edge of the flange. The finish ply shall then be applied, terminating at the flange-sleeve juncture of the pipe flashing.
 - 1. These components are used to flash heat pipes, equipment supports (round pylons) and pipe penetrations where movement is anticipated.
- G. Sealant: Caulk all exposed finish ply edges at gravel stops, waste stacks, pitch pans, vent stacks, etc., with a smooth continuous bead of approved sealant.

3.10 FIELD QUALITY CONTROL

- A. Require site attendance of roofing and insulation material manufacturers daily during installation of the Work.
- B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Architect.

- 1. Notify Architect or Owner seven days in advance of date and time of inspection.
- C. Final Roof Inspection Report: After final roof inspection is completed one copy of the final report (hardcopy or digital format) shall be provided to the General Contractor/Construction Manager, Architect, and Roofing Installer.
- D. Repair or remove and replace components of membrane roofing system where test results or inspections indicate that they do not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.11 CLEANING

- A. Remove bituminous markings from finished surfaces.
- B. In areas where finished surfaces are soiled by bitumen or other source of soiling caused by work of this section, consult manufacturer of surfaces for cleaning advice and comply with their documented instructions.
- C. Repair or replace defaced or damaged finishes caused by work of this section.

3.12 PROTECTION

- A. Protect installed roofing and flashings from construction operations.
- B. Where traffic must continue over finished roof membrane, protect surfaces using durable materials.
- C. Protect roofing during remainder of construction period. At end of construction period, or at a time when remaining construction will in no way affect or endanger roofing, inspect roofing and prepare a written report, with copies to Architect and Owner, describing nature and extent of deterioration or damage found.
- D. Repair or replace (as required) deteriorated or defective work found at time of above inspection to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- E. All areas around job site shall be free of debris, roofing materials, equipment and related items after completion of job.
- F. Drain verification. At final inspection of all work, Contractor shall verify that all drains, scuppers, etc., are functioning properly. Drains shall have adequate strainers.

3.13 POST INSTALLATION MEETING

A. A meeting shall be held at the completion of the project and attended by all parties that were present at the pre-job conference. A punch list of items required for completion shall be compiled by the Contractor and the Manufacturer's representative. The Contractor shall complete all punch list items and acquire Manufacturer's warranty for final submittal to Architect.

END OF SECTION 075200

SECTION 077100 - MANUFACTURED ROOF SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Manufactured roof specialties, including: fascia, coping, reglet, counterflashing, and expansion joint

1.02 RELATED REQUIREMENTS

- A. Section 013800 General Requirements: Submittal procedures.
- B. Section 075200 Modified Bituminous Membrane Roofing.
- C. Section 079005 Joint Sealers.

1.03 REFERENCE STANDARDS

- A. AAMA 2605 Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels; 2013.
- B. ASTM D4586/D4586M Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2012).
- C. NRCA (RM) The NRCA Roofing Manual; 2017.
- D. SMACNA (ASMM) Architectural Sheet Metal Manual; 2012.

1.04 SUBMITTALS

- A. See Section 013000 Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on shape of components, materials and finishes, anchor types and locations.
- C. Shop Drawings: Indicate configuration and dimension of components, adjacent construction, required clearances and tolerances, and other affected work.
- D. Selection Samples: For each item with a paint finish specified, submit color chips representing manufacturer's full range of available colors. Submit actual samples not photo reproductions.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA (ASMM) details.

1.06 WARRANTY

- A. Refer to roofing membrane section 075200 for Special Project Full System Warranty requirements for items to be included from this specification section.
- B. Finish Warranty: Manufacturer's 20-year finish warranty stating products to be free of corrosion, checking, crazing, chalking, discoloring, fading, oxidation, and that exposed finish surface will not peel, crack, chip, or spall.
 - 1. Excessive color change/fading greater than 5 NBS (Hunter) units and passing 5000 hrs per ASTM D 2249-85, ASTM D 2244 and ASTM D 822-85 respectively.
 - 2. Chalking shall not be less than a rating of No. 8 per ASTM D 659 and ASTM D 4214.
 - 3. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

PART 2 PRODUCTS

2.01 COMPONENTS

A. Fascia

- 1. Subject to compliance with requirements, manufacturers offering the following products that may be incorporated into the work include:
 - a. Basis of Design: Design concept and the drawings indicate the size, profiles, dimensional requirements, and aesthetics of the following:
 - 1) Metal-Era: Anchor-Tite: www.metalera.com
 - Products by other manufacturers (listed below) may be considered, provided deviations in dimensions, profiles, and formulations are minor and do not change the design concept as judged by the Architect.
 - 1) Architectural Products Co.: www.archprod.com.
 - 2) Dimensional Metal Inc. (DMI): www.dmimetals.com
 - 3) Firestone Building Products, Inc.: www.firestonebpco.com
 - 4) OMG Roofing Products/OMG Edge Systems formerly W. P. Hickman: www.omgroofing.com
 - 5) Metal-Era Inc: www.metalera.com.
 - 6) Johns Manville: www.jm.com
 - 7) MM Systems Corp: www.mmsystemscorp.com
 - 8) Sika Saranfil: www.sarnafilus.com
 - 9) Siplast: www.siplast.com
- 2. Provide fascia in shapes and sizes indicated, with shop-mitered and welded-corners. Include water dams formed from at least 0.028-inch- (0.7-mm-) thick, galvanized steel sheet; anchor plates; cleats or other attachment devices; concealed splice plates; and trim and other accessories indicated or required for complete installation, with no exposed fasteners.
- 3. High performance roof edge system shall be certified by the manufacturer to comply with ANSI/SPRI Standard ES-1-98. Roof edge shall meet performance design criteria according to the following test standards:
 - ANSI/SPRI ES-1-98 Test Method RE-1 Test for Roof Edge Termination of Single-Ply Roofing Membranes: The fascia system shall be tested to secure the membrane to minimum of 100 lbs/ft in accord with the ANSI/SPRI ES-1-98 Test Method RE-1. Use the current edition of ANSI/SPRI ES-1 Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems.
 - b. ANSI/SPRI ES-1-98 Test Method RE-2 Pull-Off Test for Fascia: The fascia system shall be tested in accord with the ANSI/SPRI ES-1-98Test Method RE-2. Use the current edition of ANSI/SPRI ES-1 Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems.
- 4. The fascia product shall be approved for use in Miami-Dade County and has been designed to comply with Florida Building Code, including the High Velocity Hurricane Zone, Miami-Dade County NOA No. 03-0108.06 Expiration Date 12/11/08.
- 5. Performance Characteristics:
 - a. Extruded bar shall lock membrane, prevent wind pullback.
 - b. Injection molded EPDM splices to allow thermal expansion of extruded aluminum anchor bar.
 - c. Fascia shall freely thermal cycle on extruded bar, preventing periodic maintenance.
- 6. Fascia metal gauge: Contractor's option of .040" thick formed aluminum or 24 ga. galvanized steel.
- 7. Extruded bar: Shall be continuous 6063-T6 alloy aluminum at 12'-0" (3.65 m) standard lengths. All bar miters are welded.
- 8. Fasteners: #9 x 2" stainless steel fasteners provided with drivers. No exposed fasteners permitted.
- 9. All inside and outside corners to be manufactured corner pieces to eliminate seams.
- 10. Standard Face Height: Minimum 6 1/2", or manufacturers next larger size, unless noted otherwise on the drawings.
- B. Reglets and Counterflashing:
 - 1. Subject to compliance with requirements, manufacturers offering the following products that may be incorporated into the work include:

- a. Basis of Design: Design concept and the drawings indicate the size, profiles, dimensional requirements, and aesthetics of the following:
 - 1) Fry Reglet: MA Masonry Reglet Customized with flat flange
 - (a) MA-3 (3 inch customized horizontal flat flange for brick)
 - (b) MA-4 (4 inch customized horizontal flat flange for CMU)
 - 2) Fry Reglet: SM Surface Mounted Reglet
 - 3) Fry Reglet: 90-Degree Inside and Outside Reglet Corners
 - 4) Fry Reglet: Spring Lock Flashing.
 - 5) Fry Reglet: Inside and Outside Spring Lock Flashing Corners.
 - 6) Fry Reglet: Spring Lock Flashing End Cap
- b. Products by other manufacturers (listed below) may be considered, provided deviations in dimensions, profiles, and formulations are minor and do not change the design concept as judged by the Architect.
 - 1) Fry Reglet: www.fryreglet.com
 - 2) OMG Roofing Products/OMG Edge Systems formerly W. P. Hickman: www.omgroofing.com
 - 3) Metal-Era Inc: www.metalera.com.
- 2. General: Provide two-piece reglets with counterflashing receiver of type, material, and profile indicated, compatible with counterflashing. Form to securely interlock with counterflashing.
- 3. Reglet Masonry Type MA: Provide with top flange for embedment in masonry mortar joint. Embedment flange into masonry to be flat and not have a turned up leg that creates a water dam for the flexible flashing.
 - a. Material: 24 gauge galvanized steel.
 - b. Provided by Roofing Contractor and installed by Masonry Contractor.
- 4. Reglet Surface Mount Type SM: Provide with straight flange for surface mounting.
 - a. Material: 24 gauge galvanized steel.
 - b. Coordinate depth of reglet with wall panel condition.
 - c. Provided by Roofing Contractor and installed by Wall Panel Contractor.
 - d. Provide continuous sealant in groove on rear face. Seal groove between top of reglet and wall. Seal all laps.
- 5. Reglet Finish: Manufacturers standard mill finish.
- 6. Counterflashing
 - a. Provide springlock counterflashing fabricated from the same metal as reglets and compatible with reglet system installed.
 - 1) Material: 24 gauge galvanized steel.
 - 2) Color to match reglet.
 - 3) Provided and installed by roofing contractor.
- 7. 90-Degree Inside and Outside Reglet and Spring Lock Flashing Corners
 - a. Material: 24 gauge galvanized steel
 - b. Color to match reglet and counterflashing.
 - c. Reglet: Provided by Roofing Contractor and installed by Masonry Contractor/Wall Panel Contractor.
 - d. Counterflashing: Provided and installed by roofing contractor.
 - e. Acute and Obtuse Intersections: Contractor to field verify and special order for corner angles less or more than 90-Degree.
- 8. Spring Lock Flashing System End Cap
 - a. Factory provided 1 inch wide foam insert to close open end of the counterflashing. Insert to function as a backer for exterior sealant.
 - 1) Sealant color to match counterflashing.
- C. Copings:
 - 1. Subject to compliance with requirements, manufacturers offering the following products that may be incorporated into the work include:

- a. Basis of Design: Design concept and the drawings indicate the size, profiles, dimensional requirements, aesthetics, and formulations of the following :
 - 1) Metal-Era: Perma-Tite Coping System Tapered Version: www.metalera.com
- b. Products by other manufacturers (listed below) may be considered, provided deviations in dimensions, profiles, and formulations are minor and do not change the design concept as judged by the Architect.
 - 1) Architectural Products Co.: www.archprod.com.
 - 2) Dimensional Metal Inc. (DMI): www.dmimetals.com
 - 3) OMG Roofing Products/OMG Edge Systems formerly W. P. Hickman: www.omgroofing.com
 - 4) Metal-Era Inc: www.metalera.com.
 - 5) Johns Manville: www.jm.com
 - 6) MM Systems Corp: www.mmsystemscorp.com
 - 7) Sika Saranfil: www.sarnafilus.com
 - 8) Siplast: www.siplast.com
- 2. Coping to have tapered top.
- 3. Coping to have minimum 6 inch outside cover face height, or manufacturers next larger size.
- 4. Coping to have minimum 6 inch inside cover face height, or manufacturers next larger size.
- 5. Coping with extruded aluminum anchor bar, 24 gauge coping cover, coping width to match wall thickness, including special supports. Include cover plates to conceal and weather seal joints and attachment flanges.
- D. Expansion Joint Covers;
 - 1. Subject to compliance with requirements, manufacturers offering the following products that may be incorporated into the work include:
 - a. Basis of Design: Design concept and the drawings indicate the size, profiles, dimensional requirements, and aesthetics of the following:
 - 1) Johns Manville Expand-O-Flash
 - b. Products by other manufacturers (listed below) may be considered, provided deviations in dimensions, profiles, and formulations are minor and do not change the design concept as judged by the Architect.
 - 1) Architectural Art Manufacturing: www.archart.com
 - 2) CS-Group; C/S Construction Specialties: www.c-sgroup.com
 - 3) Johns Manville Corporation: www.jm.com.
 - 4) MM Systems Corp: www.mmsystemscorp.com.
 - 5) Balco Inc.: www.balcousa.com
 - 6) InPro Corporation: www.inprocorp.com.
 - 7) BASF/Watson Bowman Acme Corporation: www.wbacorp.com
 - 2. Control and Expansion Joint Covers: Composite construction of 4 inch wide flexible EPDM flashing of white color with closed cell urethane foam backing, each edge seamed to aluminum sheet metal flanges, designed for nominal joint width of 2 inch. Include special formed corners, tees, intersections, and wall flashings, each sealed watertight.

2.02 ACCESSORIES

- A. Sealant: Type specified in Section 079005.
- B. Roof Cement: ASTM D4586/D4586M, Type I.
- C. General: Provide manufacturer's standard accessories designed and manufactured to match and fit roof edge treatment system indicated.
- D. Exposed Fasteners: Stainless steel, nonmagnetic, of manufacturer's standard type and size for product and application indicated. Match finish of exposed heads with material being fastened.
- E. Concealed Fasteners: Same metal as item fastened or other noncorrosive metal as recommended by manufacturer.

- F. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
- G. Asphalt Mastic: SSPC-Paint 12, solvent-type asphalt mastic, nominally free of sulfur and containing no asbestos fibers, compounded for 15-mil (0.4-mm) dry film thickness per coat.
- H. Mastic Sealant: Polyisobutylene; nonhardening, nonskinning, nondrying, nonmigrating sealant.
- I. Foam-Rubber Seal: Manufacturer's standard foam.
- J. Adhesives: Type recommended by manufacturer for substrate and project conditions, and formulated to withstand minimum 60-lbf/sq. ft. (2.9-kPa) wind-uplift force.

2.03 FABRICATION

- A. Roofing Contractor/Local Fabricator shop or field fabricated/broken fascia, reglet, counterflashing, and expansion joint will not be accepted.
- B. All roof edge components are to be designed and tested to meet ANSI/SPRI ES-1, and be fabricated in an ANSI/SPRI ES-1 approved fabrication facility.

2.04 FINISHES

- A. All exposed to view roof components specified above to have the following finish.1. All items to be the same color unless specifically noted.
- B. Finishes: Due to differences in manufacturer finishing standards, or base metal used, provisions for clear and/or color anodized, and painted material is included. All finishes are acceptable and manufacturers are to provide their standard of ONE listed below.
 - 1. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating or AAMA 612 clear anodic coating with electrolytically deposited organic seal; not less than 0.7 mils thick.
 - a. Color to be clear anodized.
 - 1) The following components are to be clear anodized; fascia, reglet, and counterflashing.
 - 2. Class I Color Anodized Finish: AAMA 611 AA-M12C22A42 Integrally colored anodic coating or AAMA 612 electrolytically deposited colored anodic coating with electrolytically deposited organic seal; not less than 0.7 mils thick.
 - a. Color to be light bronze.
 - 1) The following components are to be color anodized; fascia, reglet, counterflashing, and expansion joint cover.
 - 3. High-Performance Organic Finish (2-coat Fluoropolymer): AA-C12C40R1X (Chemical Finish): cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions.
 - a. Finish to be Pearledize/Mica, consisting of 0.2 mil primer with 0.8 mil color coat containing mica pearlescent flakes to simulate the appearance of an anodized/metallic finish.
 - b. Color to be selected from manufacturers standard color chart. Minimum twenty colors.
 - 1) Color simulating clear anodized aluminum to be available in color choices.
 - c. The following components to be painted; fascia, reglet, counterflashing, and expansion joint cover.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that deck, curbs, roof membrane, base flashing, and other items affecting work of this Section are in place and positioned correctly.

3.02 INSTALLATION

- A. Install components in accordance with manufacturer's instructions and NRCA (RM) applicable requirements.
- B. Comply with NRCA (RM) drawing details as noted:
- C. Coordinate installation of components of this section with installation of roofing membrane and base flashings.
- D. Coordinate installation of sealants and roofing cement with work of this section to ensure water tightness.
- E. Coordinate installation of flashing flanges into reglets.

END OF SECTION 077100

SECTION 079005 - JOINT SEALERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Sealants and joint backing.
- B. Precompressed foam sealers.

1.02 RELATED REQUIREMENTS

- A. Section 013000 Administrative Requirements: Submittal procedures.
- B. Section 088000 Glazing: Glazing sealants and accessories.
- C. Section 093000 Tiling: Sealant used as tile grout.
- D. Section 321373 Pavement Joint Sealants: Exterior sealants for horizontal pavements and surfaces.

1.03 REFERENCE STANDARDS

- A. ASTM C834 Standard Specification for Latex Sealants; 2014.
- B. ASTM C919 Standard Practice for Use of Sealants in Acoustical Applications; 2012.
- C. ASTM C920 Standard Specification for Elastomeric Joint Sealants; 2014.
- D. ASTM C1193 Standard Guide for Use of Joint Sealants; 2013.
- E. SCAQMD 1168 South Coast Air Quality Management District Rule No.1168; current edition.

1.04 SUBMITTALS

- A. See Section 013000 Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data indicating sealant chemical characteristics.

1.05 QUALITY ASSURANCE

- A. Maintain one copy of each referenced document covering installation requirements on site.
- B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- C. Applicator Qualifications: Company specializing in performing the work of this section with minimum three years documented experience and approved by manufacturer.

1.06 PROJECT CONDITIONS

A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

1.07 SEQUENCING AND SCHEDULING

A. Coordinate the work with all sections referencing this section.

1.08 WARRANTY

- A. See Section 017800 Closeout Submittals, for additional warranty requirements.
- B. Correct defective work within a five year period after Date of Substantial Completion.
- C. Warranty: Include coverage for installed sealants and accessories which fail to achieve airtight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.01 MANUFACTURERS

1.

- A. Subject to compliance with requirements, manufacturers offering the following products that may be incorporated into the work include:
 - Silicone, Polyurethane and Acrylic Sealants:
 - a. Dow Corning: www.dowcorning.com
 - b. Bostik Inc: www.bostik-us.com.
 - c. Momentive Performance Materials, Inc (formerly GE Silicones): www.momentive.com.
 - d. Pecora Corporation: www.pecora.com.
 - e. BASF Construction Chemicals-Building Systems: www.chemrex.com.
 - f. Tremco Global Sealants; Product : www.tremcosealants.com.
 - g. Sika Construction: www.sikaconstruction.com
 - h. Soudal Inc.: www.soudalusa.com
- B. Subject to compliance with requirements, manufacturers offering the following products that may be incorporated into the work include:
 - 1. Preformed Compressible Foam Sealers:
 - a. EMSEAL Joint Systems, Ltd: www.emseal.com.
 - b. Sandell Manufacturing Company, Inc: www.sandellmfg.com.
 - c. Dayton Superior Corporation: www.daytonsuperior.com.
 - d. Tremco Global Sealants: www.tremcosealants.com.
 - e. Sika Construction: www.sikaconstruction.com
 - f. Soudal Inc.: www.soudalusa.com

2.02 SEALANTS

- A. Sealants and Primers General: Provide only products having lower volatile organic compound (VOC) content than 250 g/L where applied within the waterproofing envelope.
- B. General Purpose Exterior Sealant: Polyurethane; ASTM C920, Grade NS, Class 25 minimum; Uses M, G, and A; single component.
 - 1. Color: Standard colors matching finished surfaces.
 - 2. Applications: Use for:
 - a. Control, expansion, and soft joints in masonry.
 - b. Joints between concrete and other materials.
 - c. Joints between metal frames and other materials.
 - d. Other exterior joints for which no other sealant is indicated.
- C. Exterior Expansion Joint Sealer: Precompressed foam sealer; urethane with water-repellent;
 - 1. Face color: Match exterior masonry veneer.
 - 2. Size as required to provide weathertight seal when installed.
 - 3. Provide product recommended by manufacturer for traffic-bearing use.
 - 4. Applications: Use for:
 - a. Exterior wall expansion joints.
- D. General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C834, Type OP, Grade NF single component, paintable.
 - 1. Color: Standard colors matching finished surfaces.
 - 2. Applications: Use for:
 - a. Interior wall and ceiling control joints.
 - b. Joints between door and window frames and wall and floor surfaces.
 - 1) Color at intersection of door frame bottom and resilient, sealed or coated flooring to match door frame color.
 - c. Other interior joints for which no other type of sealant is indicated.

- E. Bathtub/Tile Sealant: White silicone; ASTM C920, Uses I, M and A; single component, mildew resistant.
 - 1. Applications: Use for:
 - a. Joints between plumbing fixtures and floor and wall surfaces.
 - b. Joints between kitchen and bath countertops and wall surfaces.
- F. Acoustic Sealant/Sound Caulk: Permanently tacky non-hardening acrylic sealant.
 - 1. Minimum 1/4 inch, continuous, sealant bead, both sides, of top stud runner and structure and bottom stud track and floor.
 - 2. Minimum 1/4 inch, continuous, sealant bead, around all openings, penetrations, and partition intersections.
- G. Interior Floor Joint Sealant: Polyurethane, self-leveling; ASTM C920, Grade P, Class 25, Uses T, M and A; single component.
 - 1. Approved by manufacturer for wide joints up to 1-1/2 inches.
 - 2. Color: Standard colors matching finished surfaces.
 - 3. Applications: Use for:
 - a. Expansion joints in floors.

2.03 ACCESSORIES

- A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.
- B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.
- C. Joint Backing: Round foam rod compatible with sealant; ASTM D 1667, closed cell PVC; oversized 30 to 50 percent larger than joint width.
- D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces are ready to receive work.
- B. Verify that joint backing and release tapes are compatible with sealant.

3.02 PREPARATION

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.
- B. Clean and prime joints in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
- D. Protect elements surrounding the work of this section from damage or disfigurement.

3.03 INSTALLATION

- A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Perform installation in accordance with ASTM C1193.
- C. Perform acoustical sealant application work in accordance with ASTM C919.
 - 1. Minimum 1/4 inch, continuous, sealant bead, both sides, of top stud runner and structure and bottom stud track and floor.
 - 2. Minimum 1/4 inch, continuous, sealant bead, around all openings, penetrations, and parition intersections.

- D. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.
- E. Install bond breaker where joint backing is not used.
- F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.
- G. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- H. Tool joints concave.
- I. Precompressed Foam Sealant: Do not stretch; avoid joints except at corners, ends, and intersections; install with face 1/8 to 1/4 inch below adjoining surface.
- J. Compression Gaskets: Avoid joints except at ends, corners, and intersections; seal all joints with adhesive; install with face 1/8 to 1/4 inch below adjoining surface.

3.04 CLEANING

A. Clean adjacent soiled surfaces.

3.05 **PROTECTION**

A. Protect sealants until cured. END OF SECTION 079005

SECTION 079513 - EXPANSION JOINT COVER ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Expansion joint assemblies for floor and wall surfaces.

1.02 RELATED REQUIREMENTS

- A. Section 013000 Administrative Requirements: Submittal procedures.
- B. Section 033000 Cast-in-Place Concrete: Expansion and contraction joints in junction of concrete slab-on-grade.
- C. Section 079005 Joint Sealers: Expansion and control joint finishing utilizing a sealant and bond breaker.
- D. Section 092116 Gypsum Board Assemblies: Placement of expansion joint assemblies in gypsum board walls and ceilings.

1.03 REFERENCE STANDARDS

- A. ASTM B221 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.
- B. ASTM B221M Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric]; 2013.
- C. ASTM B308/B308M Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles; 2010.
- D. ASTM B455 Standard Specification for Copper-Zinc-Lead Alloy (Leaded-Brass) Extruded Shapes; 2010.

1.04 SUBMITTALS

- A. See Section 013000 Administrative Requirements, for submittal procedures.
- B. Product Data: Provide joint assembly profiles, profile dimensions, anchorage devices and available colors and finish.
- C. Shop Drawings: Indicate joint and splice locations, miters, layout of the work, affected adjacent construction and anchorage locations.
- D. Manufacturer's Installation Instructions: Indicate rough-in sizes and required tolerances for item placement.

1.05 QUALITY ASSURANCE

A. Field Measurements: Verify compliance with manufacturer's requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Expansion Joint Cover Assemblies: Subject to compliance with requirements provide products by one of the following, but not limited to the following:
 - 1. Architectural Art Mfg., Inc: www.archart.com.
 - 2. Balco, Inc.: www.balcousa.com
 - 3. C/S Group; C/S Construction Specialties, Inc: www.c-sgroup.com.
 - 4. Inpro: www.inprocorp.com.
 - 5. MM Systems Corp: www.mmsystemscorp.com/#sle.
 - 6. BASF/Watson Bowman Acme Corp.: www.wbacorp.com

- B. Basis of Design: Design concept and the drawings indicate the size, profiles, dimensional requirements and aesthetics of the following:
 - 1. Architectural Art Manufacturing Model #K-10-11-11 for interior floor to floor.
 - 2. Architectural Art Manufacturing Model #H-10-65-14 for interior wall-to-wall corner, 2"
 - 3. InPro Corporation Model: 1200 Series Foam Seal for exterior vertical expansion joint in masonry veneer.

2.02 EXPANSION JOINT COVER ASSEMBLIES

- A. Expansion Joint Cover Assemblies General: Factory-fabricated and assembled; designed to completely fill joint openings, sealed to prevent passage of air, dust, water, smoke; suitable for traffic expected.
 - 1. Joint Dimensions and Configurations: As indicated on drawings.
 - 2. Joint Cover Sizes: Selected to suit joint width and configuration, based on manufacturer's published recommendations and limitations.
 - 3. Lengths: Provide covers in full lengths required; avoid splicing wherever possible.
 - 4. Anchors, Fasteners, and Fittings: Provided by cover manufacturer.
- B. Exterior Vertical Expansion Joint:
 - 1. Flexible profile manufactured from a monolithic piece of foam and factory applied elastomeric silicone membrane coating to provide moisture and water intrusion on vertical surfaces. Profile shall be capable of providing plus or minus 25% building movement and resist ultraviolet degradation. Profile shall be installed without the use of adhesives or anchor system.
 - a. Seal preformed and manufacturer from a polyether urethane foam per ASTM C864-98 with a factory applied silicone membrane on the exposed face.
 - b. Color to be selected by Architect from manufacturers standard color range.

2.03 MATERIALS

- A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper; or ASTM B308/B308M, 6061 alloy, T6 temper.
- B. Backing Paint for Aluminum Components in Contact with Cementitious Materials: Asphaltic type.

2.04 FABRICATION

- A. Joint Covers: Aluminum cover plate, aluminum frame construction, designed to permit cover movement with full recovery, flush mounted.
- B. Provide joint components in single length wherever practical. Minimize site splicing.

2.05 FINISHES

A. Floors: Mill finish.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that joint preparation and dimensions are acceptable and in accordance with manufacturer's requirements.

3.02 PREPARATION

A. Install anchoring devices in conformance to templates.

3.03 INSTALLATION

- A. Install components and accessories in accordance with manufacturer's instructions.
- B. Align work plumb and level, flush with adjacent surfaces.

C. Rigidly anchor to substrate to prevent misalignment.

3.04 PROTECTION

- Do not permit traffic over unprotected floor joint surfaces. A.
- B. Provide strippable coating to protect finish surface. **END OF SECTION 079513**

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Non-fire-rated hollow metal doors and frames.
- B. Hollow metal frames for wood doors.
- C. Thermally insulated hollow metal doors with frames.
- D. Hollow metal borrowed lites glazing frames.

1.02 RELATED REQUIREMENTS

- A. Section 013000 Administrative Requirements: Submittal procedures.
- B. Section 061000 Rough Carpentry: Shims.
- C. Section 087100 Door Hardware.
- D. Section 088000 Glazing: Glass for doors and borrowed lites.
- E. Section 099000 Painting: Field painting.

1.03 REFERENCE STANDARDS

- A. ADA Standards Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- B. ANSI/ICC A117.1 American National Standard for Accessible and Usable Buildings and Facilities; International Code Council; 2009.
- C. ANSI/SDI A250.3 Test Procedure and Acceptance Criteria for Factory Applied Finish Coatings for Steel Doors and Frames; 2007 (R2011).
- D. ANSI/SDI A250.8 Specifications for Standard Steel Doors and Frames (SDI-100); 2014.
- E. ANSI/SDI A250.10 Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2011.
- F. ASTM A653/A653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
- G. ASTM A1008/A1008M Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2015.
- H. ASTM A1011/A1011M Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2014.
- I. ASTM A924 Specification for General Requirements for Steel Sheet, Metallic Coated by the Hot Dip Process.
- J. ASTM A 1008/A 1008M Standard Specification for Steel, sheet, Cold rolled, Carbon, High Strength Low-Alloy, High Strength Low Alloy with Improved Formability, Solution Hardened and Bake Hardenable.
- K. ASTM E90 Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009.
- L. ASTM E413 Classification for Rating Sound Insulation; 2010.
- M. ICC A117.1 Accessible and Usable Buildings and Facilities; 2009.

- N. DHI A115 Series Specifications for Steel Doors and Frame Preparation for Hardware; Door and Hardware Institute; 2000 (ANSI/DHI A115 Series).
- O. NAAMM HMMA 830 Hardware Selection for Hollow Metal Doors and Frames; 2002.
- P. NAAMM HMMA 831 Hardware Locations for Hollow Metal Doors and Frames; 2011.
- Q. NAAMM HMMA 820 TN01 Grouting Hollow Metal Frames
- R. NAAMM HMMA 820 TN03 Guidelines for Glazing of Hollow Metal Transom, Sidelight and Windows.
- S. NAAMM HMMA 840 Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames; 2007.
- T. NAAMM HMMA 861 Guide Specifications for Commercial Hollow Metal Doors and Frames; 2006.
- U. NFPA 80 Standard for Fire Doors and Other Opening Protectives; 2016.
- V. NFPA 252 Standard Methods of Fire Tests of Door Assemblies; 2012.
- W. SDI 117 Manufacturing Tolerances for Standard Steel Doors and Frames; 2013.
- X. SDI 111 Recommended Details and Guidelines for Standard Steel Doors and Frames and Accessories.
- Y. UL (BMD) Building Materials Directory; current edition.
- Z. UL 10C Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.
- AA. UL 1784 Standard for Air Leakage Tests of Door Assemblies; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced standards/guidelines.
- B. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.
- C. Samples: Submit two samples of food service door finish, 2 x 2 inches in size showing factory finishes, colors, and surface texture.
- D. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.
- E. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.
- F. Manufacturer's Qualification Statement.
- G. Submit LEED data and forms on all products contained in system as specified herein.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.
 Provide hollow metal frames from SDI Certified manufacturer.
- B. Maintain at project site copies of reference standards relating to installation of products specified.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
- B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Steel Doors and Frames: Subject to compliance with requirements, manufacturers offering the following products that may be incorporated into the work include;
 - 1. Basis of Design: Design concept and the drawings indicate the size, profiles, dimensional requirements and aesthetics of the following:
 - a. Steelcraft B-Series full flush, steel stiffened doors.
 - 2. Products by other manufacturers (listed below) may be considered, provided deviations in dimensions and profiles are minor and do not change the design concept as judged by the Architect:
 - a. Curries, an Assa Abloy Group company: www.assaabloydss.com.
 - b. Custom Metal Products: www.custommetalproductsnc.com
 - c. Mesker, dormakaba Group: www.meskeropeningsgroup.com/#sle.
 - d. Republic Doors, an Allegion brand: www.republicdoor.com/#sle.
 - e. Ceco Door Products an Assa Abloy Group company: www.cecodoor.com.
 - f. Steelcraft, an Allegion brand: www.allegion.com/#sle.
 - g. Metal Products Inc. (MPI): www.metalproductsinc.com
 - h. Pioneer Industries : www.pioneerindustries.com

2.02 DESIGN CRITERIA

- A. Requirements for Hollow Metal Doors and Frames:
 - 1. Steel used for fabrication of doors and frames shall comply with one or more of the following requirements; Galvannealed steel conforming to ASTM A653/A653M, cold-rolled steel conforming to ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel conforming to ASTM A1011/A1011M, Commercial Steel (CS) Type B for each.
 - 2. Accessibility: Comply with ICC A117.1 and ADA Standards.
 - 3. Exterior Door Top Closures: Flush end closure channel, with top and door faces aligned.
 - 4. Door Edge Profile: Manufacturers standard for application indicated.
 - 5. Typical Door Face Sheets: Flush.
 - 6. Door Undercut: Manufacturer's standard, compatible with threshold configuration specified in section 087100.
 - 7. Interior Glazed Lights: Non-removable, square, stops on non-secure side. Size stops to accept 1/4 inch glass thickness. Refer to section 088000 Glazing for glass requirements.
 - 8. Exterior Glazed Lights: Non-removable, square, stops on non-secure side. Glazing pocket to accept 7/8 inch total thickness insulated unit. Size stops in accordance with specified glass thickness. Refer to section 088000 Glazing for glass requirements.
 - 9. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
 - 10. Finish: Factory primed, for field finishing.
- B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.03 HOLLOW METAL DOORS

- A. Exterior Doors: Thermally insulated.
 - 1. Grade: ANSI A250.8 Level 3, physical performance Level A, Model 1, full flush; 16 gage faces.
 - 2. Core: Vertical steel stiffeners, 22 gage, spaced not to exceed six inches apart, fill between stiffeners with manufacturers standard extruded polystyrene insulation or batt insulation
 - 3. Door Thickness: 1-3/4 inch, nominal.
 - 4. Thickness: 1-3/4 inches.
 - 5. Exterior Doors Top and Bottom Closures : Close top and bottom edges of doors flush as an integral part of the door construction or by the addition of 16 gage, metallic-coated steel channels with channel webs placed even with top and bottom edges.
 - a. Bottom closure is not required on doors with concealed automatic door bottoms. Provide manufacturers standard door bottom.
 - 6. Interior Doors Top Closures : Close top edges of doors flush as an integral part of the door construction or by the addition of 16 gage, metallic-coated steel channels with channel webs placed even with top edges.
 - 7. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness.
 - 8. Door Face Sheets: Flush.
 - 9. Insulating Value: U-value of 0.50, when tested in accordance with ASTM C1363.
 - 10. Weatherstripping: Refer to Section 087100.
- B. Interior Doors, Non-Fire Rated:
 - 1. Grade: ANSI A250.8 Level 2, physical performance Level B, Model 1, full flush, 18 gage faces.
 - 2. Core: Vertical steel stiffeners, 22 gage, spaced not to exceed six inches apart, filled with fiberglass batt insulation
 - 3. Door Thickness: 1-3/4 inch, nominal.
 - 4. Texture: Smooth faces.

2.04 HOLLOW METAL FRAMES

- A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.
- B. General:
 - 1. Comply with the requirements of grade specified for corresponding door, except:
 - a. Frames for Exterior Hollow Metal Doors: Comply with frame requirements specified in ANSI A250.8 Level 3 Doors: 14 gage frames.
 - b. Frames for Interior Wood and Hollow Metal Doors: Comply with frame requirements specified in ANSI A250.8 for Level 1, 16 gage.
 - 2. Finish: Same as for door.
 - 3. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.
 - 4. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inches high to fill opening without cutting masonry units.
 - 5. Frames Wider than 48 Inches: Reinforce with steel channel fitted tightly into frame head, flush with top.
 - 6. Frames Installed Back-to-Back: Reinforce with steel channels anchored to floor and overhead structure.
- C. Exterior Door Frames: Face welded type.
 - 1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with A40/ZF120 coating.
 - 2. Wall Attachment: Lock-in masonry "T". Minimum three anchors per jamb.
 - 3. Weatherstripping: Separate, see Section 087100.

- D. Interior Door Frames at CMU Walls, Non-Fire-Rated and Fire-Rated: Fully welded type, seamless with joints filled.
 - 1. Fire Rating: Same as door, labeled.
 - 2. Wall Attachment: Lock-in masonry "T". Minimum three anchors per jamb.
- E. Interior Door Frames at Gypsum Board/Metal Stud Partitions Non-Fire-Rated and fire-Rated: Knock-down type, slip-on with mitered or coped corners for field assembly.
 - 1. Fire Rating: Same as door, labeled.
 - 2. Wall Attachment: Metal stud anchor/flush steel stud anchor. Minimum three anchors per jamb.
 - 3. Floor Attachment: Fixed base.
- F. Frames for Wood Doors: Comply with frame requirements in accordance with corresponding door.
- G. Borrowed Lites Glazing Frames: Construction and face dimensions to match door frames, and as indicated on drawings.
- H. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.
- I. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inch high to fill opening without cutting masonry units.

2.05 FINISHES

A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

2.06 ACCESSORIES

- A. Glazing: As specified in Section 088000.
- B. Removable Stops: Formed sheet steel, shape as indicated on drawings, mitered or butted corners; prepared for countersink style tamper proof screws.
- C. Astragals for Double Doors: Specified in Section 087100.
- D. Grout for Frames: Portland cement grout with maximum 4 inch slump for hand troweling; thinner pumpable grout is prohibited.
- E. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.
- F. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

2.07 FINISHES

- A. Manufacturer Installed Primer: Rust-inhibiting, complying with ANSI A250.10 one coat, baked-on rust inhibiting prime paint.
- B. Frame installer provided material Fibered Asphalt Coating: Asphalt emulsion or other high-build, water-resistant, resilient coating.
 - 1. When temperature conditions necessitate the use of anti-freezing agents in the mortar, the inside of the frame shall be coated minimum 1/16 inch thick.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 PREPARATION

- A. Frame installer to coat inside of frames to be installed in masonry and to be grouted, with fibered asphalt coating, prior to installation.
 - 1. Fibered asphalt coating to be installed in all frames when anti-freeze agents are added to the grout.

3.03 INSTALLATION

- A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.
- B. Coordinate frame anchor placement with wall construction.
- C. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.
- D. Install door hardware as specified in Section 087100.
- E. Comply with glazing installation requirements of Section 088000.
- F. Coordinate installation of electrical connections to electrical hardware items.
- G. Touch up damaged factory finishes.

3.04 TOLERANCES

- A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.
- B. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.05 ADJUSTING

A. Adjust for smooth and balanced door movement. **END OF SECTION 081113**

SECTION 081416 - FLUSH WOOD DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Flush wood doors; flush and flush glazed configuration; non-rated.
- B. Factory glazing of doors.

1.02 RELATED REQUIREMENTS

- A. Section 013000 Administrative Requirements: Submittal procedures.
- B. Section 061000 Rough Carpentry: Installation of wood doors and hardware.
- C. Section 081113 Hollow Metal Doors and Frames.
- D. Section 087100 Door Hardware.

1.03 REFERENCE STANDARDS

- A. ASTM E152 Methods of Fire Tests of Door Assemblies.
- B. ICC (IBC) International Building Code; 2012.
- C. ITS (DIR) Directory of Listed Products; Intertek Testing Services/Warnock Hersey NA, Inc.; current edition.
- D. NFPA 80 Standard for Fire Doors and Other Opening Protectives; 2016.
- E. NFPA 252 Standard Methods of Fire Tests of Door Assemblies; 2012.
- F. UL (BMD) Building Materials Directory; Underwriters Laboratories Inc.; current edition.
- G. UL 10B Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.
- H. UL 1784 Standard for Air Leakage Tests of Door Assemblies; Current Edition, Including All Revisions.
- I. WDMA I.S. 1A Interior Architectural Wood Flush Doors; 2013.

1.04 SUBMITTALS

- A. See Section 013000 Administrative Requirements, for submittal procedures.
- B. Product Data: Indicate door core materials and construction; thickness, veneer species, type and characteristics, cut and matching requirements, factory machining and factory finishing criteria. Provide glass size, type, pattern and thickness for factory glazed doors..
- C. Specimen warranty.
- D. Test Reports: Show compliance with specified requirements for the following:
 1. Indicate compliance with specified fire rating (positive pressure or neutral pressure).
- E. Shop Drawings: Illustrate door opening criteria, elevations, sizes, types, swings, undercuts required, special beveling, special blocking for hardware, factory machining criteria, factory finishing criteria, identify cutouts for glazing
- F. Selection Samples: Submit samples representing manufacturer's full range of available colors. Submit actual samples not photo reproductions.
- G. Manufacturer's Installation Instructions: Indicate special installation instructions.

1.05 QUALITY ASSURANCE

- A. Maintain one copy of the specified door quality standard on site for review during installation and finishing.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with not less than three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Package, deliver and store doors in accordance with specified quality standard and manufacturer's care and handling instructions.
- B. Accept doors on site in manufacturer's packaging. Inspect for damage.
- C. Protect doors with resilient packaging sealed with heat shrunk plastic. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges with tinted sealer if stored more than one week. Break seal on site to permit ventilation.
 - 1. HVAC system should be operational prior to arrival of doors. Acceptable humidity shall be no less than 25% or greater than 55%.

1.07 PROJECT CONDITIONS

A. Coordinate the work with door opening construction, door frame and door hardware installation.

1.08 WARRANTY

- A. See Section 017800 Closeout Submittals, for additional warranty requirements.
- B. Provide manufacturer's warranty for the following term:
 - 1. Interior Doors: Life of installation.
- C. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Wood Veneer Faced Doors:
- B. Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include:
 - 1. Design concept and the drawings indicate the size, profiles, dimensional requirements and aesthetics of the following:
 - a. Wood doors based on Masonite Architectural/Marshfield Door Systems.
 - 2. Products by other manufacturers may be considered provided deviations in dimensions and profiles are minor and do not change the design concept as judged by the Architect:
 - a. Oshkosh Architectural Wood Doors: www.oshkoshdoor.com
 - b. VT Industries, Inc.: www.vtindustries.com
 - c. Eggers Industries: www.eggersindustries.com.
 - d. Assa Abbloy/Graham Wood Doors: www.grahamdoors.com.
 - e. Masonite Architectural dba Algoma Hardwoods Inc., and Marshfield Door Systems : www.masonitearchitectural.com.

2.02 DOORS

- A. Doors: Refer to drawings for locations and additional requirements.
 - 1. Quality Level: Custom Grade, "A" Grade Faces, Extra Heavy Duty performance, in accordance with WDMA I.S.1-A.
 - 2. Wood Veneer Faced Doors: 5-ply veneer and solid core unless otherwise indicated.

- B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.
 - 1. Provide solid core doors at each location.
 - 2. Fire Rated Doors: Tested to ratings indicated on drawings in accordance with International Building Code ("positive pressure"); UL, or WH (ITS) labeled without any visible intumescent seals (Category A) when door is open.
 - 3. Smoke and Draft Control Doors (Indicated as "S" on Drawings): In addition to required fire rating, provide door assemblies tested in accordance with UL 1784 with maximum air leakage of 3.0 cfm per sq ft of door opening at 0.10 inch wg pressure at both ambient and elevated temperatures for "S" label; if necessary, provide additional gasketing or edge sealing.
 - 4. Wood veneer facing for field transparent finish as indicated on drawings.

2.03 DOOR CORES

- A. Non-Rated Solid Core, Smoke, 20 and 45 Minute Rated Doors: Type: particleboard core (PC).
 - 1. Door types: Flush (F), narrow view glass (NVG), narrow glass short (NGS), half-glass (HG) or other type indicated on the A6 drawings.
- B. Non-Rated Solid Core Doors: Type: structural composite lumber core (SCLC).
 1. Door Types: Full glass (FG1) or full glass with mid-rail (FG2).

2.04 DOOR FACINGS

- A. Veneer Facing for Transparent Finish: White birch, veneer grade in accordance with quality standard indicated, rotary cut, with book match between leaves of veneer, balance match of spliced veneer leaves assembled on door or panel face.
 - 1. Vertical Edges: Same species as face veneer.
 - 2. "Pair Match" each pair of doors; "Set Match" pairs of doors within 10 feet of each other when doors are closed.

2.05 ACCESSORIES

- A. Glazing Stops: Non-fire-rated and 20 minute; Wood, of same species as door facing, mitered corners .
- B. Glazing Stops: Fire-rated doors 45 minute and above: Flush, wood veneer clad PVC or veneer wrapped rolled steel of same species as door facing. Provide glazing stops to match rating requirement of the door. Fire rated glazing to meet requirements of NFPA 80 to ensure all fire doors have a completed opening that meets all fire rating requirements.

2.06 DOOR CONSTRUCTION

- A. Fabricate doors in accordance with door quality standard specified.
- B. Core Blocking:

2.

a.

a.

- 1. Non-Rated Doors Flush (F), narrow view glass (NVG), narrow glass short (NGS), half-glass (HG) or other type indicated on the A6 drawings.
 - Provide solid blocks at lock edge, and top of door for closer for hardware reinforcement.
 - b. Provide solid blocking for other through-bolted hardware.
 - Non-Rated Doors Full glass (FG1) or full glass with mid-rail (FG2).
 - a. Solid blocking not required.
- 3. Rated Doors: Flush (F), narrow view glass (NVG) or other type indicated on the A6 drawings.
 - Single door Provide top blocking for closers, provide one mid-rail block or two lock blocks.
 - b. Pairs Provide bottom lock block.
- 4. All Doors with Closers:
 - a. Provide top lock blocking.

- b. Particleboard is not acceptable as blocking material.
- C. Fit door edge trim to edge of stiles after applying veneer facing.
- D. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.
- E. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
- F. Provide edge clearances in accordance with the quality standard specified.

2.07 FACTORY GLAZING - WOOD VENEER DOORS

- A. Glazing: Provided by wood door manufacturer as specified in Section 088000.
- B. Infill all nail holes, to match wood veneer color, both sides of glazing stops.

2.08 FACTORY FINISHING - WOOD VENEER DOORS

- A. Factory finish doors in accordance with approved sample for a transparent finish. Color to be selected by Architect.
- B. Finish Type: Water based stain with UV resistant cured polyurethane sealer to comply with EPA Title 5 guidelines for VOC emmisions limitations or UV cured urethane per WDMA TR-6.
 - 1. Sheen: Satin Gloss.
 - 2. Testing: ANSI A161 1-1993 Section 9-3 Chemical Resistance.
 - a. Chemical Resistance: ANSI A161 1-1993 Section 9-3 Chemical Resistance.
 - b. Adhesion: ASTM D 3359 Method B to provide no loss of adhesion.
 - c. Water Resistance: Cellulose sponge containing 152 grams of water with no visible discoloration, staining, blistering or grain raise after 24 hours of exposure.

2.09 ACCESSORIES

- A. Glazing Stops: Non-fire-rated and 20 minute; Wood, of same species as door facing, mitered corners, flush beads/stops without reveal; prepared for countersink style nails or screws. Nail/screw holes to be filled with wood putty to match wood species. Sand filler smooth.
- B. Glazing Stops: Fire-rated doors 45 minute and above: Flush, wood veneer clad PVC or veneer wrapped rolled steel of same species as door facing. Provide glazing stops to match rating requirement of the door. Fire rated glazing to meet requirements of NFPA 80 to ensure all fire doors have a completed opening that meets all fire rating requirements.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install doors in accordance with manufacturer's instructions and specified quality standard.
- B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.
- C. Use machine tools to cut or drill for hardware.
- D. Coordinate installation of doors with installation of frames and hardware.
- E. Coordinate installation of glazing.

3.02 ADJUSTING

- A. Adjust doors for smooth and balanced door movement.
- B. Adjust closers for full closure.

END OF SECTION 081416

SECTION 084313 - ALUMINUM-FRAMED STOREFRONTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Aluminum-framed storefront, with vision glass.
- B. Weatherstripping.
- C. Perimeter sealant.
 - 1. Perimeter caulking at interior and exterior wall veneer/substrate.
 - 2. Perimeter expandable spray foam insulation to be installed between exterior veneer/substrate and wood storefront anchorage blocking at frame surround to prevent wall cavity air to infiltrate the back side of the storefront framing.

1.02 RELATED REQUIREMENTS

- A. Section 013000 Administrative Requirements Submittal procedures.
- B. Section 051200 Structural Steel Framing: Steel attachment members.
- C. Section 079005 Joint Sealers: Perimeter sealant and back-up materials.
- D. Section 087100 Door Hardware: Hardware items other than specified in this section.
- E. Section 088000 Glazing: Glass and glazing accessories.

1.03 REFERENCE STANDARDS

- A. AAMA CW-10 Care and Handling of Architectural Aluminum From Shop to Site; 2015.
- B. AAMA 611 Voluntary Specification for Anodized Architectural Aluminum; 2012.
- C. ASTM B209 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.
- D. ASTM B209M Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]; 2014.
- E. ASTM B221 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.
- F. ASTM B221M Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric]; 2013.
- G. ASTM E283 Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004 (Reapproved 2012).
- H. ASTM E330/E330M Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.
- I. ASTM E331 Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2009).

1.04 PERFORMANCE REQUIREMENTS

- A. Design and size components to withstand the following load requirements without damage or permanent set, when tested in accordance with ASTM E 330, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
 - 1. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.

- B. Movement: Accommodate movement between storefront and perimeter framing and deflection of lintel, without damage to components or deterioration of seals.
- C. Air Infiltration: Limit air infiltration through assembly to 0.06 cu ft/min/sq ft of wall area, measured at a reference differential pressure across assembly of 1.57 psf as measured in accordance with ASTM E 283.
- D. Water Leakage: None, when measured in accordance with ASTM E 331 with a test pressure difference of 2.86 lbf/sq ft.
- E. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
- F. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.

1.05 SUBMITTALS

- A. See Section 013000 Administrative Requirements, for submittal procedures.
- B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, and internal drainage details.
- C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and field welding required.
 - 1. Zero Sightline Operable Vents: Shop drawings to include all anchors, supports, frame attachments, connections, fastening, sealing methods and integration with the storefront system.
- D. Design Data: Provide framing member structural and physical characteristics, engineering calculations, and dimensional limitations.

1.06 QUALITY ASSURANCE

- A. Designer Qualifications: Design structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the State in which the Project is located.
- B. Manufacturer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.
- C. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.
- D. Source Limitations for Storefront System: Obtain all storefront, integral exterior sunshades and zero sightline operable vents and components through one source from a single manufacturer.
 - 1. Storefront manufacturers that do not manufacture sunshades or zero sightline operable vents are to provide proof of an arrangement with the selected sunshade and zero sightline operable vent manufacturer such that the sunshade or zero sightline operable vent can be included within any warranty requirements of the storefront system.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Handle products of this section in accordance with AAMA CW-10.
- B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.08 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F. Maintain this minimum temperature during and 48 hours after installation.

1.09 WARRANTY

- A. See Section 017800 Closeout Submittals, for additional warranty requirements.
- B. General Contractor shall assume full responsibility and warrant for one year the satisfactory performance of the total storefront system installation. Correct defective Work within a one year period after Date of Substantial Completion.
 - 1. Includes: glass (including insulated glazing units) near-zero sightline operable vent device anchorage and setting system, sealing, flashing and etc, as it relates to air, water and structural adequacy.
- C. Provide five year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.
- D. Provide five year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, gloss reduction, chalking, or flaking.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Storefront: Subject to compliance with requirements, manufacturers offering the following products that may be incorporated into the work include:
 - 1. Basis of Design: Design concept and the drawings indicate the size, profiles, dimensional requirements and aesthetics of the following:
 - a. Exterior Storefront: EFCO Series 403 Flush Glazed Thermal Screw Spline Storefront.
 - b. Near-Zero Sight-Line Operable Vent: EFCO WV410.
 - 2. Products by other manufacturers (listed below) may be considered, provided deviations in dimensions and profiles are minor and do not change the design concept as judged by the Architect:
 - a. Storefront:
 - 1) Apogee Enterprises, Inc./EFCO Corporation: www.efcocorp.com
 - 2) Graham Architectural Products: www.grahamwindows.com
 - 3) Kawneer North America: www.kawneer.com.
 - 4) Manko Window Systems, Inc: www.mankowindows.com.
 - 5) Oldcastle Building Envelope/Vistawall Architectural Products/CRL(C. R. Laurence)/United States Aluminum: www.oldcastlebe.com.
 - 6) Peerless Products, Inc.: www.peerless-usa.com
 - 7) YKK AP America Inc: www.ykkap.com.
 - 8) Trulite Glass and Aluminum Solutions: www.trulite.com
 - 9) Apogee Enterprises/Tubelite, Inc.: www.tubeliteinc.com.
 - 3. Near Zero Sightline Operable Vents: If the storefront manufacturers listed above do not single source zero sightline operable vents then products by other manufacturers (listed below) may be considered, provided the warranty, deviations in dimensions and profiles are minor and do not change the design concept as judged by the Architect:
 - a. Winco Window 1150SF Series; 2 inch Heavy Commercial Near -Zero Sightline Thermally Improved Vent: www.wincowindow.com
 - b. DeSCo Architectural, Inc.: www.descoarch.com

2.02 STOREFRONT

- A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
 - 1. Glazing Position: Centered (front to back).
 - 2. Vertical Mullion Dimensions: 2 inches wide by 4-1/2 inches deep.
 - 3. Air Infiltration Test Pressure Differential: 1.57 psf.
 - 4. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
 - 5. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
 - 6. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
 - 7. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
 - 8. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
 - 9. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
- B. Performance Requirements:
 - 1. Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
 - a. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.
 - 2. Water Penetration Resistance on Manufactured Assembly: No uncontrolled water on interior face, when tested in accordance with ASTM E331 at pressure differential of 8 psf.
 - 3. Air Leakage Laboratory Test: Maximum of 0.06 cu ft/min sq ft of wall area, when tested in accordance with ASTM E283 at 6.27 psf pressure differential across assembly.
 - 4. Movement: Accommodate movement between storefront and perimeter framing and deflection of lintel, without damage to components or deterioration of seals.
 - 5. Air Infiltration: Limit air infiltration through assembly to 0.06 cu ft/min/sq ft of wall area, measured at specified differential pressure across assembly in accordance with ASTM E283.
 - 6. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
 - 7. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.

2.03 COMPONENTS

- A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
 - 1. Framing members for interior applications need not be thermally broken.
 - 2. Glazing Stops: Flush.
- B. Zero Sightline Operable Vent/Sash: Aluminum project-out awning; finished to match storefront; turn handle latch.
 - 1. All aluminum components to be extrusions fabricated from aluminum alloy 6063-T6, manufactured within commercial tolerances and free from defects impairing strength and/or durability.

- 2. All aluminum horizontal components shall be fabricated to have a minimum wall thickness of 0.063 inch to a maximum of 0.125 inch.
- 3. Depth of main frame shall not be less than 2 inch.
- 4. Depth of vent shall not be less than 3-1/4 inch.
- 5. Each corner shall be mitered and assembly by means of double corner keys and hydraulically swedged. Seal all joints with sealant.
- 6. Vent/Sash shall present a flush and zero to near-zero sightline condition on the exterior when closed.
 - a. Overlap sash or exposed framing is not acceptable.
- 7. Operable Sash Weatherstripping: wool pile; permanently resilient, profiled to achieve effective weather seal.
- C. Insect Screen Frame: Rolled aluminum frame of rectangular sections; fit with adjustable hardware; nominal size similar to operable glazed unit.
 - 1. Insect Screens: Woven aluminum mesh; 14/18 mesh size.
 - 2. Screen Clips: Four screen clips total, two per side.
 - a. Screen mounting holes shall be pre-drilled at the factory.
 - 3. Operable Hardware Access: Provide top hinged wicket at each turn handle.
- D. Sill Receptor, Sill Subframe and Sill Extension: Receptors, subframes and extensions are required for all exterior aluminum storefront system whether specifically shown/detailed on the architectural storefront details or required by the manufacturer to meet the aluminum storefront system warranty.
 - General: Receptors, extensions and subframes to be an extruded, thermally broken, aluminum, receiver type sill receptor or subframe with a minimum thickness of .063" as indicated on the drawings. Extensions to be extruded aluminum with a minimum thickness of .063" depth as indicated on the drawings. Assembly shall not require the use of exposed fasteners or rivets. All exposed to view edges shall be hemmed. Color and finish to match aluminum storefront frame.
 - 2. Sill Receptor: Set receptor in a continuous bed of sealant to insure watertight seal with exterior wall components. Sill receptor shall return up the back of the storefront sill in the interior of the room and be one continuous piece the full depth of the storefront sill. Outside edge of sill receptor to have built-in drip edge. Provide receptor in one continuous piece the full width of the storefront opening. If storefront opening width exceeds the limits for one continuous piece receptor then provide a splice joint sealed with 4" wide, self-adhering flashing tape and sealant to provide a watertight splice per manufacturers requirements. Provide receptor with mechanically attached, end dams/caps that have been sealed with a self-adhering sheet product or sealant to provide a watertight condition.
 - a. Basis of Design:Design concept and the drawings indicate the size, profiles, dimensional requirements and aesthetics of the following:
 - 1) Sill Receptor: EFCO Corporation: 2G90 thermally broken sill receptor: www.efcocorp.com.
 - 2) Self-Adhering Flashing Tape: W. R. Grace; Perma-Barrier Tape (EFCO Corporation; #WM01)
 - 3. Sill Extension: Slope for positive wash. Extension to attach to receptor without the need for exposed mechanical attachment or additional sealant. Extension to extend over the edge of the exterior veneer with a formed drip edge. Extension model number provided as the basis of design is for shape and basic design intent. Supplier/installer is to verify exact length of extension(s) required from the architectural storefront sill details. Distance of exterior face of storefront frame from the face of the exterior wall veneer may vary depending on exterior wall thickness and conditions.
 - a. Basis of Design:Design concept and the drawings indicate the size, profiles, dimensional requirements and aesthetics of the following:
 - 1) Sill Extension: EFCO Corporation: ______ sill extension: www.efcocorp.com.
 - 4. No field or shop fabricated brake metal sill receptors, subframes or extensions will be accepted.

2.04 MATERIALS

- A. Extruded Aluminum: ASTM B221 (ASTM B221M).
- B. Sheet Aluminum for Brake Metal: ASTM B209 (ASTM B209M). Minimum 0.040 gauge thickness. Prefinished sheet in color and gloss to match adjacent framing. Joints between brake metal and metal framing to be "hairline" in width. Provide "Z" clips to secure brake metal to metal framing. Provide sealant in all hairline joints, color to match adjacent framing color.
- C. Fasteners: Stainless steel.
- D. Perimeter Sealant: Type as specified in Section 079005.
- E. Glass: As specified in Section 088000.
- F. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

2.05 FINISHES

- A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.
- B. Touch-Up Materials: As recommended by coating manufacturer for field application.

2.06 HARDWARE

- A. Other Door Hardware: As specified in Section 087100.
- B. Weatherstripping: Wool pile, continuous and replaceable; provide on all doors.
- C. Sill Sweep Strips: Resilient seal type, retracting, of neoprene; provide on all doors.
- D. Operable Vent Operator: Locking handles shall be cam type lever action handle, with US25D brushed finish, fitted to projecting 4-bar stainless steel sash arms.
- E. Operable Vent Limit Stops: Vandal resistant, manufacturer standard non-removable aluminum block limit stops with maximum outswing of 8" projection.
 - 1. Provide on all first floor and second floor classsroom windows.

2.07 FABRICATION

- A. Fabricate components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.
- B. Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof.
- C. Prepare components to receive anchor devices. Fabricate anchors.
- D. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.
- E. Arrange fasteners and attachments to conceal from view.
- F. Reinforce framing members for imposed loads.
- G. Finishing: Apply factory finish to all surfaces that will be exposed in completed assemblies.
 - 1. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify dimensions, tolerances, and method of attachment with other work.
- B. Verify that wall openings and adjoining air and vapor seal materials are ready to receive work of this section.

3.02 INSTALLATION

- A. Install wall system in accordance with manufacturer's instructions.
- B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- C. Provide alignment attachments and shims to permanently fasten system to building structure.
- D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
- E. Provide thermal isolation where components penetrate or disrupt building insulation.
 - 1. Install perimeter expandable spray foam insulation between exterior veneer/substrate and wood storefront anchorage blocking at frame surround to prevent wall cavity air from infiltrating the back side of the storefront framing.
- F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.
- G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.
- H. Coordinate attachment and seal of perimeter air and vapor barrier materials.
- I. Provide expandable foam insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- J. Install operating sash.
- K. Set thresholds in bed of sealant and secure.
- L. Install glass and infill panels in accordance with Section 088000, using glazing method required to achieve performance criteria.
- M. Install perimeter sealant in accordance with Section 079005.
- N. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES

- A. Maximum Variation from Plumb: 0.06 inch per 3 feet non-cumulative or 0.06 inch per 10 feet, whichever is less.
- B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

3.04 ADJUSTING

A. Adjust operating hardware and sash for smooth operation.

3.05 CLEANING

A. Remove protective material from pre-finished aluminum surfaces.

B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths, and take care to remove dirt from corners and to wipe surfaces clean.

C. Remove excess sealant by method acceptable to sealant manufacturer. END OF SECTION 084313
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 this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Commercial door hardware for the following swinging doors:
 - a. Hollow metal.
 - b. Flush wood.
 - 2. Salvaging and re-installation of existing hardware; see Hardware Set 02.
- B. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
 - 1. ANSI A117.1 Accessible and Usable Buildings and Facilities.
 - 2. ICC/IBC International Building Code.
 - 3. NFPA 70 National Electrical Code.
 - 4. NFPA 80 Fire Doors and Windows.
 - 5. NFPA 101 Life Safety Code.
 - 6. NFPA 105 Installation of Smoke Door Assemblies.
 - 7. KENTUCKY BUILDING CODE.

1.3 ALTERNATE PRICING

- A. Provide alternate pricing (Alternate No. 3) to include the Owner's preferred hardware manufacturers and series as indicated below:
 - 1. Key Cylinders: Sargent; keyway and number of pins as directed by Owner; large format removable core; factory keyed to Owner's existing master key system.
 - 2. Locksets: Sargent 8200 LNL series.

1.4 SUBMITTALS

A. Number of Submittals: All items listed in this section are to be included in one submittal prepared by one Supplier.

- B. Product Data: Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.
- C. Qualification Data:
 - 1. Finish Hardware Installers
 - a. Finish hardware, including electrified hardware, for wood, hollow metal, and aluminum doors to be installed by personnel trained and certified by the manufacturer of the product furnished.
 - b. Provide manufacturer's certificates for installer as part of Contractor's bid information. Failure to supply certificates may result in rejection of bid.
 - 2. Hardware Supplier

- a. Established contract hardware firm which maintains and operates an office, display, and stock in project area and which is a factory authorized distributor of the lock being furnished.
- b. Hardware scheduled and furnished by or under direct supervision an Architectural Hardware Consultant.
- c. All schedules submitted to the Architect for approval and job use must carry the signature and certified seal of this Architectural Hardware Consultant.
- 3. Architectural Hardware Consultant
 - a. Currently certified by the Door and Hardware Institute.
 - b. Full-time employee of the Hardware Supplier or an individual having no contractual ties to any supplier/manufacturer entity.
 - c. Available at reasonable times to Architect, Owner, and Contractor during course of work.
- D. Maintenance Data: For each type of door hardware. Include final hardware schedule, keying schedule, product datasheets, in 3-ring binder, labeled on spine with project name and "Door Hardware".
- E. Warranty: Special warranty specified in this Section.
- F. Other Action Submittals:
 - 1. Door Hardware Sets: Prepared by or under the supervision of a DHI certified Architectural Hardware Consultant, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final door hardware sets with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 - a. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule"; other formats will be rejected without review. Double space entries, and number and date each page.
 - b. Numerical Sequence of Sets and Headings: Submittal headings shall be in exact order as hardware sets in specification: one heading only per set. Submittal set numbers shall relate to specification set numbers, ie. if three headings are required for Set 12 due to door width differences, then the heading numbers should be 12.1, 12.2, and 12.3 or employing similar linking logic.
 - c. Door Numbers: Identical to those used in the contract documents.
 - d. Number of Copies: (5).
 - e. Content: Include the following information:
 - 1) Identification number, location, hand, fire rating, and material of each door and frame.
 - 2) Type, style, function, size, quantity, and finish of each door hardware item.
 - 3) Complete designations of every item required for each door or opening including name and manufacturer.
 - 4) Degree of opening for closer and overhead stop and holder installation.
 - 5) Keying information.
 - 6) Fastenings and other pertinent information.
 - 7) Location of each door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
 - 8) Explanation of abbreviations, symbols, and codes contained in schedule.
 - 9) Mounting locations for door hardware.
 - 10) Door and frame sizes and materials.
 - 11) List of related door devices specified in other Sections for each door and frame.
 - f. Submittal Sequence: Submit the final door hardware sets at earliest possible date, particularly where approval of the door hardware sets must precede fabrication of other work that is critical in Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the door hardware sets.

2. Keying Schedule: Prepared by or under the supervision of Architectural Hardware Consultant, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations.

1.5 QUALITY ASSURANCE

b.

- A. Furnish proper hardware types and quantities for door function, hardware mounting and clearances, and to meet applicable codes. Bring discrepancies to the attention of the Architect a minimum of (10) days prior to bid date so that an addendum may be issued. No additional compensation will be allowed after bidding for hardware changes required for proper function, hardware mounting or clearances, or to meet codes.
- B. Engineering Responsibility: Preparation of 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.
- C. Source Limitations: **All items listed in hardware sets are to be furnished by one supplier**. Obtain each type and variety of door hardware from a single manufacturer, unless otherwise indicated.
- D. Regulatory Requirements: Comply with NFPA 70, NFPA 80, NFPA 101 and ANSI A117.1 requirements and guidelines as directed in the model building code including, but not limited to, the following:
 - 1. NFPA 70 "National Electrical Code", including electrical components, devices, and accessories listed and labeled as defined in Article 100 by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
 - 2. Where indicated to comply with accessibility requirements, comply with Americans with Disabilities Act (ADA), "Accessibility Guidelines for Buildings and Facilities (ADAAG)," ANSI A117.1 as follows:
 - a. Handles, Pulls, Latches, Locks, and other Operating Devices: Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.
 - Door Closers: Comply with the following maximum opening-force requirements indicated: 1) Interior Hinged Doors: 5 lbf applied perpendicular to door.
 - Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
 - c. Thresholds: Not more than 1/2 inch high. Bevel raised thresholds with a slope of not more than 1:2.
 - 3. NFPA 101: Comply with the following for means of egress doors:
 - a. Latches, Locks, and Exit Devices: Not more than 15 lbf to release the latch. Locks shall not require the use of a key, tool, or special knowledge for operation.
 - b. Thresholds: Not more than 1/2 inch high.
 - 4. Fire-Rated Door Assemblies: Provide door hardware for assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252 (neutral pressure at 40" above sill) or UL-10C.
 - a. Test Pressure: Positive pressure labeling.
- E. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:
 - 1. Function of building, purpose of each area and degree of security required.
 - 2. Plans for existing and future key system expansion.
 - 3. Requirements for key control storage and software.
 - 4. Installation of permanent keys, cylinder cores and software.
 - 5. Address and requirements for delivery of keys.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.
- B. Tag each item or package separately with identification related to the final door hardware sets, and include basic installation instructions, templates, and necessary fasteners with each item or package.
- C. Deliver keys to Owner by registered mail or overnight package service. Obtain Owner's contact name and address from Architect.

1.7 COORDINATION

A. Templates: Distribute door hardware templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Distribute templates in a timely manner so as not to delay suppliers. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

1.8 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
 - 1. Structural failures including excessive deflection, cracking, or breakage.
 - 2. Faulty operation of the hardware.
 - 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 4. Electrical component defects and failures within the systems operation.
- C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.
- D. Special Warranty Periods:
 - 1. Ten years for mortise locks and latches.
 - 2. Five years for exit hardware.
 - 3. Ten years for manual door closers.

1.9 MAINTENANCE SERVICE

- A. 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 door hardware.
- B. Maintenance Service: Beginning at Substantial Completion, provide (6) months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door hardware operation. Provide parts and supplies same as those used in the manufacture and installation of original products.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in this and door hardware sets indicated in Part 3 "Door Hardware Sets" Article.
 - 1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturers' products.
- B. Designations: Requirements for design, grade, function, material, finish, size and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Schedule" Article. Products are identified by using door hardware designations, as follows:
 - 1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in Part 3 "Door Hardware Schedule" Article.
 - 2. References to BHMA Standards: In addition to other requirements in this section, provide products complying with or exceeding these standards and requirements for description, quality, and function.
- C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electrified access control door hardware, in compliance with specifications, must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01 "Substitution Procedures". Approval of requests is at the discretion of the architect, owner, and their designated consultants.
- D. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include manufacturers specified.

2.2 BUTT HINGES, GENERAL

- A. Quantity: Provide the following, unless otherwise indicated:
 - 1. Two Hinges: For doors with heights up to 60 inches (1524 mm).
 - 2. Three Hinges: For doors with heights 61 to 90 inches (1549 to 2286 mm).
 - 3. Four Hinges: For doors with heights 91 to 120 inches (2311 to 3048 mm).
 - 4. For doors with heights more than 120 inches (3048 mm), provide 4 hinges, plus 1 hinge for every 30 inches (750 mm) of door height greater than 120 inches (3048 mm).
- B. Template Requirements: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.
- C. Hinge Height, Width, and Weight: Unless otherwise indicated, provide the following:
 - 1. Doors with Exit Devices or 3'6" or more in width: 5" high, heavy-weight hinges.
 - 2. Doors less than 3'6" in width: 4-1/2" high, standard-weight hinges.
 - 3. Width: 4-1/2" heavy-weight, 4" standard-weight, unless proper clearance requires a different width.
 - 4. Doors with Closers: Antifriction-bearing hinges.
- D. Hinge Base Metal: Unless otherwise indicated, provide the following:
 - 1. Exterior and in-swinging restroom door hinges: Stainless steel, with stainless-steel pin.

- 2. Balance of hinges: Steel, with steel pin.
- E. Hinge Options: Provide the following:
 - 1. Nonremovable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for reverse bevel lockable doors.
 - 2. Corners: Square.
 - 3. Number of knuckles: Five.
- F. Fasteners: Comply with the following:
 - 1. Machine Screws: For metal doors and frames. Install into drilled and tapped holes.
 - 2. Wood Screws: For wood doors and frames.
 - 3. Threaded-to-the-Head Wood Screws: For fire-rated wood doors.
 - 4. Screws: Phillips flat-head. Finish screw heads to match surface of hinges.
- G. Template Hinge Dimensions: BHMA A156.7.
- H. Available Manufacturers:
 - 1. Bommer Industries, Inc. (BI).
 - 2. Hager Companies (HAG).
 - 3. McKinney Products Company; an ASSA ABLOY Group company (MCK).
 - 4. Stanley Commercial Hardware; Div. of The Stanley Works (STA).
 - 5. PBB, Inc. (PBB)

2.3 LOCKS AND LATCHES, GENERAL

- A. Accessibility Requirements: Where indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."
 - 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 (22 N).
- B. Latches and Locks for Means of Egress Doors: Comply with NFPA 101. Latches shall not require more than 15 lbf (67 N) to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.
- C. Lock Trim:
 - 1. Levers: Cast.
 - a. Sargent L model with full return.
 - 2. Roses: Forged.
 - a. Sargent LN model.
 - 3. Lockset Designs: Provide design indicated in hardware sets, or, if sets are provided by another manufacturer, provide designs that match those designated.
- D. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
 - 1. Mortise Locks: Minimum 3/4-inch (19-mm) latchbolt throw.
- E. Backset: 2-3/4 inches (70 mm), unless otherwise indicated.

- F. Strikes: Manufacturer's standard strike with strike box for each latchbolt or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, and as follows:
 - 1. Strikes for Mortise Locks and Latches: BHMA A156.13.

2.4 MECHANICAL LOCKS AND LATCHES

- A. Lock Functions: Function numbers and descriptions indicated in door hardware sets comply with the following:
 - 1. Mortise Locks: BHMA A156.13.
- B. Mortise Locks: Stamped steel case with steel or brass parts; BHMA A156.13 Grade 1.
 - 1. Available Manufacturers:
 - a. Best Access Systems; Div. of The Stanley Works (BAS).
 - b. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company (C-R).
 - c. SARGENT Manufacturing Company; an ASSA ABLOY Group company (SAR).
- C. Compatibility with Key Cylinders: fully warranted for use with key cylinder furnished.

2.5 KEY CYLINDERS

- A. Standard Lock Cylinders: BHMA A156.5, Grade 1.
- B. Cylinders: Provide cylinders for all devices requiring key cylinders to properly function: constructed from brass or bronze, stainless steel, or nickel silver, and complying with the following:
 - 1. Number of Pins: Six or seven as directed by Owner.
 - 2. Keyway: Sargent; patented or non-patented as directed by Owner.
 - 3. Mortise Type: Threaded cylinders with rings and straight- or clover-type cam.
- C. Permanent Cores: Manufacturer's standard; finish face to match lockset; complying with the following:
 - 1. Large-format Removable Cores: Core insert, removable by use of a special key; for use only with core manufacturer's cylinder and door hardware.
- D. Construction Keying: Comply with the following:
 - 1. Construction Cores: Provide keyed brass construction cores that are replaceable by permanent cores for locking devices. Provide 6 construction master keys.
 - a. Replace construction cores with permanent cores as directed by Owner.
- E. Supplemental Items: Provide cylinder spacers, collars, and correct cams as needed for proper function of locking devices.
- F. Available Manufacturers:
 - 1. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company (C-R).
 - 2. SARGENT Manufacturing Company; an ASSA ABLOY Group company (SAR).
 - 3. Schlage Commercial Lock Division; an Allegion Company (SCH).

2.6 KEYING

- A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference, and as follows:
 - 1. Existing System: Master key or grand master key locks to Owner's existing system.
- B. Keys: Nickel silver.
 - 1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:
 - a. Notation: "DO NOT DUPLICATE."
 - 2. Quantity: Provide the following:
 - a. Cylinder Change Keys: Three per cylinder.
 - b. Master Keys: Six per master.
 - c. Grand Master Keys: Six.
 - d. Control Keys: Two.
 - e. Construction Control Keys: Two.

2.7 **PROTECTIVE TRIM UNITS**

- A. Size:
 - 1. Width
 - a. Singles, and pairs with removable mullions or surface applied astragals: 2 inches (38 mm) less than door width on push side and 1 inch (13 mm) less than door width on pull side
 - b. Other pairs: 1 inch (13 mm) less than door width
 - 2. Height: as specified in door hardware sets; or, if constrained by door bottom rail height, 1" less bottom rail height.
- B. Fasteners: Manufacturer's machine or self-tapping countersunk screws.
- C. Metal Protective Trim Units: BHMA A156.6; beveled 4 sides; fabricated from 0.050-inch- (1.3-mm-) thick stainless steel.
- D. Available Manufacturers:
 - 1. Hager Companies (HAG).
 - 2. IVES Hardware; an Allegion Company (IVE).
 - 3. Hiawatha (HIW).
 - 4. Burns (BRN).
 - 5. Rockwood Manufacturing Company (ROC).
 - 6. Trimco (TRI).

2.8 MECHANICAL WALL AND FLOOR STOPS AND HOLDERS

- A. Stops and Bumpers: BHMA A156.16, Grade 1.
 - 1. Provide wall stops for doors unless floor, overhead, or other type stops are scheduled or indicated. Do not mount floor stops where they will impede traffic. Provide floor stops (and spacers if needed) of proper height and configuration to accommodate floor condition. Where floor or wall stops are not appropriate, provide overhead holders.
 - 2. Properties. Cast construction with fastener suitable for wall or floor condition.

- 3. Available Manufacturers:
 - a. Hager Companies (HAG).
 - b. IVES Hardware; an Allegion Company (IVE).
 - c. Hiawatha (HIW).
 - d. Burns (BRN).
 - e. Rockwood Manufacturing Company (ROC).
 - f. Trimco (TRI).

2.9 SILENCERS

- A. Provide silencers for Metal Door Frames, though not listed in the door hardware sets: BHMA A156.16, Grade 1; neoprene or rubber, minimum diameter 1/2 inch (13 mm); fabricated for drilled-in application to frame.
- B. Available Manufacturers:
 - 1. Glynn-Johnson; an Allegion Company (GLY).
 - 2. Hager Companies (HAG).
 - 3. IVES Hardware; an Allegion Company (IVE).
 - 4. McKinney Products Company; an ASSA ABLOY Group company (MCK).
 - 5. Rockwood Manufacturing Company (ROC).
 - 6. Trimco (TRI).

2.10 DOOR GASKETING

- A. General: Provide continuous weather-strip gasketing on exterior hollow metal doors and provide smoke, light, or sound gasketing on interior doors where indicated or scheduled. Provide noncorrosive fasteners as indicated by models in hardware sets.
 - 1. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame. If hardware is to be attached to the frame and would interfere with the gasketing, then provide hardware compatible gasketing that does not need to be cut for the mounting of hardware.
 - 2. Mullion Gasketing: Fasten to mullions, forming seal when doors are closed.
 - 3. Seals integral to threshold at out-swinging exterior hollow metal doors.
- B. Air Leakage: Not to exceed 0.50 cfm per foot (0.000774 cu. m/s per m) of crack length for gasketing other than for smoke control, as tested according to ASTM E 283.
- C. Mullion Gasketing: Sealing up to 1/4" gaps, 4 vanes, adhesive backed, collapsible to 1/32", black. Basis of Design: DHSI (DHS) Model MS-SA/75 x BK.
- D. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
- E. Jamb Gasketing Materials:
 - 1. Adhesive Seals. As specified in hardware sets or approved equal.
 - 2. Intumescents: As required.
 - 3. Screwed-on weatherstrip and sweeps. Neoprene.
 - 4. Panic type thresholds. Neoprene.
- F. Available Manufacturers for Jamb Gaskets (provided they provide items with neoprene inserts):
 - 1. Hager Companies (HAG).
 - 2. National Guard Products (NGP).
 - 3. Pemko Manufacturing Co. (PEM).

- 4. Reese Enterprises (REE).
- 5. Zero International (ZER).

2.11 THRESHOLDS

- A. Standard: BHMA A156.21
- B. Accessibility Requirements: Where thresholds are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."
 - 1. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch (13 mm) high.
- C. Thresholds for Means of Egress Doors: Comply with NFPA 101. Maximum 1/2 inch (13 mm) high.
- D. Fasteners: 1/4-20 machine screws and expansion anchors.
- E. Gasketing material: At panic-type thresholds: neoprene.
- F. Available Manufacturers (provided they provide items with neoprene inserts):
 - 1. Hager Companies (HAG).
 - 2. National Guard Products (NGP).
 - 3. Pemko Manufacturing Co. (PEM).
 - 4. Reese Enterprises (RE).
 - 5. Zero International (ZRO).

2.12 FABRICATION

- A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rated labels and as otherwise approved by Architect.
 - 1. Manufacturer's identification is permitted on rim of lock cylinders only.
- B. Base Metals: Produce door hardware units of base metal, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18. Do not furnish manufacturer's standard materials or forming methods if different from specified standard.

2.13 FINISHES

- A. Standard: BHMA A156.18, as indicated in door hardware sets.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. 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

- A. 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.
- B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 **PREPARATION**

- A. Steel Doors and Frames: Comply with DHI A115 Series.
 - 1. Surface-Applied Door Hardware: Drill and tap doors and frames according to ANSI A250.6.
- B. Wood Doors: Comply with DHI A115-W Series.

3.3 INSTALLATION

- A. Mounting Heights: Mount door hardware units at heights indicated as follows unless otherwise indicated or required to comply with governing regulations.
 - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 - 2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
- B. Mounting Locations:
 - 1. Wall Stops: Locate so that lockset spindle and wall stop share horizontal and vertical centerlines.
 - 2. Closers and Overhead Stop/Holders: Template and mount closers and overhead stops for maximum degree of opening before door encounters obstruction or so as to interface with specified wall stops and holders. These functionality requirements override any degree of opening information in the specifications or submittals.
- C. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 09 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
 - 1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
 - 2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- D. Weatherstrip and Gasketing with Metal Retainers: Fit up as needed for neat appearance with no gaps between retainers or bulbs.

E. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants." Position for complete seal with bottom of doors with no penetration of air or daylight.

3.4 ADJUSTING

- A. Initial Adjustment: 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.
- B. Door Closers:
 - 1. Unless otherwise required by authorities having jurisdiction, adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches (75 mm) from the latch, measured to the leading edge of the door.
 - 2. Adjust latch period so that door does not slam nor injure fingers.
 - 3. Adjust spring power for minimum force required so that door properly and reliably latches. It is recommended that all closers be adjusted to a Spring Size 1 (either at the factory or at the facility of the Contract Hardware Supplier) prior to delivery to job; they can then be adjusted up to meet requirements. ADA maximum force to open a non-rated interior doors is 5 lbf; 8.5lbf for an exterior non-rated door. Installer is required to adjust spring power on every closer during installation using a door force gage. If ADA requirements cannot be met due to door-frame-hardware clearance issues of HVAC issues, bring to Contractors attention to resolve problem.
 - 4. Adjust backcheck to slow door down before hitting stop point so as to prevent damage to closer, arm, door, frame, and fasteners.
- C. Occupancy Adjustment: Approximately six months after date of Substantial Completion, Installer shall examine and readjust, including adjusting operating forces, each item of door hardware as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.5 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items as necessary to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.6 DOOR HARDWARE SCHEDULE

Hardware Set 01 – Doors 136, 137, 225, 226, 227

(3)	Butt Hinges	BB1279 4.5 X 4.0	26D	HAG
(1)	Storeroom Lock	63-8204-LNL	626	SAR
(1)	Kick Plate	KO050 8 x 2LDW x CS x B4E	630	TRI
(1)	Wall Stop, Concave	1270CV	626	TRI

Hardware Set 02 - Door C1D

(6)	Butt Hinges	BB1199 5 x 4.5	630	HAG
(2)	Kick Plate	KO050 8 x 2LDW x CS x B4E	630	TRI
(1)	Cat H Adhesive Mullion Seal/Mu	te MS-SA/75	Black	DHS
(1)	Cat H Jamb Seal Set	135NA	628	NGP
(1)	Panic Threshold	896N x RCE	628	NGP
ЪТ.	1 0 1 1 1 1 1 1 1 1	• • • •		

Note 1: Salvage and re-install the following hardware items:

- (2) Panic Devices with their Key Cylinders
- (1) Removable Mullion with its Key Cylinder

(2) Door Closers

Note 2: Remove existing seal from mullion; clean with solvent and apply new mullion seal.

Note 3: Remove existing threshold. Fill screwholes with Rockite or similar product. Install mullion and threshold.

END OF SECTION 087100

SECTION 088000 - GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Glass.
- B. Glazing compounds and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 079005 Joint Sealers: Sealant and back-up material.
- B. Section 081113 Hollow Metal Doors and Frames: Glazed lites in doors and borrowed lites.
- C. Section 081416 Flush Wood Doors: Factory glazed doors.
- D. Section 084313 Aluminum-Framed Storefronts: Framing system.
- E. Section 102800 Toilet, Bath, and Laundry Accessories: Mirrors.

1.03 REFERENCE STANDARDS

- A. 16 CFR 1201 Safety Standard for Architectural Glazing Materials; current edition.
- B. ASTM C920 Standard Specification for Elastomeric Joint Sealants; 2014.
- C. ASTM C1036 Standard Specification for Flat Glass; 2011.
- D. ASTM C1048 Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2012.
- E. ASTM C1172 Standard Specification for Laminated Architectural Flat Glass; 2014.
- F. ASTM C1193 Standard Guide for Use of Joint Sealants; 2013.
- G. ASTM E2190 Standard Specification for Insulating Glass Unit Performance and Evaluation; 2010.
- H. GANA (GM) GANA Glazing Manual; 2009.
- I. GANA (SM) GANA Sealant Manual; 2008.

1.04 SUBMITTALS

- A. Product Data on Glass Types: Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.
 - 1. Submit designation of the percentages of post-consumer and pre-consumer recycled-content in glass products.
- B. Product Data on Glazing Compounds: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors.
- C. Product Data on Solar Control Coatings: Provide product data on all specified solar control coatings to be provided.

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with GANA Glazing Manual and FGMA Sealant Manual for glazing installation methods.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience.
- C. Insulated Glass Fabricator Qualifications: Current, approved member of the Insulating Glass Certification Council (IGCC). Member warrants that its manufactured insulated glass units (IGU) will

correspond in all material respects to the specification and will be free from defects in material and workmanship for ten (10) years from the date of substantial completion.

1.06 FIELD CONDITIONS

- A. Do not install glazing when ambient temperature is less than 50 degrees F.
- B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.07 WARRANTY

- A. See Section 017800 Closeout Submittals, for additional warranty requirements.
- B. Sealed Insulating Glass Units: Provide a five (5) year warranty to include coverage for seal failure, interpane dusting or misting, including replacement of failed units.

PART 2 PRODUCTS

2.01 GLASS MATERIALS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include;:
- B. Glass Manufacturers:
 - 1. Cardinal Glass Industries: www.cardinalcorp.com.
 - 2. AGC Flat Glass North America, Inc: www.na.agc-flatglass.com.
 - 3. Guardian Industries Corp: www.sunguardglass.com.
 - 4. Pilkington North America Inc: www.pilkington.com/na.
 - 5. Vitro Glass + PPG Glass: www.ppgideascapes.com.
 - 6. Trulite Glass and Aluminum Solutions: www.trulite.com
 - 7. Zeledyne: www.versaluxglass.com.
- C. Float Glass: Provide float glass based glazing unless noted otherwise.
 - 1. Annealed Type: ASTM C1036, Type I Transparent Flat, Class 1 Clear, Quality-Q3.
 - 2. Heat-Strengthened and Fully Tempered Types: ASTM C1048, Kind HS and Kind FT.
 - 3. Thicknesses: As indicated; for exterior glazing comply with requirements indicated for wind load design regardless of thickness indicated.
- D. Clear Float Glass : Clear, annealed.
 - 1. Comply with ASTM C 1036, Type I, transparent flat, Class 1 clear, Quality Q3 (glazing select).
 - 2. Comply with ASTM C 1048.
- E. Safety Glass : Clear; fully tempered.
 - 1. Comply with ASTM C 1036, Type I, transparent flat, Class 1 clear, Quality Q3 (glazing select) and ASTM C 1048.
 - 2. Comply with 16 CFR 1201 test requirements for Category II.
 - 3. 6 mm minimum thick.
 - 4. Provide this type of glazing in the locations indicated on the drawings.

2.02 SEALED INSULATING GLASS UNITS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include:
 - 1. Cardinal Glass Industries: www.cardinalcorp.com.
 - 2. Glenny Glass: www.glennygls.com
 - 3. Guardian Industries Corp: www.guardian.com.
 - 4. Louisville Plate Glass: www.louisvilleplateglass.com
 - 5. Oldcastle Building Envelope: www.oldcastlebe.com
 - 6. Trulite Glass and Aluminum Solutions: www.trulite.com

- 7. Viracon, Apogee Enterprises, Inc: www.viracon.com.
- B. Sealed Insulating Glass Units: Types as indicated.
 - 1. Application: Exterior, except as otherwise indicated.
 - 2. Durability: Certified by an independent testing agency to comply with ASTM E2190.
 - 3. Edge Spacers: Aluminum, bent and soldered corners.
 - 4. Edge Seal: Glass to elastomer with supplementary silicone sealant.
 - 5. Purge interpane space with dry hermetic air.
- C. Insulated Glass Units : Double pane with glass to elastomer edge seal.
 - 1. Locations: Exterior metal windows, storefront and/or curtainwall window systems.
 - 2. Total unit thickness of 1 inch, minimum.
 - 3. Outer pane of 1/4" glass, inner pane of 1/4" glass.
 - 4. Place low E coating on No.2 surface within the unit.
 - 5. Low-E Coating: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include:
 - a. AGC Energy Select 40
 - b. Guardian SN-68
 - c. PPG Solarban 60
- D. Insulated Glass Units : Double pane with glass to elastomer edge seal.
 - 1. Locations: Exterior hollow metal, aluminum storefront and /or curtainwall doors.
 - 2. Locations: Base Bid.
 - 3. Total unit thickness of 7/8 inch, minimum.
 - 4. Outer pane of 3/16 glass, inner pane of 3/16 glass.
 - 5. Place low E coating on No.2 surface within the unit.
 - 6. Low-E Coating: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include:
 - a. AGC Energy Select 40
 - b. Guardian SN-68
 - c. PPG Solarban 60

2.03 GLAZING COMPOUNDS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include,
- B. Manufacturers:
 - 1. Bostik Inc: www.bostik-us.com.
 - 2. Momentive Performance Materials, Inc (formerly GE Silicones): www.momentive.com.
 - 3. Pecora Corporation: www.pecora.com.
 - 4. BASF Construction Chemicals-Building Systems: www.buildingsystems.basf.com.
 - 5. Substitutions: Refer to Section 016000 Product Requirements.
- C. Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; non-bleeding, non-staining; ASTM C920, Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; standard color.

2.04 GLAZING ACCESSORIES

- A. Setting Blocks: Neoprene, 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot of glazing or minimum 4 inch x width of glazing rabbet space minus 1/16 inch x height to suit glazing method and pane weight and area.
- B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Minimum 3 inch long x one half the height of the glazing stop x thickness to suit application, self adhesive on one face.

- C. Glazing Tape, Back Bedding Mastic Type: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; hardness range of 5 to 30 cured Shore A durometer; coiled on release paper; black color.
 - 1. Manufacturers:
 - a. Pecora Corporation: www.pecora.com.
 - b. Tremco Global Sealants: www.tremcosealants.com.
 - c. Substitutions: Refer to Section 016000 Product Requirements.
- D. Glazing Gaskets: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; standard color.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that openings for glazing are correctly sized and within tolerance.
- B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and ready to receive glazing.

3.02 PREPARATION

- A. Clean contact surfaces with solvent and wipe dry.
- B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- C. Prime surfaces scheduled to receive sealant.
- D. Install sealants in accordance with ASTM C1193 and GANA Sealant Manual.
- E. Install sealants in accordance with manufacturer's instructions.

3.03 INSTALLATION - EXTERIOR/INTERIOR DRY METHOD (GASKET GLAZING)

- A. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.
- B. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.
- C. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.04 INSTALLATION - EXTERIOR WET METHOD (SEALANT AND SEALANT)

- A. Place setting blocks at 1/4 points and install glazing pane or unit.
- B. Install removable stops with glazing centered in space by inserting spacer shims both sides at 24 inch intervals, 1/4 inch below sight line.
- C. Fill gaps between glazing and stops with sealant to depth of bite on glazing, but not more than 3/8 inch below sight line to ensure full contact with glazing and continue the air and vapor seal.
- D. Apply sealant to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

3.05 CLEANING

- A. Remove glazing materials from finish surfaces.
- B. Remove labels after Work is complete.
- C. Clean glass and adjacent surfaces.

3.06 **PROTECTION**

After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat A. absorbing or reflective glass units. END OF SECTION 088000

SECTION 092116 - GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Metal stud wall framing. non-loadbearing.
- B. Metal channel ceiling framing.
- C. Sound Attenuation Batts / Acoustic insulation.
- D. Gypsum sheathing.
- E. Cementitious backing board.
- F. Gypsum wallboard.
- G. Glass mat faced gypsum board.
- H. Joint treatment and accessories.
- I. Suspended gypsum board on track/grid.
- J. Products installed, but not furnished, under this Section include the following:
 - 1. Access panels to be furnished by, but not limited to the following; mechanical, electrical, plumbing, controls, communication/data contractors.

1.02 RELATED REQUIREMENTS

- A. Section 013000 Administrative Requirements Submittal procedures.
- B. Section 061000 Rough Carpentry: Wood blocking product and execution requirements.
- C. Section 072100 Thermal Insulation: Thermal insulation.
- D. Section 075200 Modified Bituminous Roofing System: Gypsum based roof cover board for field of roof.
- E. Section 079005 Joint Sealers: Acoustic sealant/sound caulk.
- F. Section 102601 Wall and Corner Guards: Standard corner guards.

1.03 REFERENCE STANDARDS

- A. AISI S100-12 North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute; 2012.
- B. ANSI A118.9 American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units; 1999 (Reaffirmed 2016).
- C. ASTM A653/A653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
- D. ASTM C475/C475M Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2015.
- E. ASTM C645 Standard Specification for Nonstructural Steel Framing Members; 2014.
- F. ASTM C665 Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2012.
- G. ASTM C754 Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2015.
- H. ASTM C840 Standard Specification for Application and Finishing of Gypsum Board; 2013.

- I. ASTM C954 Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2015.
- J. ASTM C1002 Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2014.
- K. ASTM C1047 Standard Specification for Accessories For Gypsum Wallboard and Gypsum Veneer Base; 2014a.
- L. ASTM C1177/C1177M Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2013.
- M. ASTM C1280 Standard Specification for Application of Gypsum Sheathing Board; 2013.
- N. ASTM C1325 Specification for Non-Asbestos Fiber-Mat Reinforced Cementitious Backer Units; 2014.
- O. ASTM C1396/C1396M Standard Specification for Gypsum Board; 2014.
- P. ASTM D3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2012.
- Q. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- R. ASTM E90 Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009.
- S. GA-214 Recommended Levels of Finish for Gypsum Board, Glass Mat and Fiber-Reinforced Gypsum Panels; 2015
- T. GA-216 Application and Finishing of Gypsum Board; 2013.
- U. GA-226 Application of Gypsum Board to Form Curved Surfaces; Gypsum Association; 2008.
- V. GA-253 Recommended Specifications for the Application of Gypsum Sheathing; Gypsum Association; 1999.
- W. GA-600 Fire Resistance Design Manual; 2015.
- X. GA-801 Handling of Storage of Gypsum Panel Products; current edition.
- Y. ICC (IBC) International Building Code; 2015.
- Z. UL (FRD) Fire Resistance Directory; current edition.

1.04 SUBMITTALS

- A. See Section 013000 Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.
- C. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.
- D. Test Reports: For stud framing products that do not comply with ASTM C645 or ASTM C754, provide independent laboratory reports showing maximum stud heights at required spacings and deflections.

1.05 QUALITY ASSURANCE

A. Perform in accordance with ASTM C840 and GA-214 and GA-216. Comply with requirements of GA-600 for fire-rated assemblies.

B. Installer Qualifications: Company specializing in performing gypsum board installation and finishing, with minimum 5 years of experience.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in original packaging, containers or bundles bearing the manufacturers brand name and identification.
- B. Store materials inside and under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes.
- C. Stack panels flat to prevent sagging.
- D. Handle gypsum boards to prevent damage to edges, ends or surfaces. Protect metal accessories and trim form being bent or damaged.
- E. In addition follow the guidelines found in GA-801.
- F. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling as required by AISI's "Code of Standard Practice".

1.07 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 or GA-216 requirements, 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 or 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

2.01 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840, GA-214 and GA-216.
1. See PART 3 for finishing requirements.

2.02 METAL FRAMING MATERIALS

- A. Manufacturers: Subject to compliance with requirements manufacturers offering the following products that may be incorporated into the work include;
 - 1. Metal Framing, Connectors, and Accessories:
 - a. Clark Dietrich Building Systems: www.dietrich.com
 - b. J. N. Linrose Manufacturing LLC: www.jnlinrose.com
 - c. Marino Ware: www.marinoware.com.
 - d. Phillips Manufacturing Company: www.phillipsmfg.com.
 - e. Southeastern Stud and Components, Inc: www.sestud.com
 - f. Telling Industries, LLC: www.tellingindustries.com.
- B. Manufacturers: Subject to compliance with requirements manufacturers offering the following products that may be incorporated into the work include;
 - 1. Drywall Suspension Systems and Accessories: Contractor's option to use a drywall suspension system for the gypsum board ceilings in lieu of metal stud ceiling framing.
 - a. Armstrong Commercial Ceilings: www.armstrong.com
 - b. USG: www.usg.com
 - c. Chicago Metallic Corporation: www.chicago-metallic.com

- C. Non-Loadbearing Framing System Components: ASTM C 645; galvanized sheet steel, of size and properties necessary to comply with ASTM C 754 for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf.
 - 1. Minimum recycled content of 30%. Preference shall be given for steel framing components containing locally recovered steel.
 - All Framing and System Components: Minimum G40 zinc-coated hot dipped galvanized steel, per ASTM A 653 or coating with equivalent corrosion resistance of ASTM A 653/A 653M, G40 (Z120) coating, roll-formed from steel meeting mechanical and chemical requirements of ASTM A 1003 with a zinc-based coating. Galvannealed products are not acceptable.
 - a. Coatings shall demonstrate equivalent corrosion resistance with an evaluation report acceptable to authorities having jurisdiction.
 - b. Equivalent Gauge Thickness for Steel Studs and Runner: Members that can show certified third party testing with gypsum board in accordance with ICC ES AC86 (current edition) need not meet the minimum thickness limitation or minimum section properties set forth in ASTM C645. The submission of an evaluation report is acceptable to show conformance to this requirement.
 - 1) Clark Dietrich Building System ProStud: www.clarkdietrich.com.
 - 2) Marino\Ware Viper Stud: www.marinoware.com
 - 3. Studs: "C" shaped with flat or formed webs with knurled faces.
 - 4. Runners: U shaped, sized to match studs.
 - 5. Ceiling Channels: C-shaped.
 - 6. Furring at Walls: Hat-shaped sections, minimum depth of 7/8 inch.
- D. Metal soffit panel support: Hat-shaped sections, minimum depth of 7/8 inch. Gauge to be 18 ga. or as determined and approved by the metal soffit panel manufacturer. On-center spacing to be determined by the metal soffit panel manufacturer.
- E. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.
- F. Partition Head to Structure Connections: Contractor option to friction fit slip leg track or track with slotted holes as specified below:
 - 1. Partition Head To Structure Connections: Provide track fastened to structure with legs of sufficient length to accommodate deflection, for friction fit of studs cut short and fastened as indicated on drawings.
 - 2. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection using slotted holes, screws and anti-friction bushings, preventing rotation of studs while maintaining structural performance of partition.
 - a. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI S100-12.
 - b. Material: ASTM A653/A653M steel sheet, SS Grade 50/340, with G60/Z180 hot dipped galvanized coating.
- G. Drywall Grid System: Grid system meeting ASTM C 635 and ASTM C 645 Standard Specification for Rigid Furring Channels for Screw Applications of Gypsum Board.
 - 1. Contractor option to use this system in lieu of framed construction.
 - 2. Intermediate-duty main beam, G40 zinc-coated hot dipped galvanized steel, double-web construction, profile height of 1-11/16" with peaked roof or rectangular top bulb and 1-1/2" knurled flange.
 - 3. Cross-tees, G40 zinc-coated hot dipped galvanized steel, double-web construction, profile height 1-1/2" with peaked roof or rectangular top bulb and 1-1/2" knurled flange.
 - 4. Wall moldings, galvanized steel, hemmed angle, nominal 1-1/4" x 1-1/4".
 - 5. Hanger wire, minimum 12 gauge and spaced along main beam not more than 4' on center to support load.
 - 6. Add vertical bracing as required to stabilize the frame.

7. Product to have manufacturers 10-year limited warranty.

2.03 BOARD MATERIALS

- A. Manufacturers: Subject to compliance with requirements manufacturers offering the following products that may be incorporated into the work include;
- B. Manufacturers Gypsum-Based Board:
 - 1. Saint-Gobain BPB/Certainteed Inc: www.bpb-na.com.
 - 2. Georgia-Pacific Gypsum(acquired Temple Inland): www.gpgypsum.com.
 - 3. Continental Building Products: www.continental-bp.com.
 - 4. National Gypsum Company: www.nationalgypsum.com/#sle.
 - 5. USG Corporation: www.usg.com/#sle.
- C. Cement Board/Backing Board For Wet Areas:
 - 1. Application: Surfaces behind tile in wet areas including tub and shower surrounds.
 - 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 - 3. ANSI Cement-Based Board: Non-gypsum-based; aggregated Portland cement panels with glass fiber mesh embedded in front and back surfaces complying with ANSI A118.9 or ASTM C1325.
 - a. Thickness: 5/8 inch.
 - b. Manufacturers: Subject to compliance with requirements manufacturers offering the following products that may be incorporated into the work include;
 - 1) Custom Building Products: www.custombuildingproducts.com.
 - 2) National Gypsum Company; PermaBase Cement Board: www.nationalgypsum.com/#sle.
 - 3) Georgia Pacific: Denshield Tile Backer: www.buildgp.com
 - 4) USG Corporation; Durock Tile Backer Board: www.usg.com.
- D. Ceiling Board: Special sag resistant gypsum ceiling board as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
 - 1. Application: Ceilings and soffits, unless otherwise indicated.
 - 2. Thickness: 5/8 inch.
 - 3. Edges: Tapered.
 - 4. Products:
 - a. CertainTeed Corporation; Interior Ceiling Drywall.
 - b. Georgia-Pacific Gypsum; ToughRock Span 24 Ceiling Board.
 - c. Lafarge North America Inc; Sagcheck.
 - d. National Gypsum Company; High Strength Brand Ceiling Board.
 - e. Temple-Inland Building Products by Georgia-Pacific, LLC; Span24 Ceiling Board.
 - f. USG Corporation; Sheetrock Brand Sag-Resistant Interior Gypsum Ceiling Board.
- E. Gypsum Wallboard: ASTM C 1396/C 1396M. Sizes to minimize joints in place; ends square cut.
 - 1. Regular Type:
 - a. Application: Use for vertical surfaces, unless otherwise indicated.
 - b. Thickness: 5/8 inch.
 - c. Edges: Tapered.
 - d. Application: Where required for fire-rated assemblies, unless otherwise indicated.
 - 2. Fire Resistant Type: Complying with Type X requirements; UL or WH rated.
 - a. At Assemblies Indicated with Fire-Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X.
 - b. Application: Where required for fire-rated assemblies, unless otherwise indicated.
 - c. Thickness: 5/8 inch.
 - d. Edges: Tapered.
- F. Abuse-Resistant Type: Gypsum wallboard especially formulated for increased impact resistance, with enhanced gypsum core and heavy duty face and back paper.
 - 1. Application: High-traffic areas indicated.

- 2. Core Type: Regular and Type X, as indicated.
- 3. Thickness: 5/8 inch.
- 4. Edges: Tapered.
- 5. Local Materials: Manufactured and of raw materials from within 500 miles of Project Site.
 - a. Manufacturers: Subject to compliance with requirements manufacturers offering the following products that may be incorporated into the work include, but are not limited to the following:
 - 1) Certainteed/Saint Gobain AirRenew Extreme Abuse
 - 2) Continental Building Products Protecta HIR 300
 - 3) USG FiberRock Abuse Resistant: www.usg.com
 - 4) National Gypsum High Abuse XP: www.nationalgypsum.com
 - 5) GP/Temple-Inland ComfortGuard AR: www.templeinland.com
- G. Mold-Moisture/Water-Resistant/Abuse Gypsum Backing Board: ASTM C 1396/C 1396M; ends square cut.
 - 1. Application: Vertical surfaces behind thinset tile, except in wet areas.
 - 2. Edges: Tapered.
 - a. Manufacturers: Subject to compliance with requirements manufacturers offering the following products that may be incorporated into the work include, but are not limited to the following:
 - 1) Certainteed/Saint Gobain Extreme Abuse with M2 Technology
 - 2) Continental Building Products Protecta HIR 300
 - 3) USG FiberRock Aqua-Tough or Mold Tough Abuse Resistant: www.usg.com
 - 4) National Gypsum Gold Bond High Abuse XP: www.nationalgypsum.com
 - 5) GP/Temple-Inland ComfortGuard: www.templeinland.com
- Exterior Gypsum Soffit Board: ASTM C 1396/C 1396M; sizes to minimize joints in place; ends square cut.
 - 1. Application: Ceilings and soffits in protected exterior areas, unless otherwise indicated.
 - 2. Core Type: Regular, as indicated.
 - 3. Thickness: 5/8 inch.
 - 4. Edges: Tapered.
- I. Exterior Sheathing Board: Sizes to minimize joints in place; ends square cut.
 - 1. Application: Exterior sheathing, unless otherwise indicated.
 - 2. Glass Mat Faced Sheathing: Glass mat faced gypsum substrate as defined in ASTM C1177/C1177M.
 - 3. Core Type: Regular.
 - 4. Regular Board Thickness: 5/8 inch.
 - 5. Edges: Square.
 - 6. Glass Mat Faced Products:
 - a. CertainTeed Corporation; GlasRoc Exterior Sheathing.
 - b. Continental Building Products; Weather Defense Platinum Exterior Sheathing.
 - c. Saint Gobain Certainteed: GlassRoc.
 - d. Georgia-Pacific Gypsum; DensGlass Sheathing.
 - e. National Gypsum Company; Gold Bond eXP Sheathing.
 - f. Temple-Inland Building Products by Georgia-Pacific, LLC; GreenGlass Exterior Sheathing.
 - Sneatning.
 - g. USG Corporation: Securock Glass-Mat Sheathing
- J. Exterior Roof Board: Sizes to minimize joints in place; ends square cut.
 - 1. Application: Roof board at parapet walls, unless otherwise indicated.
 - a. Installer/supplier of roof board to coordinate with roofing manufacturer/installer to ensure that roof board selected (fiber-glass faced and/or unfaced/gypsum-fiber board

or plywood sheathing per section 061000) meets the roof manufacturers warranty requirements as described in section 075400 Thermoplastic Membrane Roofing.

- 2. Glass-Mat-Faced Board: Glass mat faced gypsum substrate as defined in ASTM C 1177/C 1177M.
- 3. Unfaced/Gypsum-Fiber Board: Gypsum-fiber substrate as defined in ASTM C 1278.
- 4. Core Type: Regular.

a.

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- 5. Board Thickness: 5/8 inch.
- 6. Edges: Square, for vertical application.
- 7. Glass-Mat-Faced Roof Board Products:
 - Georgia-Pacific Gypsum LLC; DensDek Prime
 - Unfaced/Gypsum-Fiber Roof Board Products:
 - a. United States Gypsum Co.; Securock Roof Board
- K. Exterior Soffit Board: Exterior gypsum soffit board as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
 - 1. Application: Ceilings and soffits in protected exterior areas, unless otherwise indicated.
 - 2. Types: Regular and Type X, in locations indicated.
 - 3. Type X Thickness: 5/8 inch.

(1)

- 4. Edges: Tapered.
- 5. Manufacturers: Subject to compliance with requirements manufacturers offering the following products that may be incorporated into the work include:
 - a. Continental Building Products; Soffitboard Type C.
 - b. CertainTeed Corporation; ProRoc Brand Exterior Soffit Board.
 - c. Georgia-Pacific Gypsum; ToughRock Fireguard C Soffit Board.
 - d. Lafarge North America Inc; Soffitboard.
 - e. National Gypsum Company; Gold Bond Brand Exterior Soffit Board.
 - f. Temple-Inland Building Products by Georgia-Pacific, LLC; Exterior Gypsum Soffit Board.
 - g. USG Corporation; Sheetrock Exterior Gypsum Ceiling Board.

2.04 ACCESSORIES

- A. Sound Attenuation Batts/Blankets/Acoustic Insulation: ASTM C 665; 2.5 pcf nominal density, preformed mineral-fiber, friction fit type, unfaced. Fiber glass sound control batt insulation, unfaced, and must meet the performance requirements of ASTM C 665 "Standard Specification for Mineral Fiber Blanket, Thermal Insulation.
 - 1. Sound Attenuation Batts/Blankets/Acoustic Insulation: ASTM C 665; 2.5 pcf nominal density, preformed mineral-fiber, creased, friction fit type, unfaced. Creased batt width to be one inch wider than the on-center spacing of the studs. Refer to drawings for stud spacing.
 - a. Contractor option to provide creased batts/blankets or support batts/blankets with "tiger teeth, lightning rods, or wire stays" between studs or support batts with metal banding attached to the metal studs or metal wire threaded through the stud openings in a continuous manner.
 - 1) Acceptable Metal Banding Product:
 - (a) Insul-Hold Co., Inc. Insul-Hold: www.insulhold.com
 - Class D, ASTM 527-80, 24 gauge galvanized metal strapping with two-three inch long arrows to secure insulation.
 - 2. Contractor option to use one of the following products:
 - a. Mineral-Fiber Manufacturers: Subject to compliance with requirements manufacturers offering the following products that may be incorporated into the work include:
 - 1) Owens Corning Thermafiber SAFB: www.thermafiber.com
 - 2) Roxul Inc. Roxul AFB: www.roxul.com
 - b. Fiber Glass Manufacturers: Subject to compliance with requirements manufacturers offering the following products that may be incorporated into the work include:

- 1) JM -Sound Control Batts: www.jm.com
- 2) Owens Corning ProPink Sound Attenuation Batts: www.owenscorning.com
- B. Sound Attenuation Batts/Blanket Product Requirements:
 - 1. Sound Attenuation Batts/Blankets/Acoustic Insulation Thickness: Minimum thickness 3 inch at 3-5/8" metal stud walls.
 - 2. Sound Attenuation Batts/Blankets/Acoustic Insulation Thickness: Minimum thickness 6 inch at 6 inch metal stud walls.
 - 3. Sound Attenuation Batts/Blankets/ Acoustic Insulation Width: Minimum width to be the same as the on-center stud spacing indicated on the drawings.
- C. Finishing Accessories: ASTM C1047, galvanized steel or rolled zinc, unless noted otherwise.
 1. Types: As detailed or required for finished appearance.
- D. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
 - 1. Ready-mixed vinyl-based joint compound.
- E. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inch in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion resistant.
- F. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch in Thickness: ASTM C954; steel drill screws, corrosion resistant.
- G. Screws: ASTM C 1002; self-piercing tapping type; cadmium-plated for exterior locations.
- H. Screws: ASTM C 954; steel drill screws for application of gypsum board to loadbearing steel studs.
- I. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.
- J. Compressible Filler: In lieu of coping gypsum board to deck profile and providing sound attenuation blanket material and acoustical sealant it is the contractor's option to provide and install cut to fit or premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene, urethane, EPDM, or PVC.
 - 1. Install at tops of non-rated, non-load-bearing metal stud walls running perpendicular or parallel to the metal deck . Place a bead of caulk 1/2 inch back from flute opening and on all sides of flute. Compress plug and slide into place.
 - a. Perpendicular to metal deck: Williams Products Inc. EVA 200G or 3000 Series Closure Flute Plugs or Strips: www.williamsproducts.net.
 - Closed Cell plugs and strips per ASTM D-1171, ASTM D-925, ASTM D-412. Density: 12.8 lbs/ft

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.02 FRAMING INSTALLATION

- A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.
- B. Suspended Ceilings and Soffits: Space framing and furring members as indicated.
 - 1. Level ceiling and soffit system to a tolerance of 1/1200.
 - 2. Laterally brace entire suspension system.
- C. Studs: Space studs as indicated on the drawings.
 - 1. Align and secure top and bottom runners at 24 inches on center.
 - 2. Install studs vertically.
 - 3. Align stud web openings horizontally.

- 4. Stud splicing is not permissible.
- 5. Extend partition framing to underside of floor or roof deck. Attach extended leg top runner to deck, maintain clearance between top of studs and runner, and brace both flanges of studs with continuous bridging.
- 6. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track. Contractor option to use slotted track.
- D. Corners: Fabricate corners using a minimum of three studs.
- E. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.
- F. Fit runners under and above openings; secure intermediate studs to same spacing as wall studs.
- G. Brace stud framing system rigid.
- H. Access Panel Opening Framing: Coordinate with the following, but not limited to; mechanical, electrical, plumbing, communication/data contractors for access panel locations in walls and ceilings.
 - 1. If access panels are being furnished by other trades verify type of access panel being provided, and if gypsum board on the recess door panel is required.
- I. Standard Wall Furring: Install at masonry walls scheduled to receive gypsum board, not more than 4 inches from floor and ceiling lines and abutting walls. Secure in place on alternate channel flanges at maximum 24 inches on center.
- J. Blocking: See Section 061000 for wood blocking. Install wood blocking for support of:
 - 1. Cabinets, shelf, and countertop supports.
 - 2. Wall mounted cabinets.
 - 3. Wall brackets.
 - 4. Handrails and guardrails.
 - 5. Fire extinguisher cabinets, brackets, and valve cabinets.
 - 6. Grab bars.
 - 7. Toilet and bath accessories.
 - 8. Toilet and urinal partitions.
 - 9. Wall-mounted door hardware and stops.
 - 10. Chalkboards, tackboards, and marker boards.
 - 11. Wall paneling and trim.
 - 12. Joints of rigid wall coverings that occur between studs.
 - 13. Locker base and wall attachment.
 - 14. Interior and exterior wall openings to receive metal frame system; window, door, etc.
 - 15. Access panels.
 - 16. Framed openings.
 - 17. Plumbing fixtures.
 - 18. Ceiling mounted projection screens and projector mounts.
 - 19. Wall mounted projection screens and projector mounts.
 - 20. Wall and ceiling mounted items indicated as N.I.C. and/or Owner provided and Owner installed.

3.03 ACOUSTIC ACCESSORIES INSTALLATION

- A. Sound Attenuation Batts /Acoustic Insulation: Friction fit, by placing tightly within on-center stud spacing, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.
- B. Acoustic Sealant/Sound Caulk: Install per requirements of 079005 Joint Sealers

3.04 BOARD INSTALLATION

- A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.
- B. Exterior Sheathing: Comply with ASTM C1280. Install sheathing vertically, with edges butted tight and ends occurring over firm bearing.
- C. Exterior Soffits: Install exterior soffit board perpendicular to framing, with staggered end joints over framing members or other solid backing.
- D. Glass Mat Faced Gypsum Board: Install in strict accordance with manufacturer's instructions.
- E. Installation on Metal Framing: Use screws for attachment of gypsum board except face layer of non-rated double-layer assemblies, which may be installed by means of adhesive lamination.
- F. Curved Surfaces: Apply gypsum board to curved substrates in accordance with GA-226.

3.05 INSTALLATION OF TRIM AND ACCESSORIES

- A. Control Joints: Place control joints consistent with lines of building spaces and as follows:
 - 1. Not more than 30 feet apart on walls and ceilings over 50 feet long.
 - 2. At exterior soffits, not more than 30 feet apart in both directions.
- B. Corner Beads: Install at external corners, using longest practical lengths.

3.06 LEVELS OF GYPSUM BOARD FINISH

- A. Paper Faced Gypsum Board: Use paper or fiberglass joint tape, bedded with powder-type or ready-mixed vinyl-based joint compound and finished with powder-type or ready-mixed vinyl-based joint compound.
- B. Finish gypsum board in accordance with levels defined in GA-214 and ASTM C 840, as follows:
 - 1. Level 4: Walls, ceilings and soffits to receive flat, eggshell, semi-gloss or gloss paint.
 - 2. Level 2: Behind cabinetry, FRP panels in janitorial/custodial rooms and on backing board to receive tile finish.
 - 3. Level 1: Fire rated wall and non-rated wall areas above finished ceilings, whether or not accessible in the completed construction.
- C. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
 - 1. Feather coats of joint compound so that camber is maximum 1/32 inch.
 - 2. Taping, filling, and sanding is not required at surfaces behind adhesive applied ceramic tile and fixed cabinetry.
 - 3. Taping, filling and sanding is not required at base layer of double layer applications.
- D. Fill and finish joints and corners of cementitious backing board as recommended by manufacturer.

3.07 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

END OF SECTION 092116

SECTION 093000 - TILING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. This Section includes the following:
 - 1. Porcelain tile
 - 2. Setting and grouting materials
 - 3. Transition strips
 - 4. Self-leveling system comprised of clips & wedges

1.02 RELATED REQUIREMENTS

- A. Section 012300 Alternates: Refer to section for additional information.
- B. Section 013000 Administrative Requirements Submittal procedures
- C. Section 079005 Joint Sealers: Acoustic sealant/sound caulk
- D. Section 090050 Finish Legend
- E. Section 092116 Gypsum Board Assemblies: Tile backer board

1.03 REFERENCE STANDARDS

- A. AISI SG02-1 North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute; 2001 with 2004 supplement. (replaced SG-971)
- B. ANSI A108.10 American National Standard Specifications for Installation of Grout in Tilework; 1999 (Reaffirmed 2010).
- C. ANSI A108.11 American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2010 (Reaffirmed 2016).
- D. ANSI A118.12 American National Standard Specifications for Crack Isolation Membranes for Thin-set Ceramic Tile and Dimension Stone Installation; 2014.
- E. ASTM A653/A653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2013.
- F. ASTM C754 Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2011.
- G. ASTM C840 Standard Specification for Application and Finishing of Gypsum Board; 2013.
- H. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials; 2014.
- I. ASTM E90 Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009.
- J. ASTM F1869 Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride;2011.
- K. ICC (IBC) International Building Code; 2012, with Kentucky Amendments; current edition.
- L. TCNA (HB) Handbook for Ceramic, Glass, and Stone Tile Installation; 2015.
- M. UL (FRD) Fire Resistance Directory; Underwriters Laboratories Inc.; current edition.

1.04 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

- B. Product data: Provide manufacturer's data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.
- C. Shop drawings indicating tile patterns and locations and widths of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
 - 1. Locate precisely each joint and crack in tile substrates by measuring, record measurements on shop drawings, and coordinate them with tile joint locations, in consultation with Architect.
- D. Samples for initial selection purposes in form of manufacturer's color charts consisting of actual tiles or sections of tile showing full range of colors, textures, and patterns available for each type and composition of tile indicated. Include samples of grout and accessories involving color selection.
- E. Samples for verification purposes of each item listed below, prepared on samples of size and construction indicated, products involve color and texture variations, in sets showing full range of variations expected.
 - 1. Each type and composition of tile and for each color and texture required, at least 12 inches square, mounted on plywood or hardboard backing and grouted.
 - 2. Full-size units of each type of trim and accessory for each color required.
- F. Master grade certificates for each shipment, type, and composition of tile, signed by tile manufacturer and Installer.
- G. Material test reports from qualified independent testing laboratory indicating and interpreting test results relative to compliance of tile and tile setting and grouting products with requirements indicated.
- H. Qualification data for firms and persons specified in "Quality Assurance" article to demonstrate their capabilities and experience. Include list of completed projects with project names, addresses, names of Architects and Owners, plus other information specified.
- I. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.
- J. Maintenance Materials: Furnish the following for Owner's use in maintenance of project:
 1. See Section 016000 Product Requirements, for additional information.

1.05 QUALITY ASSURANCE

- A. Single-Source Responsibility for Tile: Obtain each color, grade, finish, type, composition, and variety of tile from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.
- B. Single-Source Responsibility for Setting and Grouting Materials: Obtain ingredients of a uniform quality from one manufacturer for each cementitious and admixture component and from one source or producer for each aggregate.
- C. Installer Qualifications: Engage an experienced Installer who has successfully completed tile installations similar in material, design, and extent to that indicated for Project.
- D. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings".
- E. Maintain one copy of ANSI A108/A118/A136.1 and TCNA (HB) on site.

1.06 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 requirement of ANSI A137.1 for labeling sealed tile packages.
- B. Prevent damage or contamination to materials by water, freezing, foreign matter, and other causes.

C. Handle tile with temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If despite these precautions coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.07 PROJECT CONDITIONS

- A. Maintain environmental conditions and protect work during and after installation to comply with referenced standards and manufacturer's printed recommendations.
- B. Vent temporary heaters to exterior to prevent damage to tile work from carbon dioxide buildup.
- C. Maintain temperatures at 50 deg F (10 deg C) or more in tiled areas during installation and for 7 days after completion, unless higher temperatures are required by referenced installation standard or manufacturer's instructions.

1.08 SEQUENCING AND SCHEDULING

A. Coordinate the work with all sections referencing this section.

1.09 WARRANTY

- A. See Section 017800 Closeout Submittals, for additional warranty requirements.
- B. Correct defective work within a five year period after Date of Substantial Completion.
- C. Warranty: Include coverage for installed sealants and accessories which fail to achieve airtight seal, exhibit loss of adhesion or cohesion, or do not cure.

1.10 EXTRA MATERIALS

- A. Deliver extra materials to Owner. Furnish extra materials that match products installed as described below, packaged with protective covering for storage and identified with labels clearly describing contents.
 - 1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed, for each type, composition, color, pattern, and size.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to the following:
 - 1. Porcelain Tile:
 - a. American Olean Tile Co., Inc.
 - b. Crossville, Inc.
 - c. Dal-Tile Corp.
 - d. Mid-State Tile Co.
 - e. Monarch Tile Manufacturing, Inc.
 - f. United States Ceramic Tile Co.
 - g. Villeroy & Boch (USA) Inc.
 - h. Wenczel Tile Co.
 - i. Winburn Tile Manufacturing Co.
 - 2. Latex-Emulsion Based-Portland Cement Mortars:
 - a. Boiardi Products Corp.
 - b. Bostik Construction Products Div.
 - c. C-Cure Chemical Co.
 - d. Custom Building Products
 - e. Dal-Tile Corp.
 - f. DAP, Inc. Div.; USG Corp.
 - g. H.B. Fuller

- h. Laticrete International, Inc.
- i. L&M Mfg., Inc.
- 3. High Performance Grout:
 - TEC Power Grout 550

2.02 PRODUCTS, GENERAL

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- A. ANSI Standard for Ceramic Tile: Comply with ANSI A137.1 "American National Standard Specifications for Ceramic Tile" for types, compositions, and grades of tile indicated.
 - 1. Furnish tile complying with "Standard Grade" requirements unless otherwise indicated.
- B. ANSI Standard for Tile Installation Materials: Comply with ANSI standard referenced with products and materials indicated for setting and grouting.
- Colors, Textures, and Patterns: Where manufacturer's standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with the following requirements:

 Provide porcelain selections by interior designer.
- D. Factory Blending: For tile exhibiting color variations within the ranges selected during sample submittals, blend tile in factory and package accordingly so that tile units taken from one package show the same range in colors as those taken from other packages and match approved samples.
- E. Mounting: Where factory-mounted tile is required, provide back- or edge-mounted tile assemblies as standard with manufacturer unless another mounting method is indicated.
- F. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating them with a continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

2.03 TILE PRODUCTS

- A. Porcelain Tile: Provide tile complying with the following requirements:
 - 1. Composition: Porcelain.
 - 2. Nominal Thickness: 3/8 inch.
 - 3. Face: Plain with square edges.
 - 4. Basis of Design:
 - 5. Price Group:
- B. Trim Units: Provide tile trim units to match characteristics of adjoining flat tile and to comply with following requirements:
 - 1. Size: As indicated, coordinated with sizes and coursing of adjoining flat tile where applicable.

2.04 SETTING & GROUTING MATERIALS

- A. Portland Cement Mortar Installation Materials: Provide materials to comply with ANSI A108.1 as required for installation method designated, unless otherwise indicated.
- B. Latex-Portland Cement Mortar: Provide product complying with ANSI A108.1 and the following requirement for composition:
 - 1. Prepackaged dry mortar mix incorporating dry polymer additive in the form of a re-emulsifiable powder to which only water is added at the job site.
 - 2. Latex additive (water emulsion) of type described below, serving as a replacement for part or all of gauging water, added at job site to prepackaged dry mortar mix supplied or specified by latex manufacturer.
 - a. Latex Type: Manufacturer's standard.
- C. Grouting Materials:
 - 1. Dry Set Grout: Provide product complying with ANSI A118.6 of color indicated.

- 2. Prepackaged Dry Grout Mix incorporating dry polymer additive in the form of a re-emulsifiable powder to which only water is added at job site.
- 3. Grout Additive: Grout Boost Advanced Pro by H.B. Fuller Construction Products, Inc. Follow all manufacturer's instructions.
- 4. Latex Additive (water emulsion) serving as a replacement for part or all of gauging water, added at job site to prepackaged dry grout mix, with type of latex and dry grout mix complying with requirements indicated below:
 - a. Latex Type: Manufacturer's Standard.
 - b. Grout Type: Dry-set grout specified or supplied by latex manufacturer. Use latex additive without a retarder with dry-set grout.

c. Application: Use to grout joints in floor and wall tile unless otherwise indicated. Note: Grout joints shall be 1/8" wide and the epoxy grout shall fill the joint space and be no lower than 1/32" of an inch from the top face of the tile.

2.05 ELASTOMERIC SEALANTS

- A. General: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer indicated that comply with requirements of Division 7 Section "Joint Sealers," including ASTM C 920 as referenced by Type, Grade, Class, and Uses.
- B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints unless otherwise indicated.
- C. Multipart Pourable Urethane Sealant for Use T: Type M; Grade P; Class 25; Uses T, M, A, and as applicable to joint substrates indicated, O.
- D. Products: Subject to compliance with requirements, manufacturers offering products which may be incorporated into the Work include, but are not limited to, the following:
 - 1. Multipart Pourable Urethane Sealant:
 - a. "Chem-Calk 550"; Bostik Construction Products Div.
 - b. "Vulkem 245"; Mameco International, Inc.
 - c. "Urexpan NR-200"; Pecora Corp.
 - d. "THC-900"; Tremco Corp.

2.06 MISCELLANEOUS MATERIALS

- A. Transition Strips: Provide a metal stepless transition strip to match Schluter-Reno U or TK Series (or approved equivalent) at all exposed edges of tile installation.
- B. Outside Corner Metal Trim: Provide outside corner metal trim equivalent to Schluter Systems Rondec-AE number RO 80 AE "Satin Anodized" finish on all outside wall corners to receive tile.
- C. Self-Leveling System: Provide two-part leveling clips and wedges (1/8" or 3/16") as manufactured by one of the following:
 - 1. Raimondi Leveling Solutions
 - 2. Tuscan Leveling System
 - 3. QEP Lash System

2.07 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with requirements of referenced standards and manufacturers including those for accurate proportioning of materials, water, or additive content; type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other procedures needed to produce mortars and grouts of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates and areas 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 from oil or waxy films and curing compounds.
 - 2. 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 before installing tile.
- B. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Blending: For tile exhibiting color variations within the ranges selected during sample submittals, verify that tile has been blended in factory and packaged accordingly so that tile units taken from one package show the same range in 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.
- B. Field-Applied Temporary Protective Coating: Where indicated under tile type or needed to prevent adhesion or staining of exposed tile surfaces by grout, protect exposed surfaces of tile against adherence of mortar and grout by precoating them with a continuous film of temporary protective coating indicated below, taking care not to coat unexposed tile surfaces:
 - 1. Petroleum paraffin wax or grout release.
- C. Protect surrounding work from damage.
- D. Vacuum clean surfaces and damp clean.
- E. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.
- F. Install backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to a feather edge.
- G. Prepare substrate surfaces for adhesive installation in accordance with adhesive manufacturer's instructions.

3.03 INSTALLATION - GENERAL

- A. ANSI Tile Installation Standard: Comply with parts of ANSI 108 series of tile installation standards included under "American National Standard Specifications for the Installation of Ceramic Tile" that apply to type of setting and grouting materials and methods indicated.
- B. TCA Installation Guidelines: TCA "Handbook for Ceramic Tile Installation"; comply with TCA installation methods indicated.
- C. Extend tile work into recesses and under or behind equipment and fixtures to form a complete covering without interruptions except as otherwise shown. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- D. 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 that plates, collars, or covers overlap tile.
- E. Jointing Pattern: Unless otherwise shown, lay tile in grid pattern. Align joints when adjoining tiles on floor, base, walls, and trim are same size. Lay out tile work and center tile fields in both directions in

each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths unless otherwise shown.

- 1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so that extent of each sheet is not apparent in finished work.
- F. Expansion Joints: Locate expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated during installation of setting materials, mortar beds, and tile. Do not saw cut joints after installation of tiles.
 - 1. Locate joints in tile surfaces directly above joints in concrete substrates.
 - 2. Prepare joints and apply sealants to comply with requirements of Division 7 Section "Joint Sealers."
- G. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

3.04 INSTALLATION - WALL TILE

A. Over interior concrete and masonry install in accordance with TCNA (HB) Method W202, thin-set with dry-set or latex-Portland cement bond coat.

3.05 CLEANING AND PROTECTION

- A. Cleaning: Upon 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. Unglazed tile may be cleaned with acid solutions only when permitted by tile and grout manufacturer's printed instructions, but no sooner than 14 days after installation. Protect metal surfaces, cast iron, and vitreous plumbing fixtures from effects of acid cleaning. Flush surface with clean water before and after cleaning.
 - 3. Remove temporary protective coating by method recommended by coating manufacturer that is acceptable to brick and grout manufacturer. Trap and remove coating to prevent it from clogging drains.
- B. Finished Tile Work: Leave finished installation clean and free of cracked, chipped, broken, unbonded, and otherwise defective tile work.
- C. Provide final protection and maintain conditions in a manner acceptable to manufacturer and installer that ensures that tile is without damage or deterioration at time of Substantial Completion.
- D. When recommended by tile manufacturer, apply a protective coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.

E. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces. **END OF SECTION**

SECTION 095113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. This Section includes the following:
 - 1. Acoustical panels Type 1 (24" x 48").
 - 2. Exposed suspension system (15/16")
- B. All acoustical panel ceiling components and installation methods shall comply with seismic zone requirements of the Kentucky Building Code.
- C. Refer to the reflected ceiling plans A/A7.1 for location of existing panels and suspension system to remain.
- D. Refer to the Room Finish Schedule on Sheet A2.1 and the Ceiling Legend and Reflected Ceiling Plan on Sheet A7.0 for the locations of acoustical ceiling tile and grid types.

1.02 RELATED REQUIREMENTS

- A. Section 012300 Alternates: Refer to section for additional information.
- B. Section 090050 Finish Legend
- C. Section 265100 Interior Lighting: Light fixtures in ceiling system
- D. Section 284600 Fire Detection and Alarm: Fire alarm components in ceiling system

1.03 DEFINITIONS

- A. CAC: Ceiling Attenuation Class.
- B. LR: Light Reflectance coefficient.
- C. NRC: Noise Reduction Coefficient.

1.04 REFERENCE STANDARDS

- A. ASTM C423 Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method; 2009a.
- B. ASTM C635/C635M Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2013a.
- C. ASTM C636/C636M Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2013.
- D. ASTM E580/E580M Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2014.
- E. ASTM E795 Standard Practices for Mounting Test Specimens During Sound Absorption Tests; 2005 (Reapproved 2012).
- F. ASTM E1264 Standard Classification for Acoustical Ceiling Products; 2014.
- G. CAL (CHPS LEM) Low-Emitting Materials Product List; California Collaborative for High Performance Schools (CHPS); current edition at www.chps.net/.
- H. GEI (SCH) GREENGUARD "Children and Schools" Certified Products; GREENGUARD Environmental Institute; current listings at www.greenguard.org.
- I. NFPA 286 Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth; 2015.
- J. UL (FRD) Fire Resistance Directory; Underwriters Laboratories Inc.; current edition.
- K. UL (GGG) GREENGUARD Gold Certified Products; current listings at http://http://productguide.ulenvironment.com/QuickSearch.aspx.

1.05 SUBMITTALS

- A. See Section 013000 Administrative Requirements, for submittal procedures.
- B. Product Data: For each type of product indicated.
- C. Samples for Initial Selection: For components with factory-applied color finishes.
- D. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
 - 1. Acoustical Panel: One set of 6-inch- (150-mm-) square Samples of each type, color, pattern, and texture.
 - 2. Exposed Suspension System Members, Moldings, and Trim: One set of 12-inch- (300-mm-) long Samples of each type, finish, and color.
- E. Qualification Data: For testing agency.
- F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each acoustical panel ceiling.
- G. Research/Evaluation Reports: For each acoustical panel ceiling and components and anchor type.
- H. Maintenance Data: For finishes to include in maintenance manuals.
- I. NRC: Noise Reduction Coefficient.

1.06 QUALITY ASSURANCE

- A. Acoustical Testing Agency Qualifications: An independent testing laboratory, or an NVLAP-accredited laboratory, with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548. NVLAP-accredited laboratories must document accreditation, based on a "Certificate of Accreditation" and a "Scope of Accreditation" listing the test methods specified.
- B. Source Limitations
 - 1. Acoustical Ceiling Panel: Obtain each type through one source from a single manufacturer.
 - 2. Suspension System: Obtain each type through one source from a single manufacturer.
- C. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:
 - 1. Fire-Resistance Characteristics: Where indicated, provide acoustical panel ceilings identical to those of assemblies tested for fire resistance per ASTM E 119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
 - a. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.
 - b. Identify materials with appropriate markings of applicable testing and inspecting agency.
 - 2. Surface-Burning Characteristics: Provide acoustical panels with the following surface-burning characteristics complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84:

1.07 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.

1.08 PROJECT 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

1.09 SEQUENCING AND SCHEDULING

A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.10 WARRANTY

- A. See Section 017800 Closeout Submittals, for additional warranty requirements.
- B. Correct defective work within a five year period after Date of Substantial Completion.
- C. Warranty: Include coverage for installed sealants and accessories which fail to achieve airtight seal, exhibit loss of adhesion or cohesion, or do not cure.

1.11 EXTRA MATERIALS

- A. Furnish extra materials described below 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 equivalent to 2.0 percent of quantity installed.
 - 2. Suspension System Components: Quantity of each exposed component equivalent to 2.0 percent of quantity installed.

PART 2 - PRODUCTS

2.01 WARRANTIES

A. Panels shall not sag for 15 years. No limit to relative humidity, short of standing water and up to 120 degrees Fahrenheit.

2.02 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
 - 1. Products: Subject to compliance with requirements, provide one of the products specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.03 ACOUSTICAL PANELS, GENERAL

- A. 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 reflectance, 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 (400 mm) away from test surface per ASTM E 795.
- B. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.

1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

2.04 MINERAL-BASE ACOUSTICAL PANELS <Choose one of the following, either Type 1 or Type 2>

- A. Ceiling Type -1: (24" x 48" x 3/4").
 - 1. Products:
 - a. Armstrong's School Zone"Fine Fissured" No. 1714.
 - b. USG: "Clima Plus" High NRC No. 22441.
 - c. CertainTeed "Fine Fissured" No. HHF-197.
 - 2. Classification: Provide Class A panels complying with ASTM E 1264 for type, form, and pattern as follows:
 - a. Type and Form: Type III, Form 2.
 - b. Pattern: CE (lightly textured).
 - 3. Color: White.
 - 4. LR: Not less than 0.84.
 - 5. NRC: Not less than 0.70, U.L. classified label on each carton.
 - 6. CAC: Not less than 35, U.L. classified label on each carton.
 - 7. Edge Detail: Square.
 - 8. Antimicrobial Treatment: Coating based to inhibit mold and mildew.
 - 9. Panels shall exceed ASTM C367 ball hardness test to 210 lbs.

2.05 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.
- B. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.
 - 1. High-Humidity Finish: Comply with ASTM C 635 requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes are indicated.
- C. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated.
- D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
 - 1. Zinc-Coated Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
 - 2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- (2.69-mm-) diameter wire.
 - 3. Wire hangers shall be installed on two diagonal corners of each 2' x 4' ceiling grid opening, or equivalent. Refer to the electrical specifications for information concerning the suspension system for ceiling mounted equipment.

2.06 METAL SUSPENSION SYSTEM FOR ACOUSTICAL PANEL CEILINGS

- A. Available Products:
 - 1. Armstrong Prelude XL
 - 2. USG DX/DXL 24 Series
 - 3. Chicago Metallic CMC 1200 Series
 - 4. Gordon, Inc.
- B. Wide-Face, Capped, Double-Web, Fire-Rated Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, hot-dip galvanized according to ASTM A 653/A 653M, not less

than G30 (Z90) coating designation, with prefinished 15/16-inch- (24-mm-) 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: Cold-rolled sheet
- 5. Cap Finish: Painted white
- 6. Width: 15/16"
- 7. Corner trim: Pre-Manufactured

PART 3 - EXECUTION

3.01 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. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 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.

3.03 INSTALLATION, GENERAL

- A. General: Install acoustical panel ceilings to comply with ASTM C 636 and seismic requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
- 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 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. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
 - 4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three 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. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, post-installed mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
 - 6. Do not attach hangers to steel deck tabs.
 - 7. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 - 8. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
- C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
 - 1. Do not use exposed fasteners, including pop rivets, on moldings and trim.

- D. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- E. 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. Where the unifinished/unpainted cut edge of a tile is exposed the edge shall be repainted to achieve a "finished" appearance.
 - 1. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.

3.04 INSTALLATION - ACOUSTICAL UNITS

- A. Fit border trim neatly against abutting surfaces.
- B. Cutting Acoustical Units:
 - 1. Cut to fit irregular grid and perimeter edge trim.
 - 2. Make field cut edges of same profile as factory edges.
 - 3. Double cut and field paint exposed reveal edges.

3.05 FIELD QUALITY CONTROL

- A. Remove and replace acoustical panel ceiling hangers where test results indicate that they do not comply with specified requirements.
- B. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.06 CLEANING

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 touch up of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

SECTION 096500 - RESILIENT TILE FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. This Section includes the following:
 - 1. Vinyl composition tile (VCT)
 - 2. Rubber floor tile
 - 3. Vinyl composition tile pattern diagram. The flooring Contractor will be responsible for submitting a complete measured floor pattern diagram for all areas to receive a floor tile pattern. The diagram will locate all floor tile pattern locations for approval prior to beginning work.
- B. Floor Slab Preparation: The installer is required to prepare all areas of floor slabs by utilizing a self leveling material equivalent to Mapei M-20 with T-2 primer, Schonox XM or TEC Level Set 300, as required over the entire floor surface. Following the manufacturer's directions completely before installing tiles.

1.02 RELATED REQUIREMENTS

- A. Section 012300 Alternates: Refer to section for additional information.
- B. Section 013000 Administrative Requirements: Submittal procedures.
- C. Section 090050 Finish Legend.
- D. Division 9 Section "Resilient Wall Base and Accessories" for resilient wall base, reducer strips and other accessories installed with resilient floor tile.

1.03 REFERENCE STANDARDS

- A. AISI SG02-1 North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute; 2001 with 2004 supplement. (replaced SG-971)
- B. ASTM A653/A653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2013.
- C. ASTM C645 Standard Specification for Nonstructural Steel Framing Members; 2014.
- D. ASTM C665 Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2012.
- E. ASTM C754 Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2011.
- F. ASTM C1002 Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2014.
- G. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials; 2014.
- H. ASTM E90 Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009.
- I. UL (FRD) Fire Resistance Directory; Underwriters Laboratories Inc.; current edition.

1.04 SUBMITTALS

- A. Product data for each type of product specified.
- B. Samples for Initial Selection: For each type of resilient floor tile indicated.
- C. Samples for Verification: Full-size units of each color and pattern of resilient floor tile required.

D. Maintenance Data: For resilient products to include in maintenance manuals.

1.05 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide products identical to those tested for fire-exposure behavior per test method indicated by a testing and inspecting agency acceptable to authorities having jurisdiction.

1.06 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 (10 deg C) or more than 90 deg F (32 deg C). Store tiles on flat surfaces.

1.07 PROJECT CONDITIONS

- A. Substrate Conditions: Use the method described below to determine the dryness as required to ensure initial and long-term success.
 - 1. ASTM F 2170 Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs using In Situ Probes.
 - a. Three tests should be conducted for areas up to 1,000 square feet and one additional test should be conducted for each additional 1,000 square feet of flooring.
 - b. Results must not exceed 75% when tested to ASTM F 2170. A diagram of the area showing the location and results of each test shall be submitted to the Interior Designer/Architect. If the test results exceed the limitations, the installer must not proceed until the problem has been corrected.
- B. The flooring contractor shall verify in writing to the owner, a minimum of thirty (30) days prior to scheduled resilient flooring installation, the following substrate conditions:
 - 1. Moisture: Initial emission rate, as tested with a calcium chloride test kit, per ASTM F 1869-89 requirements.
 - 2. Alkalinity: Maximum pH of 9.
- C. Maintain temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive floor tile during the following time periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- D. After post-installation period, maintain temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).
- E. Close spaces to traffic during floor covering installation.
- F. Close spaces to traffic for 48 hours after floor covering installation.
- G. Install resilient products after other finishing operations, including painting, have been completed.

1.08 SEQUENCING AND SCHEDULING

A. Coordinate the work with all sections referencing this section.

1.09 WARRANTY

- A. See Section 017800 Closeout Submittals, for additional warranty requirements.
- B. Correct defective work within a five year period after Date of Substantial Completion.
- C. Warranty: Include coverage for installed sealants and accessories which fail to achieve airtight seal, exhibit loss of adhesion or cohesion, or do not cure.

1.10 EXTRA MATERIALS

- A. Furnish extra materials described below 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.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Armstrong World Industries
 - 2. Azrock
 - 3. Congoleum
 - 4. Flexco
 - 5. Johnsonite/Tarkett
 - 6. Nora/Interface
- B. Available Manufacturers: Other manufacturers proposed which meet the specific standards specified shall submit actual samples and specifications for review to the Designer/Architect not less than seven (7) days before the bid date.

2.02 COLORS AND PATTERNS

A. Colors and Patterns: As selected by Interior Designer from manufacturer's full range.

2.03 VINYL COMPOSITION TILE

A. Products: Subject to compliance with requirements, provide one of the following Basis of Design selections:

2.04 VINYL COMPOSITION TILE ADDITIONAL REQUIREMENTS

- A. Wearing Surface: Smooth
- B. Thickness: 1/8"
- C. Size: 12" by 12" (305 by 305 mm)
- D. Fire-Test-Response Characteristics:
 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm per ASTM E 648

2.05 RUBBER FLOOR TILE PRODUCT DATA SHEET

A. Products: Subject to compliance with requirements, provide one of the following Basis of Design selections: Johnsonite, to match existing.

2.06 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 manufacturer to suit resilient products and substrate conditions indicated.
- C. Feature Strip: Install 1" wide vinyl composition tile feature strip at all door ways, that divide two areas/rooms to receive resilient floor tile centered under door. Install 1" wide vinyl composition tile feature strips at floor tile pattern areas in longest lengths available from the manufacturer. Refer to the floor plans for locations. Material(s) for feature strips may be selected from 12" x 12" vinyl composition floor tile.

PART 3 EXECUTION

3.01 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. The flooring Contractor shall prepare floor slabs to receive new floor covering to prevent telegraphing of irregular slab conditions per the floor covering manufacturer's recommendations.
 - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of resilient products.
- B. Concrete Substrates: Prepare according to ASTM E 710.
 - 1. Where irregular slab conditions occur, utilize POZ patch self leveling material as required (or approved equivalent) to return the slab to a smooth, level surface.
 - 2. Verify that substrates are dry and free of curing compounds, sealers and hardeners.
- C. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
- D. Use trowelable leveling and patching compound to fill cracks, holes and depressions in substrates. Prepare all slabs to receive new floor covering to prevent telegraphing of irregular slab conditions per the floor covering manufacturer's recommendations.
- E. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
 - 1. Do not install resilient products until they are same temperature as space where they are to be installed.
- F. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation and dust. Proceed with installation only after unsatisfactory conditions have been corrected.
- G. Where any concrete slab expansion material has been utilized adjacent to walls, columns, etc. and the thickness exceeds 1/4" out from the vertical surface. The flooring installer shall remove the expansion material and clean out the void in the floor surface. The installer shall then place a 1/4" thick removable spacer along the vertical surface and fill the remaining void with POZ self-leveling material (or approved equivalent). After the leveling material has cured, remove the 1/4" spacer and install tile per manufacturer's recommendations.

3.03 TILE INSTALLATION

- A. Lay out 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 at perimeter.
- B. Match tiles for color and pattern by selecting tiles from cartons in same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
 1. Lay tiles square with room axis unless otherwise indicated.
- C. Scribe, cut, and fit tiles to butt tightly to vertical surfaces, permanent fixtures, including pipes, outlets, edgings, door frames, thresholds and nosings. Ties shall be installed under cabinets and casework.

- D. Extend tiles into toe spaces, door reveals, closets, and similar openings.
- E. Maintain reference markers, holes, or openings that are in place or plainly marked for future cutting by repeating on finish flooring as marked on subfloor. Use chalk or other nonpermanent marking device.
- F. Install tiles on covers for telephone and electrical ducts, and similar items in finished floor areas. Maintain overall continuity of color and pattern with pieces of flooring installed on these covers. Tightly adhere tile edges to substrates that abut covers and to cover perimeters..
- G. Adhere tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, and puckering at joints. Telegraphing of adhesive spreader marks and other surface imperfections.
- H. Maintain tile coursing, ensure that all tile coursing runs true and even, at no time shall coursing be allowed to "grow" or "shrink" causing uneven joints. Notify Designer/Architect of problems with the tile sizes.
- I. Where floor tile borders/patterns occur, the center "field" tiles shall be full size tiles and the border tiles along the wall shall be cut to center the field tiles.
- J. Provide color matching caulk at the intersection of hollow metal frames and resilient flooring.

3.04 SEQUENCING AND SCHEDULING

- A. Install tiles and accessories per the work schedule set by the General Contractor.
- B. Do not install tiles over concrete slabs or areas of patching until all areas are sufficiently dry to bond with adhesive as determined by tile manufacturer's recommended bond and moisture test.

3.05 CLEANING AND PROTECTION

- A. Perform the following operations immediately after completing resilient product 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.
 - a. Do not wash surfaces until after time period recommended by manufacturer.
- B. Protect resilient flooring against mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods indicated or recommended by tile manufacturer.
 - 1. Apply protective floor polish to horizontal surfaces that are free from soil, visible adhesive, and surface blemishes if recommended in writing by manufacturer.
 - a. Coordinate selection of floor polish with Owner's maintenance service.
 - b. Provide two coats of floor polish.
 - 2. Cover products installed on horizontal surfaces with undyed, untreated building paper until Substantial Completion.
 - 3. Do not move heavy and sharp objects directly over surfaces. Place hard board or plywood panels over flooring and under objects while they are being moved. Slide or roll objects over panels without moving panels.

END OF SECTION

SECTION 096513 - RESILIENT WALL BASE AND ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

1.

- A. This Section includes the following:
 - 1. Resilient wall base rolls only. Refer to the drawings and the room finish schedule for additional information.
 - 2. Resilient flooring accessories
 - 3. Resilient stair accessories NOTE: The landing and second floor level shall receive a resilient stair tread as a visually impaired warning.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - Section 090050 Finish Legend
 - 2. Section 096502 Resilient Tile Flooring

1.02 RELATED REQUIREMENTS

A. Section 013000 - Administrative Requirements - Submittal procedures

1.03 REFERENCE STANDARDS

- A. AISI SG02-1 North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute; 2001 with 2004 supplement (replaced SG-971)
- B. ASTM A653/A653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2013
- C. ASTM C645 Standard Specification for Nonstructural Steel Framing Members; 2014
- D. ASTM C665 Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2012
- E. ASTM C754 Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2011
- F. ASTM C1002 Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2014
- G. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials; 2014
- H. ASTM E90 Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009
- I. UL (FRD) Fire Resistance Directory; Underwriters Laboratories Inc.; current edition

1.04 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections:
 - 1. Product data for each type of product specified
 - 2. Samples for initial selection purposes of manufacturer's standard sample sets in form of pieces cut from each type of product specified showing full range of colors and patterns available

1.05 QUALITY ASSURANCE

A. Single-Source Responsibility for Products: Obtain each type and color of product specified from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.

- B. Fire Performance Characteristics: Provide products with the following fire performance characteristics as determined by testing products per ASTM test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
- C. Critical Radiant Flux: 0.45 watts per sq. cm or more per ASTM E 648.
- D. Smoke Density: Less than 450 per ASTM E 662.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to Project site in original manufacturer's unopened cartons and containers, each bearing names of product and manufacturer, Project identification, and shipping and handling instructions.
- B. Store products in dry spaces protected from the weather with ambient temperatures maintained between 50 deg F (10 deg C) and 90 deg F (32 deg C).
- C. Move products into spaces where they will be installed at least 48 hours in advance of installation.

1.07 PROJECT CONDITIONS

- A. Maintain a minimum temperature of 70 deg F (21 deg C) in spaces to receive products specified in this Section for at least 48 hours prior to installation, during installation, and for not less than 48 hours after installation. After this period, maintain a temperature of not less than 55 deg F (13 deg C).
- B. Do not install products until they are at the same temperature as that of the space where they are to be installed.
- C. Close spaces to traffic during installation of products specified in this Section.

1.08 SEQUENCING AND SCHEDULING

A. Sequence installing products specified in this Section with other construction to minimize possibility of damage and soiling during remainder of construction period.

1.09 EXTRA MATERIALS

- A. Deliver extra materials to Owner. Furnish extra materials matching products installed as described below, packaged with protective covering for storage, and identified with labels clearly describing contents.
 - 1. Furnish not less than 10 linear feet for each 500 linear feet or fraction thereof of each different type and color of resilient wall base installed, on a continuous roll. One roll per color.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products specified in each Product Data Sheet at end of this Section.

2.02 RESILIENT WALL BASE

A. Vinyl Wall Base: Products complying with FS SS-W-40, Type I, and requirements specified in the Rubber Wall Base Product Data Sheet at end of this Section.

2.03 RESILIENT ACCESSORIES

A. Vinyl Accessories: Products complying with requirements specified in Vinyl Accessory Product Data Sheet at end of this Section.

2.04 INSTALLATION ACCESSORIES

- A. Concrete Slab Primer: Nonstaining type as recommended by flooring manufacturer.
- B. Trowelable Underlayments and Patching Compounds: Latex-modified, portland- cement-based formulation provided or approved by flooring manufacturer for applications indicated.
- C. Adhesives: Water-resistant type recommended by manufacturer to suit resilient flooring product and substrate conditions indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine areas where installation of products specified in this Section will occur, with Installer present, to verify that substrates and conditions are satisfactory for installation and comply with manufacturer's requirements and those specified in this Section.

3.02 PREPARATION

- A. General: Comply with manufacturer's installation specifications for preparing substrates indicated to receive products indicated.
- B. Use trowelable leveling and patching compounds per manufacturers directions to fill cracks, holes, and depressions in substrates.
- C. Remove coatings, including curing compounds, and other substances that are incompatible with flooring adhesives and that contain soap, wax, oil, or silicone, by using a terrazzo or concrete grinder, a drum sander, or a polishing machine equipped with a heavy-duty wire brush.
- D. Broom and vacuum clean substrates to be covered immediately before installing products specified in this Section. Following cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust.
- E. Apply concrete slab primer, if recommended by flooring manufacturer, prior to applying adhesive. Apply according to manufacturer's directions.

3.03 INSTALLATION

- A. General: Install products specified in this Section using methods indicated according to manufacturer's installation directions.
- B. All work required to put the wall and floor surface into acceptable condition to receive the specified products shall be the full responsibility of the installer. All surfaces shall be prepared to prevent the telegraphing of irregular substrate conditions onto/through the surface of the new wall base or other accessories.
- C. Apply resilient wall base to walls, columns, pilasters, casework, and other permanent fixtures in rooms and areas where base is required. Install wall base in lengths as long as practicable. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
 - 1. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient wall base with manufacturer's recommended adhesive filler material.
 - 2. Install inside and exterior corners before installing straight pieces.
 - 3. Form inside corners on job from straight pieces of maximum lengths possible by cutting an inverted V-shaped notch in toe of wall base at the point where corner is formed. Shave back of base where necessary to produce snug fit to substrate.
 - 4. Form outside corners on job from straight pieces of maximum lengths possible by shaving back of base at point where bending will occur. Remove a strip perpendicular to length of base and only deep enough to produce a snug fit without bends whitening or removal of more than half the thickness of wall base.

- 5. Form radius corners for bullnose CMU as follows: The installer shall use a section of 2" diameter plastic pipe to aid in altering the shape of the wall base profile to ease the installation of the material. Simply drape the wall base profile over the pipe with the toe of the wall base facing up. Heat the wall base along the radius of the pipe with a hot air gun or torch until pliable. While holding the wall base section firmly in contact with the pipe, quench the heated wall base area with a water dampened cloth until the wall base is cool. (This process only takes a few seconds to perform). The wall base will maintain the shape of the pipe when removed. Cut the wall base to the desired length of the return and install with cove base adhesive. Use contact bond adhesive for extremely short returns. Roll with a 2" hand roller to ensure proper adhesion.
- D. Place resilient accessories so they are butted to adjacent materials of type indicated and bond to substrates with adhesive. Install reducer strips at edges of flooring that otherwise would be exposed.
- E. Fill all rubber stair tread nosings with epoxy approved by the stair tread manufacturer to prevent any flexing of the tread's nosing. Provide cove stick flash base at all one piece tread riser locations.

3.04 CLEANING AND PROTECTION

- A. Perform the following operations immediately after completing installation:
 - 1. Remove visible adhesive and other surface blemishes using cleaner recommended by manufacturers of resilient product involved.
 - 2. Sweep or vacuum floor thoroughly.
 - 3. Do not wash until after time period recommended by manufacturer.
 - 4. Damp-mop resilient accessories to remove black marks and soil.
- B. Protect wall base against mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods indicated or recommended by manufacturer of resilient product involved.
- C. Clean products specified in this Section not more than 4 days prior to dates scheduled for inspections intended to establish date of Substantial Completion in each area of Project. Clean products using method recommended by manufacturer.

3.05 VINYL WALL BASE PRODUCT DATA SHEET

Vinyl Wall Base Designation: VWB-1

Style: Cove with top-set toe

Minimum Nominal Thickness: 1/8"

Height: 4"

Lengths: Coils in lengths standard with manufacturer, but not less than 100 feet

Exterior Corners: Pre-molded or formed on job

Interior Corners: Pre-molded or formed on job

Ends: Pre-molded

Color and Pattern: As selected by Architect/Designer from manufacturer's full range of colors and patterns produced for vinyl wall base complying with requirements indicated.

Available Products:

- 1. Roppe Corporation
- 2. Flexco Div., Textile Rubber Co.
- 3. Johnsonite

3.06 VINYL ACCESSORY PRODUCT DATA SHEET

Vinyl Accessory Designation: Resilient Edge Strips

Profile and Dimensions: 1/8" thick, homogeneous rubber composition, tapered or bullnose edge.

Color: As selected by Architect/Designer from manufacturer's full range of colors produced for rubber accessories complying with requirements indicated.

3.07 RUBBER STAIR ACCESSORY DATA SHEET

Rubber Accessory Designation: Stair Treads and Risers

Surface Texture:

Nosing Style: Square. The leading 2 inches (51mm) of the tread shall have visual contrast of dark-on-light or light-on-dark from the remainder of the tread. Inserts shall be vinyl, abrasive inserts are not acceptable.

Nosing Height: As indicated

Thickness: 3/16 inch tapering to 1/8 inch at back edge

Size: Lengths and depths to fit each stair tread and riser in one piece

Rubber Treads and Risers: As selected by Designer from manufacturer's full range of colors and patterns produced for rubber stair accessories complying with requirements indicated.

Available Products:

- 1. Flexco Div., Textile Rubber Co.
- 2. Johnsonite
- 3. Roppe Corporation

END OF SECTION

SECTION 099000 - PAINTING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Special Conditions and Division 1 Specification Sections, apply to this Section.

1.02 RELATED REQUIREMENTS

- A. Section 015721 Indoor Air Quality Management
- B. Section 055000 Metal Fabrications: Shop-primed items
- C. Section 055100 Metal Stairs: Shop-primed items
- D. Section 090050 Finish Legend
- E. Section 101100 Visual Display Surfaces

1.03 REFERENCE STANDARDS

- A. 40 CFR 59, Subpart D National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency
- B. ASTM D 16 Standard Terminology for Paint, Related Coatings, Materials, and Applications
- C. ASTM D 4442 Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials
- D. GreenSeal GS-11 Paints

1.04 SUMMARY

- A. This Section includes surface preparation and field painting of exposed exterior and interior items and surfaces including field-applied dry-erase coatings and surface preparation and [Delete if not required] primer.
 - 1. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.
- B. VOC data: Submit Green Seal GS-11 and/or GC-03 compliance documents and description of the basis for compliance.
- C. Submit environmental data in accordance with Table 1 of ASTM E2129 for products provided under work of this Section.
- D. Paint exposed surfaces, except where these Specifications indicate that the surface or material is not to be painted or is to remain natural. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces. If a color of finish is not indicated, Architect will select from standard colors and finishes available.
 - 1. Painting includes field painting of exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron supports, and surfaces of mechanical and electrical equipment that do not have a factory-applied final finish.
 - 2. All exposed to view (from the ground) flashing are to be furnished prefinished where available. If items are not available prefinished, they are to be painted. Coordinate with Contractor on these items.
 - 3. Exposed copper piping shall receive a painting system.
 - 4. It shall be the full responsibility of the painter to verify all paint, types to determine if paint(s) system specified are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by painter/manufacturer based on testing and field experience. All existing painted

surfaces shall be tested to ensure product compatibility and to ensure that the paint bond will not fail.

- 5. Painting shall include field painting pre-finished grilles, registers and diffusers located on gypsum board ceilings and soffits, which are to receive an accent paint color.
- 6. Painting shall include field painting of clips, wires, etc. used to suspend acoustical ceiling components, which are exposed after construction is complete.
- 7. Painting shall include field painting exposed unfinished countertop and shelving brackets.
 - Exterior items to receive a painting system include but are not limited to the following: a. Lintels
- E. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
 - 1. Prefinished items include the following factory-finished components:
 - a. Architectural woodwork
 - b. Elevator equipment
 - c. Finished mechanical and electrical equipment
 - d. Light fixtures
 - Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:
 - a. Furred areas
 - b. Ceiling plenums
 - c. Pipe spaces
 - d. Duct shafts
 - 3. Finished metal surfaces include the following:
 - a. Anodized aluminum
 - b. Stainless steel
 - c. Chromium plate
 - d. Bronze and brass
 - Operating parts include moving parts of operating equipment and the following:
 - a. Valve and damper operators
 - b. Linkages
 - c. Sensing devices
 - d. Motor and fan shafts
 - 5. Labels: Do not paint over UL, FMG, or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.
- F. Related Sections include the following:
 - 1. Division 5 Section "Structural Steel" for shop priming structural steel
 - 2. Division 5 Section "Metal Fabrications" for shop priming ferrous metal
 - 3. Division 8 Section "Steel Doors and Frames" for factory priming steel doors and frames
 - 4. Division 9 Section "Gypsum Drywall" for surface preparation of gypsum board

1.05 **DEFINITIONS**

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- A. General: Standard coating terms defined in ASTM D 16 apply to this Section.
 - 1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
 - 2. Eggshell refers to low-sheen finish with a gloss range between 20 and 35 when measured at a 60-degree meter.
 - 3. Semigloss refers to medium-sheen finish with a gloss range between 35 and 70 when measured at a 60-degree meter.
 - 4. Full gloss refers to high-sheen finish with a gloss range more than 70 when measured at a 60-degree meter.

1.06 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

- B. Certification: By manufacturer that all paints and coatings do not contain any of the prohibited chemicals specified; GreenSeal GS-11 certification is not required but if provided shall constitute acceptable certification.
- C. Manufacturer's Instructions: Indicate special surface preparation procedures.
- D. Maintenance Data: Submit data on cleaning, touch-up, and repair of painted and coated surfaces.
- E. VOC Content: Determine VOC (Volatile Organic Compound) content of solvent borne and waterborne paints and related coatings in accordance with EPA Method 24 or ASTM D3960.
- F. Product Data: For each paint system indicated. Include primers.
 - 1. When proposing another manufacturers product other than product specified, a complete cross-reference list must be included with the submittal. Shop drawings will be automatically returned if the list is not included.
 - 2. Material List: An inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
 - 3. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.
- G. Samples for Initial Selection: For each type of finish-coat material indicated.
 - 1. After color selection, Architect will furnish color chips for surfaces to be coated.
 - 2. The painter is required to submit drawdowns of each paint color for review of color and sheen match.

1.07 QUALITY ASSURANCE

- A. Applicator Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.
- B. Source Limitations: Obtain primers for each coating system from the same manufacturer as the finish coats.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label and the following information:
 - 1. Product name or title of material
 - 2. Product description (generic classification or binder type)
 - 3. Manufacturer's stock number and date of manufacture
 - 4. Contents by volume, for pigment and vehicle constituents
 - 5. Thinning instructions
 - 6. Application instructions
 - 7. Color name and number
 - 8. VOC content
- B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7 deg C). Maintain storage containers in a clean condition, free of foreign materials and residue.
 - 1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily.

1.09 PROJECT CONDITIONS

A. Apply waterborne paints only when temperatures of surfaces to be painted and surrounding air are between 50 and 90 deg F (10 and 32 deg C).

- B. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.
 - 1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.
- C. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- D. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

1.10 EXTRA MATERIALS

- A. See Section 016000 Product Requirements, for additional provisions.
- B. Supply 1 gallon of each color; store where directed.
- C. Label each container with color in addition to the manufacturer's label.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.
- B. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles or approved equivalent as manufactured by one of the following manufacturers.
- C. Paint Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
 - 1. ICI Paints & Devoe High Performance Coatings (ICI)
 - 2. Sherwin-Williams Co. (Sherwin-Williams)
 - 3. Coronado Paint Company (Coronado)
 - 4. PPG Paints, Inc. (Pittsburgh & Porter Paints)
 - 5. Farrell Calhoun Paint
- D. Recycled Content: Minimum (20) (xxxx) percent post-consumer recycled content for light colors; minimum (50) (xxxx) percent post-consumer recycled content for dark colors.
- E. Toxicity/IEQ: Comply with applicable regulations regarding toxic and hazardous materials, and as specified. Paints and coatings must meet or exceed the VOC and chemical component limits of Green Seal requirements.
 - 1. Interior paint: Comply with GS-11
 - 2. Exterior paint: Comply with GS-11

2.02 PAINT MATERIALS, GENERAL

- A. Material Compatibility: Provide primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
- B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying manufacturer's product identification will not be acceptable.
 - 1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.

2.03 PAINTS AND COATINGS - GENERAL

- A. Toxicity/IEQ: Comply with applicable regulations regarding toxic and hazardous materials, and as specified. Paints and coatings applied on site shall comply with the following VOC content limits:
 1. Interior paint: Comply with GS-11
 - 2. Exterior paint: Comply with GS-11
 - 3. Flat: 50 g/L
 - 4. Non-flat: 150 g/L
- B. Paints and Coatings: Ready mixed, unless intended to be a field-catalyzed coating.
 - 1. Provide paints and coatings of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 - 2. Supply each coating material in quantity required to complete entire project's work from a single production run.
 - 3. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.
- C. Primers: Where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.
- D. Chemical Content: The following compounds are prohibited:
 - 1. Aromatic Compounds: In excess of 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings)
 - 2. Acrolein, acrylonitrile, antimony, benzene, butyl benzyl phthalate, cadmium, di (2-ethylhexyl) phthalate, di-n-butyl phthalate, di-n-octyl phthalate, 1,2-dichlorobenzene, diethyl phthalate, dimethyl phthalate, ethylbenzene, formaldehyde, hexavalent chromium, isophorone, lead, mercury, methyl ethyl ketone, methyl isobutyl ketone, methylene chloride, naphthalene, toluene (methylbenzene), 1,1,1-trichloroethane, vinyl chloride

2.04 PAINT SYSTEMS - EXTERIOR

- A. Exterior Primers:
 - 1. Exterior Concrete and Masonry Primer: Factory formulated alkali resistant acrylic latex primer for exterior application
 - a. Sherwin-Williams Loxon Concrete & Masonry Primer A24W8300 VOC 99 g/l 3.2 mils. DFT
 - b. Glidden Professional Condition A24W100: Applied at a dry film thickness of not less than 1.6 mils (0.041 mm)
 - c. PPG Industries Perma-Crete Int/Ext Alkalie Resistant Primer 4-603VOC< 100 g/l
 - d. Benjamin Moore & Co. Products
 - 1) Concrete and Masonry, N068 Super Spec Masonry High Build Primer
 - 2. Exterior Ferrous Metal Primer: Factory formulated rust inhibitive metal primer for exterior application.
 - a. Sherwin-Williams Pro-Industrial Pro-Cryl Universal acrylic primer B66-310 series VOC less than 100 g/l 2.0-4.0 mils. DFT
 - b. Glidden Professional DTM P/F B66W1 applied at a dry film thickness of not less than 2.0 mils (0.051 mm)
 - c. PPG Industries Pitt-Tech Plus Int/Ext DTM Industrial Primer 90-912 series VOC <100 g/l
 - d. Benjamin Moore & Co. Products
 - 1) Ferrous Metal, P06 Alkyd Metal Primer
 - 3. Exterior Galvanized Metal Primer: Factory formulated galvanized metal primer for exterior application.
 - a. Sherwin-Williams Pro-Industrial Pro-Cryl Universal acrylic Primer B66-310 series VOC less than 100 g/l 2.0-4.0 mils DFT

- b. Glidden Professional; 4020 Devflex; DTM Flat Interior/Exterior Waterborne Primer and Finish applied at a dry film thickness of not less than 2.0 mils (0.051 mm)
- c. PPG Industries Pitt-Tech Plus Int/Ext DTM Industrial Primer 90-912 series VOC <100 g/l
- d. Benjamin Moore & Co. Products
 - 1) Galvanized Metal, P04 Acrylic Metal Primer
- B. Exterior Finish Coats:
 - 1. Exterior Semigloss Acrylic Enamel: Factory formulated semigloss waterborne acrylic_latex enamel for exterior application.
 - a. Sherwin-Williams Exterior Super Paint Latex Satin A89 Series VOC 114 g/l 1.44 mils DFT
 - b. Glidden Professional Exterior Latex Gloss A8W151 100 percent acrylic semi-gloss finish applied at a dry film thickness of not less than 1.3 mils (0.033 mm)
 - c. PPG Industries Speedhide Exterior 100% Acrylic Semi-Gloss 6-900XI series VOC < 50 g/l
 - d. Exterior Semigloss Acrylic Semigloss, N449 Ultra Spec Exterior Gloss Finish
 - e. Benjamin Moore & Co. Products
 - 1) Exterior Semigloss Acrylic Semigloss, N449 Ultra Spec Exterior Gloss Finish
- C. Exterior Finish Coats Metal: Factory formulated water based alkyd urethane enamel:
 - 1. Sherwin Williams; Pro-Industrial, number B53-1050 series, gloss (B53-1150 semi-gloss, B53-1250 low sheen) VOC 50 g/l <0.42 lb/gal, wet mils 4.0 5.0, dry mils 1.4 1.7
 - 2. PPG Industries 1506-0110 Lifemaster Oil Interior/Exterior semi-gloss
- D. Exterior Finish Coats Wood: Factory formulating latex semi-gloss for exterior application:
 - 1. Glidden Professional; Fortis 350, number 2406-XXX V series VOC 50 g/1 4.0-4.6 mils wet 1.4-1.6 mils dry
 - 2. Sherwin-Williams A-100 Exterior Latex [Select flat, satin, low sheen, or gloss]

2.05 PAINT SYSTEMS - INTERIOR

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- A. Interior Primers:
 - 1. Interior Concrete Primer: Factory formulated alkali resistant acrylic latex interior primer for interior application
 - a. Sherwin-Williams PrepRite Block Filler B25W25 VOC 42 g/l 8.0 mils. DFT
 - b. Glidden Professional GP 3010
 - c. PPG Industries Speedhide Int/Ext Hi Fill Block Filler 6-15 VOC < 50 g/l
 - d. Benjamin Moore & Co. Products
 - 1) Interior Concrete Primer, N068 Super Spec Masonry High Build Primer
 - 2. Interior Gypsum Board Primer: Factory formulated latex based primer for interior application
 - a. Sherwin-Williams Promar 200 Zero VOC Latex Primer B28W2600 VOC 2 G/L 1.5 DFT
 - b. Glidden Professional GP 1000
 - PPG Industries Speedhide Zero Latex Primer 6-4900 Zero VOC
 - d. Benjamin Moore & Co. Products
 - 1) Interior Gypsum Board Primer, N534 Ultra Spec 500 Interior Primer
 - 3. Interior Wood Primer for acrylic enamel and semigloss alkyd enamel finishes: Factory formulated alkyd or acrylic latex based interior wood primer
 - a. Sherwin-Williams Multi-Purpose Latex Primer B51W8020 VOC 96 G/L 1.4 mils DFT
 - b. Glidden Professional Multi-Purpose Latex Primer B51W8020
 - c. PPG Industries Seal-Grip Int/Ext Universal Acrylic Primer 17-921 VOC > 100 g/l
 - d. Benjamin Moore & Co. Products
 - 1) Interior Wood Primer, 023 Fresh Start All Purpose Primer

- 4. Interior Ferrous Metal Primer: Factory formulated quick drying rust inhibitive alkyd based metal primer
 - a. Sherwin-Williams Pro-Industrial Pro-Cryl Universal acrylic Primer B66-310 series VOC 110 g/l 2.0-4.0 mils DFT
 - b. Glidden Professional 4020 DTM P/F
 - c. PPG Industries Pitt-Tech Plus Int/Ext DTM Industrial Primer 90-912 series VOC < 100 g/l
 - d. Benjamin Moore & Co. Products
 - 1) Interior Ferrous Metal Primer, P06 Alkyd Metal Primer
- 5. Interior zinc-coated metal primer: Factory formulated galvanized metal primer
 - a. Sherwin-Williams Pro-Cryl Universal Water Based Primer B66-310 Series VOC 110 g/l 2.0-4.0 mils DFT
 - b. Glidden Professional; 4020 Devflex DTM Flat Interior/Exterior Waterborne Primer and Finish applied at a dry film thickness of not less than 2.0 mils (0.051 mm)
 - c. PPG Industries Pitt-Tech Plus Int/Ext DTM Industrial Primer 90-912 series VOC < 100 g/l
 - d. Benjamin Moore & Co. Products
 - 1) Interior Zinc-Coated Metal Primer, P04 Acrylic Metal Primer
- B. Interior Finish Coats:

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- Interior Finish Coats Metal: Factory formulated water based alkyd urethane enamel:
 - a. Sherwin Williams; Pro-Industrial, number B53-1050 series, gloss (B53-1150 semi-gloss, B53-1250 low sheen) VOC 50 g/l <0.42 lb/gal, wet mils 4.0 5.0, dry mils 1.4 1.7
 - b. Benjamin Moore & Co. 79301 Advance waterborne interior alkyd semi-gloss
 - c. PPG Industries 1506-0110 Lifemaster Oil interior/exterior semi-gloss
- 2. Interior Flat Acrylic Paint: Factory formulated flat acrylic emulsion latex paint for interior application
 - a. Sherwin-Williams Promar 200 Zero VOC Interior Latex Flat B30W2651 VOC 2 G/L 1.6 DFT
 - b. Glidden Professional 1210-XXXX Ultra-Hide Flat
 - c. PPG Industries Speedhide Zero Interior Latex Flat 6-4110 series Zero VOC
 - d. Benjamin Moore & Co. Products
 - 1) Interior Flat Acrylic, N536 Ultra Spec 500 Interior Flat
- 3. Interior Semigloss Acrylic Enamel: Factory formulated semigloss acrylic latex enamel for interior application
 - a. Sherwin-Williams Promar 200 Zero VOC Interior Latex Semi-gloss B31W2600 Series 0 g/l 1.6 mils DFT. If using above product for trim areas, this is the more durable product.
 - b. Glidden Professional; 1416-XXXX Ultra Hide Latex Semi-gloss Interior Wall and Trim Enamel applied at a dry film thickness of not less than 1.5 mils (0.038 mm)
 - c. PPG Industries Speedhide Zero Interior Latex Semi-Gloss 6-4510 series Zero VOC
 - d. Benjamin Moore & Co. Products
 - 1) Interior Semigloss Acrylic Enamel, N539 Ultra Spec 500 Interior Semigloss
- 4. Interior Exposed Metal Decking and Bar Joists:
 - a. Glidden Spraymaster Alkyd Flat Dry Fall 1380-1200 with subsequent coats only as required for complete, proper and full coverage
 - b. PPG Industries Speedhide Super Tech WB Interior Dry-Fog 6-725XI, VOC < 100 g/l
 - c. Sherwin Williams Pro Industrial Waterborne Acrylic Dryfall Flat, White B42W181 with subsequent coats only as required for complete, proper and full coverage
 - d. Benjamin Moore & Co. Products

- 1) Interior Expose Decking and Bar Joists, N110 Super Kote 5000 Dry Fall Latex Flat
- C. All walls, Gypsum board ceilings, metal deck, structural elements, conduit, all unfinished surfaces exposed after construction is complete shall receive a paint system unless noted otherwise.
- D. All unfinished exterior surfaces including concrete block, steel lintels, etc. will receive a paint system. Refer to the specifications for additional information.

2.06 ACCESSORY MATERIALS

- A. Accessory Materials: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required to achieve the finishes specified whether specifically indicated or not; commercial quality.
- B. Patching Material: Latex filler
- C. Fastener Head Cover Material: Latex filler

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Test existing finishes for lead before sanding, scraping, or removing. If lead is present, conform to procedures applicable when hazardous or contaminated materials are discovered.
- B. Substrate: Install formaldehyde-free MDF, particle board, or straw particle board.
- C. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for paint application. Comply with procedures specified in PDCA P4.
 - 1. Proceed with paint application only after unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
 - 2. Start of painting will be construed as Applicator's acceptance of surfaces and conditions within a particular area.
- D. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
 - 1. Notify Architect about anticipated problems when using the materials specified over substrates primed by others.
- E. Indoor Air Quality: Provide temporary ventilation during work of this section.
- F. Waste Management: As specified in Section 01351 Waste Management and as follows:
 - 1. Coordinate with manufacturer for take-back program. Set aside scrap to be returned to manufacturer for recycling into new product. Close and seal all partially used containers of paint to maintain quality as necessary for reuse.

3.02 PREPARATION

- A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.
- B. Cleaning: Before applying paint or other surface treatments, clean substrates of substances that could impair bond of the various coatings. Remove oil and grease before cleaning.
 - 1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

- 2. **Required Surface Preparation:**
 - a. Step 1 Dust wall and other surfaces to receive paint by working down with a dust mop, static duster, or feather duster.
 - b. Step 2 Clean surface with a mild detergent using a sponge or soft cloth. Avoid using cleaners containing alcohol on latex paint, as alcohol can dissolve and damage the paint film.
 - c. Step 3 Wash surfaces from the bottom up to avoid water running down the wall over the dirt.
 - d. Step 4 Rinse out the sponge in clean water until the cleaning solution is removed. Use the cleaned sponge to thoroughly rinse the washed area. Residual cleaner will interfere with adhesion of paint applied subsequently.
 - e. Step 5 Use a soft cloth or towel to blot excess water off the paint film.
 - f. Refer to Item C below for additional requirements.
- C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.
 - 1. Provide barrier coats over incompatible primers or remove and reprime.
 - 2. Cementitious Materials: Prepare concrete, concrete unit masonry, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
 - a. Use abrasive blast-cleaning methods if recommended by paint manufacturer.
 - b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces if moisture content exceeds that permitted in manufacturer's written instructions.
 - c. Clean concrete floors to be painted with a 5 percent solution of muriatic acid or other etching cleaner. Flush the floor with clean water to remove acid, neutralize with ammonia, rinse, allow to dry, and vacuum before painting.
 - 3. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.
 - a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
 - b. Prime, stain, or seal wood to be painted immediately on delivery. Prime edges, ends, faces, undersides, and back sides of wood, including cabinets, counters, cases, and paneling.
 - c. If transparent finish is required, backprime with spar varnish.
 - d. Backprime paneling on interior partitions where masonry, plaster, or other wet wall construction occurs on back side.
 - e. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately on delivery. Revise first subparagraph and associated subparagraphs below to suit Project.
 - 4. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC's recommendations.
 - a. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with same primer as the shop coat.
 - 5. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

- D. Material Preparation: Mix and prepare paint materials according to manufacturer's written instructions.
 - 1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
 - 2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
 - 3. Use only thinners approved by paint manufacturer and only within recommended limits.
- E. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.03 APPLICATION

- A. Paint Strippers: Compounds that do not contain methylene chloride tend to be slower-acting than conventional paint strippers and may take from one hour to overnight to work. Comply with manufacturer's recommendations for application.
- B. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.
 - 1. Paint colors, surface treatments, and finishes are indicated in the paint schedules.
 - 2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
 - 3. Provide finish coats that are compatible with primers used.
 - 4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, grilles, convector covers, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.
 - 5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
 - 7. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
 - 8. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
 - 9. Sand lightly between each succeeding enamel or varnish coat.
- C. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
 - 1. The number of coats and film thickness required are the same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
 - 2. Omit primer over metal surfaces that have been shop primed and touchup painted.
 - 3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure that edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
 - 4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure, and until application of another coat of paint does not cause undercoat to lift or lose adhesion.
- D. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.

- 1. Brushes: Use brushes best suited for type of material applied. Use brush of appropriate size for surface or item being painted.
- 2. Rollers: Use rollers of carpet, velvet-back, or high-pile sheep's wool as recommended by manufacturer for material and texture required.
- 3. Spray Equipment: Use airless spray equipment with orifice size as recommended by manufacturer for material and texture required.
- E. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve dry film thickness indicated. Provide total dry film thickness of the entire system as recommended by manufacturer.
- F. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and occupied spaces.
- G. Mechanical items to be painted include, but are not limited to, the following:
 - 1. Uninsulated metal piping.
 - 2. Uninsulated plastic piping.
 - 3. Pipe hangers and supports.
 - 4. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
 - 5. Duct, equipment, and pipe insulation having "all-service jacket" or other paintable jacket material.
 - 6. Mechanical equipment that is indicated to have a factory-primed finish for field painting.
- H. Electrical items to be painted include, but are not limited to, the following: List below contains electrical items that are usually field painted. Add other items to suit Project.
 - 1. Switchgear.
 - 2. Panelboards.
 - 3. Electrical equipment that is indicated to have a factory-primed finish for field painting.
- I. Prime Coats: Before applying finish coats, apply a prime coat, as recommended by manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn-through or other defects due to insufficient sealing.
- J. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.
- K. Stipple Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling, such as laps, irregularity in texture, skid marks, or other surface imperfections.
- L. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

3.04 FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT

- A. Refer to Section 220553 and Section 260553 for schedule of color coding of equipment, duct work, piping, and conduit.
- B. Paint shop-primed equipment, where indicated.
- C. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- D. Finish equipment, piping, conduit, and exposed duct work in utility areas in colors according to the color coding scheme indicated.
- E. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.05 INDOOR AIR QUALITY

- A. Wear protective clothing and respirators when applying oil-based paints or using spray equipment with any paints.
- B. Maximize ventilation during application and drying.
- C. Isolate area of application from rest of building.
- D. Vacate space for as long as possible after application. Wait a minimum of 48 hours before occupying freshly painted rooms.

3.06 CLEANING

- A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from Project site.
 - After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping without scratching or damaging adjacent finished surfaces.

3.07 PROTECTION

1.

- A. Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.
- B. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.
 - 1. After work of other trades is complete, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

3.08 EXTERIOR PAINT SCHEDULE

1

- A. Concrete Unit Masonry: Provide the following finish systems over exterior concrete unit masonry:
 1. Semigloss Acrylic-Enamel Finish: Two finish coats over a block filler
 - a. Block Filler: Concrete unit masonry block filler
 - b. Finish Coats (Minimum Two): Exterior semigloss acrylic enamel
- B. Ferrous Metal: Provide the following finish systems over exterior ferrous metal. Primer is not required on shop-primed items.
 - Semigloss Acrylic-Enamel Finish: Two finish coats over a rust-inhibitive primer
 - a. Primer: Exterior ferrous-metal primer
 - b. Finish Coats (Minimum Two): Exterior semigloss acrylic enamel
- C. Zinc-Coated Metal: Provide the following finish systems over exterior zinc-coated metal surfaces: 1. Semigloss Acrylic-Enamel Finish: Two finish coats over a galvanized metal primer
 - a. Primer: Exterior galvanized metal primer
 - b. Finish Coats (Minimum Two): Exterior semigloss acrylic enamel
- D. Wood: Provide the following finish systems over exterior wood:
 - 1. Primer: Exterior wood primer
 - 2. Finish Coats: (Minimum two): Exterior semi-gloss latex

3.09 INTERIOR PAINT SCHEDULE

1.

- A. Concrete: Provide the following finish systems over interior concrete masonry:
 - Semigloss Acrylic-Enamel Finish: Two finish coats over a primer
 - a. Primer: Interior CMU Primer
 - b. Finish Coats (Minimum Two): Interior semigloss acrylic enamel
- B. Gypsum Board Ceilings & Soffits: Provide the following finish systems over interior gypsum board surfaces:
 - 1. Flat Acrylic Finish: Two finish coats over a primer

- a. Primer: Interior gypsum board primer
- b. Finish Coats (Minimum Two): Interior flat acrylic paint
- C. Gypsum Board (Walls): Provide the following finish systems over interior gypsum board surfaces:
 1. Finish: Two finish coats.
 - a. Primer: Interior gypsum board primer
 - b. Finish Coats (Minimum Two): Interior semi-gloss acrylic enamel
- D. Wood and Hardboard: Provide the following paint finish systems over new interior wood surfaces:
 - Semigloss Acrylic-Enamel Finish: Two finish coats over a wood undercoater
 - a. Primer: Interior wood primer for acrylic-enamel and semigloss alkyd-enamel finishes
 - b. Finish Coats (Minimum Two): Interior semigloss acrylic enamel
- E. Ferrous Metal: Provide the following finish systems over ferrous metal:
 - Semigloss Acrylic-Enamel Finish: Two finish coats over a primer
 - a. Primer: Interior ferrous-metal primer
 - b. Finish Coats (Minimum Two): Interior semigloss acrylic enamel
- F. Zinc-Coated Metal: Provide the following finish systems over interior zinc-coated metal surfaces: 1. Semigloss Acrylic-Enamel Finish: Two finish coats over a primer
 - a. Primer: Interior zinc-coated metal primer
 - b. Finish Coats (Minimum Two): Interior semigloss acrylic enamel
- G. Interior Exposed Metal Decking and Bar Joists:
 - 1. First and Second Coats: Alkyd flat dry fall
 - 2. Subsequent coats only as required for complete, proper and full coverage

3.10 WASTE MANAGEMENT

1.

1

- A. Separate waste in accordance with the Waste Management Plan. Set aside extra paint for future color matches, or reuse by Owner. Where local options exist for leftover paint recycling, collect all waste paint by type and provide for delivery to recycling or collection facility.
- B. Close and tightly seal all partly used paint and finish containers and store protected in well-ventilated, fire-safe area at moderate temperature.
- C. Place empty containers of solvent-based paints in areas designated for hazardous materials.
- D. Do not dispose of paints or solvents by pouring on the ground. Place in designated containers for proper disposal.

END OF SECTION

SECTION 101101 - VISUAL DISPLAY BOARDS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Special Conditions and Division 1 Specification Sections, apply to this Section.
- B. Section 090050 Finish Legend.

1.02 SUMMARY

- A. This Section includes the following types of visual display boards:
 - 1. Porcelain enamel markerboards (for liquid chalk)
 - 2. Vinyl-fabric-faced cork tackboards and tack strips
- B. Display board installation will utilize "Z" or "L" clip mounting bars top and mounting angles bottom only. Adhesives used for mounting display boards will not be acceptable.
- C. Where visual display boards are too wide for the location indicated, the supplier shall notify the designer and modify the width accordingly.
- D. Related Sections: The following sections contain requirements that relate to this section:
 1. Division 6 Section "Miscellaneous Carpentry" for wood blocking and grounds

1.03 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of the Contract and Division 1 Specification Sections.
- B. Product Data: Include manufacturer's data substantiating that products comply with requirements indicated.
- C. Shop Drawings: Provide shop drawings for each type of markerboard, and tackboard required. Include sections of typical trim members and dimensioned elevations. Show anchors, grounds, reinforcement, accessories, layout, and installation details.
- D. Samples: Provide the following samples of each product for initial selection of colors, patterns, and textures, as required, and for verification of compliance with requirements indicated.
 - 1. Samples for initial selection of color and pattern
 - a. Porcelain Enamel Markerboard: Manufacturer's color charts consisting of actual sections of porcelain enamel finish showing the full range of colors available for each type of markerboard required
 - b. Vinyl-fabric-faced Cork Tackboards: Manufacturer's color charts consisting of actual sections of vinyl fabric, showing the full range of colors, textures, and patterns available for each type of vinyl-fabric-faced cork tackboard indicated
- E. Certificates: In lieu of laboratory test reports, when permitted by the Designer/Architect, submit the manufacturer's certification that vinyl-fabric-faced cork tackboard materials furnished comply with requirements specified for flame spread ratings.

1.04 QUALITY ASSURANCE

- A. Manufacturer: Furnish all markerboards, tackboards and tackstrips from a single manufacturer for the entire project.
- B. Fire Performance Characteristics: Provide vinyl-fabric-faced tackboards with surface burning characteristics indicated below, as determined by testing assembled materials composed of facings and backings identical to those required in this section, in accordance with ASTM E 84, by a testing organization acceptable to authorities having jurisdiction.
 - 1. Flame Spread: 25 or less

- 2. Smoke Developed: 10 or less
- C. Design Criteria: The drawings indicate sizes, profiles, and dimensional requirements of visual display boards. Other visual display boards having equivalent performance characteristics with deviations from indicated dimensions and profiles may be considered, provided deviations do not change the design concept or intended performance. The burden of proof of equality is on the proposer.

1.05 WARRANTY

A. Porcelain Enamel Markerboard Warranty: Furnish the manufacturer's written warranty, agreeing to replace porcelain enamel markerboards that do not retain their original writing and erasing qualities, become slick and shiny, or exhibit crazing, cracking, or flaking, provided the manufacturer's instructions with regard to handling, installation, protection, and maintenance have been followed.
 1. Warranty Period: 50 years

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Visual Display Board Manufacturer: Subject to compliance with requirements, provide products including, but are not limited to one of the following:
 - 1. Porcelain Enamel Markerboards:
 - a. American Display Products
 - b. American Visual Display
 - c. Best-Rite Chalkboard Company
 - d. Claridge
 - e. Ghent Manufacturing
 - f. Lemco Company
 - g. Marsh Company
 - h. Platinum Visual Systems
 - i. Polyvision
 - j. Weber Costello Company
 - 2. Tackboards and Tackstrips:
 - a. American Display Products
 - b. American Visual Display
 - c. Best-Rite Chalkboard Company
 - d. Claridge
 - e. Ghent Manufacturing
 - f. Marsh Company
 - g. Neil, Inc.

j.

- h. Platinum Visual Systems
- i. Polyvision
 - Weber Costello Company

2.02 MATERIALS

- A. Porcelain Enamel Markerboards: Provide balanced, high-pressure-laminated porcelain enamel markerboards of 3-ply construction consisting of face sheet, core material, and backing.
 - Face Sheet: Provide face sheet of 24-gage enameling grade steel especially processed for temperatures used in coating porcelain on steel. Coat the exposed face and exposed edges with a 3-coat process consisting of primer, ground coat, and color cover coat, and the concealed face with a 2-coat process consisting of primer and ground coat. Fuse cover and ground coats to steel at the manufacturer's standard firing temperatures, but not less than 1200 deg F (649 deg C).
 - 2. Markerboard Cover Coat: Provide the manufacturer's standard light-colored special writing surface with gloss finish intended for use with liquid felt-tipped markers.
 - a. Color shall be as selected by Designer/ Architect from full range of standard colors.

- 3. Core: Provide the manufacturer's standard 3/8-inch-thick particleboard core material complying with the requirements of ANSI A208.1, Grade 1-M-1.
- 4. Backing Sheet: Provide the manufacturer's standard 0.015-inch-thick aluminum sheet backing.
- 5. Laminating Adhesive: Provide the manufacturer's standard moisture-resistant thermoplastic-type adhesive.
- B. Vinyl-Fabric-Faced Tackboards: Provide mildew-resistant, washable, vinyl fabric complying with FS CCC-W-408, Type II, weighing not less than 13 ounces per square yard, laminated to 1/4-inch-thick cork sheet. Provide fabric that has a flame spread rating of 25 or less when tested in accordance with ASTM E 84. Provide color and texture as scheduled or as selected from the manufacturer's standards.
 - 1. Backing: Make panels rigid by factory laminating cork face sheet under pressure to 1/4-inch-thick hardboard backing.
- C. Tackstrips: Provide Exhibit and Display Rail constructed of aluminum frame with cork insert. Provide only fabric that has a flame spread rating of 25 or less when tested in accordance with requirements of ASTM E84. Size shall be 2" wide x lengths as indicated on drawings. Provide color and texture as selected from the manufacturer's full range of standard colors.

2.03 ACCESSORIES

- A. Metal Trim and Accessories: Fabricate frames and trim of not less than 0.062-inch-thick aluminum alloy, size and shape as indicated, to suit type of installation. Provide straight, single-length units wherever possible; keep joints to a minimum. Miter corners to a neat, hairline closure.
 - 1. Where the size of boards or other conditions exist that require support in addition to the normal trim, provide structural supports or modify the trim as indicated or as selected by the Architect from the manufacturer's standard structural support accessories to suit the condition indicated.
 - 2. Tray: Furnish the manufacturer's standard continuous, solid extrusion-type aluminum tray with ribbed section and smoothly curved exposed ends, for each markerboard.
 - Map Rail: Furnish map rail at the top of each unit, complete with the following accessories:
 a. Display Rail: Provide continuous cork display rail approximately 1 or 2 inches
 - wide, as indicated, integral with the map rail.
 - b. End Stops: Provide one end stop at each end of the map rail.
 - c. Map Hooks: Provide 2 map hooks with flexible metal clips for each 4 feet of map rail or fraction thereof.
 - d. Flag Holder: Provide one flag holder for each room.

2.04 FABRICATION

- A. Porcelain Enamel Markerboards: Laminate facing sheet and backing sheet to core material under pressure with manufacturer's recommended flexible, waterproof adhesive.
- B. Assembly: Provide factory-assembled markerboard and tackboard units, except where field-assembled units are required.
 - 1. Make joints only where total length exceeds maximum manufactured length. Fabricate with the minimum number of joints, balanced around the center of the board, as acceptable to the Designer/Architect.
 - 2. Provide the manufacturer's standard vertical joint system between abutting sections of markerboard.
 - 3. Provide manufacturer's standard mullion trim at joints between markerboard and tackboard.

2.05 FINISHES

- A. General: Comply with NAAMM "Metal Finishes Manual" for recommendations relative to application and designations of finishes.
- B. Finish designations prefixed by "AA" conform to the system established by the Aluminum Association for designating aluminum finishes.

C. Class II Clear Anodized Finish: AA-M12C22A31 (Mechanical Finish: as fabricated, nonspecular; Chemical Finish: etched, medium matte; Anodic Coating: Class II Architectural, clear film thicker than 0.4 mil).

PART 3 EXECUTION

3.01 PREPARATION

A. Field Measurements: Take field measurements prior to the preparation of shop drawings and fabrication where possible, to ensure proper fitting of the work. Allow for trimming and fitting wherever taking of field measurements before fabrications might delay work.

3.02 INSTALLATION

- A. Deliver factory-built markerboard and tackboard units completely assembled in one piece without joints, wherever possible. Where dimensions exceed panel size, provide 2 or more pieces of equal length as acceptable to the Designer/Architect. When overall dimensions require delivery in separate units, prefit components at the factory, disassemble for delivery, and make final joints at the site. Use splines at joints to maintain surface alignment.
- B. Installer must examine the areas and conditions under which units are to be installed and notify the Designer/Architect in writing of conditions detrimental to the proper timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the installer.
- C. Markerboards and tackboards shall be installed in strict accordance with manufacturer's recommendations, using concealed hangers at the top and wall angle at the bottom. Installation shall not require grounds.
- D. Provide blocking pads behind all boards at 16" o.c.
- E. Install units in locations and at mounting heights indicated and in accordance with the manufacturer's instructions. Keep perimeter lines straight, plumb and level. Provide all grounds, clips, backing materials, brackets, anchors, trim and accessories necessary for a complete installation.
- F. Boards shall not be installed until the walls have been painted. Any damage to the painted walls shall be corrected.

3.03 ADJUST AND CLEAN

- A. Verify that accessories required for each unit have been properly installed and that operating units function properly.
- B. Clean units in accordance with the manufacturer's instructions.

END OF SECTION

SECTION 101424 - SIGNS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Special Conditions and Division 1 Specification Sections, apply to this Section.
- B. Division 9 Section 090050 Finish Legend

1.02 SUMMARY

- A. This Section includes the furnishing of Specialty Signs. Extent of Specialty Signs is shown on the Drawings and in this section.
- B. Forms of Specialty Signs required include the following:
 - 1. Interior Panel signs (mechanical attachment)
 - 2. Cast metal plaques
- C. Work not included in this section:
 - 1. Illuminated exit signs are specified in Division 16.

1.03 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of the Contract and Division 1 Specification Sections.
- B. Product Data: Include manufacturer's construction details relative to materials, dimensions of individual components, profiles, and finishes for each type of sign required.
- C. Shop Drawings: Provide shop drawings for fabrication and erection of signs. Include plans, elevations, and large-scale sections of typical members and other components. Show anchors, grounds, reinforcement, accessories, layout, and installation details.
 - 1. Provide message list for each sign required, including large-scale details of wording and layout of lettering.
 - 2. For signs supported by or anchored to permanent construction, provide setting drawings, templates, and directions for installation of anchor bolts and other anchors to be installed as a unit of Work in other Sections.
 - 3. Furnish full-size rubbings for metal plaques.
 - 4. Furnish full-size spacing templates for individually mounted dimensional letters and numbers.
 - 5. Samples: Provide the following samples of each sign component for initial selection of color, pattern and surface texture as required and for verification of compliance with requirements indicated.
 - a. Samples for verification of color, pattern, and texture selected, and compliance with requirements indicated:
 - Panel Sign Cast Acrylic Sheet and Plastic Laminate: Provide a sample panel not less than 8-1/2 inches by 11 inches for each material indicated. Include a panel for each color, texture, and pattern required. On each panel include a representative sample of the graphic image process required, showing graphic style, and colors and finishes of letters, numbers, and other graphic devices.
 - 2) Plastic Dimensional Letters: Provide full-size representative sample of letter type required, showing style, color and material finish and method of attachment.

1.04 QUALITY ASSURANCE

A. Single-Source Responsibility: For each separate type of sign required, obtain signs from one source from a single manufacturer.

- B. Design Criteria: The drawings indicate size, profiles, and dimensional requirements of signs and are based on the specific type and model indicated. Signs by other manufacturers may be considered provided that deviations in dimensions and profiles are minor and do not change the design concept as judged by the Architect. The burden of proof of equality is on the proposer.
- C. ADA Regulations: All signage specified herein shall comply with the minimum sign requirements as outlined by the most current Americans with Disabilities Act (ADA).
 - 1. Manufacturer shall be responsible for complying with all applicable requirements of ADA whether specifically specified or not. Notify Architect of any discrepancies between ADA requirements and the contract documents.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products of one of the following: 1. Manufacturers of Interior Panel Signs:
 - a. APCO Architectural Sign Systems
 - b. ASI Modulex
 - c. Best Manufacturing Co.
 - d. Contemporary Plastics, Inc.
 - e. Fastsigns of Louisville
 - f. Innerface Sign System
 - g. Inpro
 - h. J. Gemini, Inc.
 - i. Mohawk Signs
 - j. Nelson-Harkins
 - k. Serigraphics Sign Systems, Inc.
 - l. Signcraft
 - 2. Manufacturers of Cast Plaques:
 - a. American Graphics, Inc.
 - b. Andco Industries Corp.
 - c. A.R.K. Ramos Manufacturing Company, Inc.
 - d. ASI Modulex
 - e. Best Manufacturing Co.
 - f. Fastsigns of Louisville
 - g. Gemini, Inc.
 - h. Metal Arts, Division of L & H Manufacturing Co.
 - i. Mohawk Signs
 - j. Nelson Harkins
 - k. Signeraft
 - 1. The Southwell Company

2.02 MATERIALS

- A. Cast Acrylic Sheet: Provide cast (not extruded or continuous cast) methyl methacrylate monomer plastic sheet, in sizes and thicknesses indicated, with a minimum flexural strength of 16,000 psi when tested in accordance with ASTM D 790, a minimum allowable continuous service temperature of 176 deg F (80 deg C), and of the following general types:
 - 1. Opaque Sheet: Where sheet material is indicated as "opaque," provide colored opaque acrylic sheet in colors and finishes as selected from the manufacturer's standards.
 - 2. Aluminum Extrusions: Provide aluminum extrusions of alloy and temper recommended by the aluminum producer or finisher for the type of use and finish indicated, and with not less than the strength and durability properties specified in ASTM B 221 for 6063-T5.
 - 3. Aluminum Castings: Provide aluminum castings of alloy and temper recommended by the aluminum producer and finisher for the casting process used and for the use and finish indicated.

- 4. ABS Plastic: Provide high-impact thermoplastic composed of copolymers of acrylonitrile, butadiene, and styrene.
- 5. Fasteners: Use concealed fasteners fabricated from metals that are not corrosive to the sign material and mounting surface.
- 6. Anchors and Inserts: Use nonferrous metal or hot-dipped galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.
- 7. Vinyl Film: Provide vinyl film signage and graphics as manufactured by 3M's films or approved equivalent. (Delete if not required)
 - a. Opaque Graphic Films
 - b. Reflective Graphic Films

2.03 PANEL SIGNS

- A. Panel Signs: Comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction.
 - 1. Produce smooth, even, level sign panel surfaces, constructed to remain flat under installed
 - conditions within a tolerance of plus or minus 1/16 inch measured diagonally.
 - 2. Material: Plastic
 - 3. Corner Condition: Square corners
 - 4. Panel Thickness: 1/8" minimum
 - 5. Attachments: Mechanical
 - 6. Size: 8" x 8"
 - 7. Copy: Final signage copy shall be provided on the shop drawings; for bidding purposes the bidder shall assume that the room name(s) and their three digit room numbers shall be listed.
- B. Graphic Content and Style: Provide sign copy that complies with the requirements indicated for size, style, spacing, content, position, material, finishes, and colors of letters, numbers, and other graphic devices.
- C. Raised Copy: Provide sign plaque with raised copy (1/32") and grade 2 braille as an integral part of the plaque. Use photo etching process or reverse engraved process. Other methods to achieve raised and braille will require pre-approval. Sign surface color must be durable and scratch and vandal resistant. Applied copy and braille strips are not acceptable.
- D. Room Number and Title: Titles shall be 3/4" Sans Serif Typestyle, centered horizontally and vertically. Numbers shall be 2" Sans Serif Typestyle, centered horizontally and vertically.
- E. Special Symbols: Handicap symbol shall be 3" high. Men/Women symbols shall be 4" high. Locate as directed by Architect.
 - 1. Equivalent raised written description must be placed directly below symbol.
- F. See room finish schedule for sign locations and copy. Size shall be nominal 8" x 8" or as indicated. Manufacturer's standard sizes incorporating minor size variations will be accepted.

2.04 CAST METAL PLAQUES

- A. Plaques: Castings shall be free from pits, scale, sand holes, or other defects. Comply with requirements specified for metal, border style, background texture, and finish and with requirements shown for thickness, size, shape, and copy. Hand-tool and buff borders and raised copy to produce the manufacturer's standards satin polished finish. Refer to "Finish" article for other finish requirements.
 - 1. Metal: Aluminum
 - 2. Border Style: As selected by Architect/ Designer
 - 3. Background Texture: Manufacturer's standard pebble texture
 - 4. Background Finish: Provide the manufacturer's standard baked enamel finish
 - 5. Layout: Refer to plaque layout sheet
 - 6. Size: 3'-0" x 1'-8"

2.05 FABRICATION - GENERAL

- A. General: Comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction.
- B. Design, fabricate, and install sign assemblies to prevent buckling, opening up of joints, and over-stressing of welds and fasteners.
- C. Mill joints to a tight, hairline fit. Form joints exposed to the weather to exclude water penetration.
- D. Conceal fasteners if possible; otherwise, locate fasteners where they will be inconspicuous.
- E. Create signage to required sizes and layout. Comply with requirements indicated for design, dimensions, finish, color, and details of construction.

2.06 FINISHES

- A. Colors and Surface Textures: For exposed sign material that requires selection of materials with integral or applied colors, surface textures or other characteristics related to appearance, provide color matches indicated, or if not indicated, as selected by the Architect from the manufacturer's standards.
- B. Metal Finishes: Comply with NAAMM "Metal Finishes Manual" for finish designations and applications recommendations.
 - 1. Aluminum Finishes: Finish designations prefixed by "AA" conform to the system established by the Aluminum Association for designating aluminum finishes.
 - 2. Baked Enamel Finish: AA-M4xC12C42R1x (Mechanical Finish: Manufacturer's standard, other nondirectional textured; Chemical Finish: Chemical conversion coating, acid chromate-fluoride-phosphate pretreatment; Organic Coating: as specified below). Apply baked enamel in compliance with paint manufacturer's specifications for cleaning, conversion coating, and painting.
 - 3. Organic Coating: Thermosetting modified acrylic enamel primer/topcoat system complying with AAMA 603.8 except with a minimum dry film thickness of 1.5 mils, medium gloss.
 - 4. Color: As selected by the Architect from the manufacturer's standard colors.

PART 3 EXECUTION

3.01 INSTALLATION

- A. General: Locate sign units and accessories where indicated, using mounting methods of the type described and in compliance with the manufacturer's instructions.
 - 1. Install signs level, plumb, and at the height indicated, with sign surfaces free from distortion or other defects in appearance.
- B. Wall Mounted Panel Signs: Attach panel signs to wall surfaces using the methods indicated below:
 - 1. Mounting: Use expansion bolt anchoring device as recommended by manufacturer to attach signs to concrete block walls. Provide minimum 4 fasteners for 8" x 8" signs.
 - 2. Mount interior signs with centerline one foot from latch side of door frames, and top of sign five feet above finish floor. Note: Lower signs as required to meet all ADA requirements.
 - 3. Where there is no wall space to the latch side of the door, including at double leaf doors, signs shall be placed on the nearest adjacent wall. Mounting location for such signage shall be so that a person may approach within 3 inches (76 mm) of signage without encountering protruding objects or standing within the swing of a door.
 - 4. Where a tactile sign is provided at a door, the sign shall be alongside the door at the latch side. Where a tactile sign is provided at double doors with one active leaf, the sign shall be located on the inactive leaf. Where a tactile sign is provided at double doors with two active leaves, the sign shall be to the right of the right-handed door. Where there is no wall space on the latch side of a single door, or to the right side of double doors, signs shall be on the nearest adjacent wall. Signs containing tactile characters shall be located so that a clear floor area 18 inches (455 mm) minimum by 18 inches (455 mm) minimum, centered on the tactile
characters, is provided beyond the arc of any door swing between the closed position and 45 degree open position.

- 5. Tactile characters on signs shall be located 48 inches (1220 mm) minimum above the finish floor or ground surface, measured from the baseline of the lowest tactile character and 60 inches (1525 mm) maximum above the finish floor or ground surface, measured from the baseline of the highest tactile character.
- C. Cast Metal Plaques: Mount Plaques using the standard method recommended by the manufacturer for the type of wall surface indicated.
- D. Concealed Mounting: Mount plaques by inserting threaded studs into tapped lugs on the back of the plaque. Set in predrilled holes filled with quick-setting cement.

3.02 CLEANING AND PROTECTION

A. At completion of the installation, clean soiled sign surfaces in accordance with the manufacturer's instructions. Protect units from damage until acceptance by the Owner.

SECTION 107300 - ALUMINUM CANOPY

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Wall supported manufactured aluminum canopy.1. Downspouts will be connected to the storm drainage system.

1.02 RELATED REQUIREMENTS

- A. Section 033000 Cast-In-Place Concrete
- B. Section 042000 Unit Masonry
- C. Section 076200 Sheet Metal Flashing and Trim
- D. Section 079000 Joint Sealants

1.03 REFERENCE STANDARDS

- A. AAMA 611 Specification for Anodized Architectural Aluminum.
- B. AAMA 2604 Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.
- C. AAMA 2605 Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
- D. ASTM B 209 Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- E. ASTM B 221 Specification for Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire Profiles and Tubes.

1.04 SUBMITTALS

- A. Product Data: For the following:
 - 1. Wall supported canopy, canopy attachment to wall, metal deck, beams, and fascia.
 - 2. Column supported canopy, columns, column embedment, metal deck, beams and fascia.
- B. Shop Drawings: Detail fabrication and installation of all formed metal fabrications. Include dimensioned plans, elevations, sections, and details of components and their connections. Show anchorage and accessory items.
 - 1. Show downspout attachment to storm drainage system.
 - 2. Show column/downspout foundation attachment.
 - 3. Manufacturer to field verify project conditions for wall bracket attachments to ensure proper attachment is indicated in the shop drawings.
- C. Field Measurements: Where formed metal canopies 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.
- D. Design Data: Submit design calculations bearing the seal of a Registered Professional Engineer, licensed in Kentucky. Design calculations shall state that the canopy system design complies with the wind uplift requirements of ASCE 7, the stability criteria of the 2015 IBC with Kentucky Amendments, and all other governing criteria.
- E. Selection Samples: Submit color chips representing manufacturer's full range of available colors and patterns. Submit actual samples not photo reproductions.

1.05 KENTUCKY DEPARTMENT OF HOUSING, BUILDINGS AND CONSTRUCTION (HBC) SUBMITTALS

- A. In addition to the shop drawings submitted to the Architect for review the pre-engineered metal canopy manufacturer shall also submit shop drawings to the pre-engineered canopy installer for shop drawings submittal to HBC for approval as a requirement of the building permit.
- B. Shop Drawings: Each sheet shall be identified with the project name and bear the seal and signature of a Kentucky licensed design professional. Section 107.1 2015 IBC with KY Amendments, current edition.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in the manufacture of canopy system, as specified, with minimum ten years of documented experience.
- B. Installer Qualifications: Canopies to be installed by the manufacturer. Third party installation is not acceptable, unless installer is certified through the manufacturer, or installs manufacturers canopies exclusively.
- C. Source Limitations: Obtain canopies through one source from a single manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver formed metal canopies wrapped in protective coverings and strapped together in suitable packs or in heavy duty cartons. Remove protective coverings before they stain or bond to finished surfaces.
- B. Store products on elevated platforms in a dry location.

1.08 WARRANTY

- A. See Section 017800 Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.
- C. Provide five year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, gloss reduction, chalking, or flaking.
 1. Provide if manufacturers standard finish is anodized or powder-coated.
- D. Provide ten year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.
 - 1. Provide if manufacturers standard finish is painted.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include:
- B. Basis of Design: design concept and the drawings indicate the size, profiles, dimensional requirements and aesthetics of the following:
 - 1. Superior Mason Products, LLC.
- C. Products by other manufacturers may be considered provided deviations in dimensions and profiles are minor and do not change the design concept as judged by the Architect.
 - 1. Architectural Fabrication, Inc.: www.arch-fab.com
 - 2. Childers Carports and Structures: www.childersonline.com
 - 3. Mapes Industries:www.mapes.com
 - 4. MASA Corporation: www.architecturalcanopies.com
 - 5. Mitchell Metals, LLC: www.mitchellmetals.net

- 6. Peachtree Protective Covers: www.peachtreecovers.com
- 7. Superior Mason Products, LLC: www.superiormetalproducts.com
- 8. Tennessee Valley Metals: www.tvmetals.com
- 9. Rusco Custom Canopies: www.ruscocanopies.com

2.02 MATERIALS

1.

- A. General: Provide materials without pitting, seam marks, roller marks, stains, discolorations, or other imperfections where exposed to view on finished units.
- B. Aluminum Members: Extruded aluminum, ASTM B 221, 6063 alloy, T6 temper.
- C. Deck Panels: Extruded .062 inch aluminum flush deck
 - Panel Profile: Flat

a.

- Deck must be continuously flat across the entire canopy. Deck profile or deck attachment to not create any open spaces to allow bird nesting/roosting.
- D. Intermediate Gutters/Drain Beam: Extruded .125 inch aluminum with one end closed at the factory and be provided with top cap that is removable for cleaning.
 - 1. Intermediate Gutter Size: Manufacturers standard size or nominal, 0.188 inch thick, 3 inch wide x 6 inch deep.
- E. Fascia/Gutter: Full perimeter extruded .094 inch aluminum fascia/gutter.
 - 1. Fascia Size: Manufacturers standard size or nominal, 0.070 inch thick, 3 inch wide x 7 inch deep to interlock with decking and gutters.
- F. Downspouts that are not a supporting column: Fully welded, extruded aluminum tubing, minimum wall thickness of 0.125 inch. Minimum size 3 inch by 3 inch or size as indicated on the drawings.
- G. Fasteners: Use fasteners fabricated from same basic metal and alloy as fastened metal, unless otherwise indicated. Do not use metals that are corrosive or incompatible with materials joined.
 - 1. Provide concealed fasteners for interconnecting formed metal fabrications and for attaching them to other work, unless otherwise indicated.
 - 2. Fasteners to be provided in same finish and color as canopy components.
- H. Structural Anchors and Rods: All ferrous fasteners and hanging accessories shall be heavily galvanized or cadmium plated and finished in same finish and color as other canopy components.
- I. Flashing: Flashing shall be made of aluminum sheet in same finish and color as the other canopy components. Minimum flashing thickness to be 0.040 inch thick. Coordinate installation of flashing with masonry and/or roofing subcontractor to integrate flashing into throughwall flashing and reglets.
- J. Corrosion Control: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

2.03 ACCESSORIES

A. Wire Ball Downspout Strainer: Install wire ball downspout strainer at each downspout location.

2.04 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble formed metal canopies in shop 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.
- B. Coordinate dimensions and attachment methods of formed metal canopies with those of adjoining construction to produce integrated assemblies with closely fitting joints and with edges and surfaces aligned, unless otherwise indicated.
- C. Welding: In accordance with ANSI/AWS D1.2.

- D. Bent Construction: Factory weld beams to columns with neatly mitered corners to form one piece rigid bents. Make welds smooth and uniform using an inert gas shielded arc. perform suitable edge preparation to assure 100% penetration. Grind welds only where interfering with adjacent structure to allow for flush connection. Field welding is not permitted.
- E. Deck Construction: Fabricate from extruded modules that interlock in a self-flashing manner. fasten interlocking joints at on center spacing creating a monolithic structural unit capable of developing the full strength of the sections. Fastening to have minimum shear strength of 350 pounds each. Assemble deck with sufficient camber to offset dead load deflection.
- F. Form metal to profiles indicated, in maximum lengths to minimize joints. Produce flat, flush surfaces without cracking or grain separation at bends. Fold back exposed edges of unsupported sheet metal to form a 1/2 inch (12 mm) wide hem on the concealed side, or ease edges to a radius of approximately 1/32 inch (1 mm) and support with concealed stiffeners.
- G. Build in straps, plates, and brackets as needed to support and anchor fabricated items to adjoining construction. Reinforce formed metal units as needed to attach and support other construction.
- H. Provide support framing, mounting and attachment clips, splice sleeves, fasteners, and accessories needed to install formed metal fabrications.

2.05 FINISHES, GENERAL

- 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. Apply organic and anodic finishes to formed metal after fabrication, unless otherwise indicated.

2.06 ALUMINUM FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.
- 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.
- C. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- D. Canopy finishes: Due to differences in canopy manufacturer finishing standards provisions for clear and/or color anodized, painted and powder coated material is included. All finishes are acceptable and manufacturers are to provide their standard of ONE listed below.
 - 1. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating or AAMA 612 clear anodic coating with electrolytically deposited organic seal; not less than 0.7 mils thick.
 - a. Color to be clear anodized.
 - 1) All canopy components to be clear anodized; fascia, deck, columns, wall hangers, and drain beam.
 - 2. Class I Color Anodized Finish: AAMA 611 AA-M12C22A42 Integrally colored anodic coating or AAMA 612 electrolytically deposited colored anodic coating with electrolytically deposited organic seal; not less than 0.7 mils thick.
 - a. Color to be light bronze.
 - 1) All canopy components to be color anodized; fascia, deck, columns, wall hangers, accessories, and drain beam.

- 3. High-Performance Organic Finish (2-coat Fluoropolymer): AA-C12C40R1X (Chemical Finish): cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions.
 - a. Finish to be Pearledize/Mica, consisting of 0.2 mil primer with 0.8 mil color coat containing mica pearlescent flakes to simulate the appearance of an anodized/metallic finish.
 - b. Color to be selected from manufacturers standard color chart. Minimum twenty colors.
 - 1) Color simulating clear anodized aluminum to be available in color choices.
 - c. All canopy components to be painted; fascia, deck, columns, wall hangers, accessories, and drain beam.
 - d. Extruded deck to be painted the same color on the topside and underside.
- 4. Powder Coated Finish: AAMA 2604 thermosetting resin of, 1.20 mils minimum, modified polyesters electrostatically applied to the aluminum profile. Profile to be baked in an oven where the powder particles are melted to a liquid state, fusing together to form a homogenous film.
 - a. Color to be selected from manufacturers standard color chart. Minimum sixteen colors.
 - 1) Color simulating clear anodized aluminum to be available in color choices.
 - b. All canopy components to be painted; fascia, deck, columns, wall hangers, accessories, and drain beam.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Locate and place formed metal fabrications level, plumb, and in alignment with adjacent construction.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where needed to protect metal surfaces and to make a weathertight connection.
- C. Form tight joints with exposed connections accurately fitted together. Provide reveals and openings for sealants and joint fillers as indicated.
- D. Corrosion Protection: Coat concealed surfaces of aluminum, zinc coated, and nonferrous metals that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.
- E. Entire unit shall be erected straight and true.
- F. Hanger rods shall be anchored using through bolt type anchors to support dead and live loads, as recommended by the manufacturer.

3.02 ADJUSTING

A. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit or provide new units.

3.03 PROTECTION

A. Protect finishes of formed metal canopies from damage during construction period. Remove temporary protective coverings at time of Substantial Completion.

END OF SECTION 107300

SECTION 123450 - LABORATORY CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. This Section includes stock laboratory casework units, complete with laboratory countertops, integral sinks, accessories, and mechanical and electrical service fittings mounted on countertop.
 - 1. In some instances casework model numbers based on specific manufacturers are shown as a further clarification only and are not intended to preclude other approved manufacturers from being accepted as equivalents.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 1. Service fittings are specified in this Section. Installation of service fittings is specified under mechanical work of Division 15 and electrical work of Division 16.

1.02 RELATED REQUIREMENTS

- A. Section 013000 Administrative Requirements Submittal procedures
- B. Section 090050 Finish Legend

1.03 REFERENCE STANDARDS

- A. AISI SG02-1 North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute; 2001 with 2004 supplement. (replaced SG-971)
- B. ASTM A653/A653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2013.
- C. ASTM C645 Standard Specification for Nonstructural Steel Framing Members; 2014.
- D. ASTM C665 Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2012.
- E. ASTM C754 Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2011.
- F. ASTM C1002 Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2014.
- G. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials; 2014.
- H. ASTM E90 Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009.
- I. UL (FRD) Fire Resistance Directory; Underwriters Laboratories Inc.; current edition.

1.04 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Product data for each type of laboratory furniture unit specified.
 - 1. Include independent laboratory certification that applied finish complies with specified chemical and physical resistance requirements.
- C. Shop drawings for laboratory casework and fittings showing plan layout, elevations, ends, cross-sections, service run spaces, location and type of service fittings, together with associated service supply connection required.
 - 1. Include details and location of anchorages and fitting to floors, walls, and base, including required blocking or back-blocking.

- 2. Include layout of units with relation to surrounding walls, doors, windows, and other building components.
- 3. Coordinate shop drawings with other work involved.
- 4. Include manufacturer's recommendations for blocking and securing of laboratory casework units and fittings.
- D. Samples for verification purposes of each type of specified finish, including top material. Provide in minimum 6-inch by 6-inch sizes. Samples will be reviewed by Designer/Architect for color, texture, and pattern only. Compliance with other specified requirements is exclusive responsibility of Contractor.
 - 1. One minimum 6-inch by 6-inch sample of each type of countertop specified.
- E. Product test reports from and based on tests performed by a qualified independent testing laboratory evidencing compliance of laboratory casework finishes with requirements specified for chemical and physical resistance.

1.05 QUALITY ASSURANCE

- A. Single Source Responsibility: Provide laboratory casework with tops, sinks, and service fittings, manufactured or furnished by same laboratory furniture company for single responsibility.
- B. Catalog Standards: Manufacturer's catalog numbers may be shown on drawings for convenience in identifying certain laboratory cabinet work. Unless modified by notation on drawings or otherwise specified, catalog description for indicated number constitutes requirements for each such cabinet.
 - 1. The use of catalog numbers and specific requirements set forth in drawings and specifications are not intended to preclude the use of any other acceptable manufacturer's product or procedures which may be equivalent, but are given for purpose of establishing standard of design and quality for materials, construction, and workmanship.
- C. Testing Laboratory Qualifications: To qualify for acceptance, an independent testing laboratory must demonstrate to Architect's satisfaction, based on evaluation of laboratory-submitted criteria conforming to ASTM E 699, that it has the experience and capability to conduct satisfactorily the testing indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver laboratory casework only after wet operations in building are completed.
- B. Store completed laboratory casework in a ventilated place, protected from the weather, with relative humidity of 50 percent or less at 70 deg F (22 deg C).
- C. Protect finished surfaces from soiling and damage during handling and installation. Keep covered with polyethylene film or other protective covering.

1.07 PROJECT CONDITIONS

A. Conditioning: Do not proceed with installation of wood flooring until spaces have been enclosed and are at approximate humidity condition planned for occupancy. Condition wood for 5 days prior to start of installation by placing in spaces to receive flooring and maintaining ambient temperature between 65 deg. F and 70 deg. F (18 deg. C and 21 deg. C) before, during, and after installation. Open packages of wood flooring which are sealed (if any) to permit natural adjustment of moisture content.

1.08 SEQUENCING AND SCHEDULING

A. Coordinate the work with all sections referencing this section.

1.09 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of institutional casework that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:
 - 1. Delamination of components or other failures of glue bond
 - 2. Warping of components
 - 3. Failure of operating hardware
 - 4. Deterioration of finishes
 - 5. Warranty Period: Five years from date of substantial completion

1.10 EXTRA MATERIALS

A. Furnish complete touch-up kit for each type and color of laboratory casework provided. Kit to include touch-up paint and other materials necessary to perform permanent spot repairs to damaged casework finish.

PART 2 PRODUCTS

2.01 WOOD LABORATORY CASEWORK

- A. General: Provide wood laboratory casework that complies with requirements specified in this article.
- B. Definitions: The following definitions apply to wood laboratory casework units:
 - 1. Exposed portions of casework include surfaces visible when doors and drawers are closed. Bottoms of cases more than 4'-0" above floor shall be considered as exposed. Visible members in open cases or behind glass doors also shall be considered as exposed portions.
 - 2. Semiexposed portions of casework includes those members behind opaque doors, such as shelves, divisions, interior faces of ends, case back, drawer sides, backs and bottoms, and back face of doors. Tops of cases 6'-6" or more above floor shall be considered semiexposed.
 - 3. Concealed portions of casework include sleepers, web frames, dust panels, and other surfaces not usually visible after installation.
- C. Exposed Materials: Do not use exposed faces of lighter-than-average color joined with exposed faces of darker-than-average color. Do not use two adjacent faces which are noticeably dissimilar in grain, figure, and natural character markings.
 - 1. Solid Lumber: Clear, dry, premium-grade red oak, free from defects and selected for compatible grain and color.
 - 2. Plywood Face Veneer: Same species as exposed solid lumber, clear, selected for grain and color compatible with exposed solid lumber, no defects. Provide solid crossbandings without voids. Edgeband exposed edges with minimum 1/8-inch-thick, solid wood edging of same species as face veneer.
- D. Semiexposed Materials: Comply with the following:
 - 1. Solid Lumber: Dry, sound, selected to eliminate appearance defects. Any species of hardwood or softwood of similar color and grain to exposed portions.
 - 2. Plywood: Hardwood, ANSI/HPMA HP, Good Grade (1) or softwood, PS-1, Group 1, A-A, INT of species to match color and grain of exposed members.
- E. Concealed Members: Comply with the following:
 - 1. Solid Lumber or Plywood: Any species, with no defects affecting strength or utility.
 - 2. Particleboard: ANSI A208.1, minimum 40 lb./cu. ft. density, Grade 1-M-2 or better.
 - 3. Hardboard: ANSI/AHA A135.4, Class 1, tempered.
- F. Manufacturers: Subject to compliance with requirements, provide wood laboratory casework products by one of the following:
 - 1. Campbell Rhea/Mohon International, Inc.

- 2. Kewaunee Scientific Equipment Corp.
- 3. Taylor/Div. American Desk.
- 4. Leonard Peterson Company
- 5. Southern Cabinetry, Inc.
- 6. Diversified Woodcrafts, Inc.
- 7. Mott Manufacturing.
- 8. Advanced Lab Concepts.
- 9. Sheldon Labs.

1.

- G. Safety Glasses/Goggles Monitor: Subject to compliance with requirement, provide safety glasses/goggle sanitizer cabinets produced by the following or approved equivalent:
 - 1. Campbellrhea, Mohon International, Inc.
 - a. Safety Glasses/Goggle Sanitizer No.6784.
 - 2. Companies who products meet or exceed the project specifications as approved by written addendum.
- H. First Aid Kit: Subject to compliance with requirements, provide first aid kits produced by the following or approved equivalent:
 - Campbellrhea, Mohon International, Inc.
 - a. First Aid Kit, 9962
- I. Fire Blanket: Subject to compliance with requirements, provide fire blankets produced by the following or approved equivalent:
 - 1. Cambellrhea, Mohon International, Inc.
 - a. Fire blanket 9960 with metal case. Cabinet size, 19 1/2" H x 17" W x 12" D.

2.02 CHEMICAL AND PHYSICAL RESISTANCE OF LABORATORY CASEWORK FINISHES

- A. General: Provide laboratory casework with a factory-applied finish that is capable of withstanding the tests specified in this article with no permanent change in gloss, color, film hardness, adhesion, or film protection.
- B. Acids: Not less than 10 drops (0.50 cc) of the following reagents applied to finish surface, covered with watch glass, convex side down, for 60 minutes, then washed and dried.
 - 1. Hydrochloric acid (37 percent), sulfuric acid (85 percent), nitric acid (25 percent), phosphoric acid (75 percent), acetic acid (98 percent).
- C. Solvent: Not less than 10 drops (0.5 cc) of the following reagents applied to finish surface, covered with watch glass, convex side up, for 60 minutes, then washed and dried.
 - 1. Ethyl alcohol, butyl alcohol, methyl alcohol, toluene, acetone, benzene, carbon tetrachloride, formaldehyde (37 percent), gasoline, ethyl acetate, ethyl ether, methyl ethyl ketone, naphtha, kerosene, xylene, glycerin, furfural.
- D. Bases and Salts: Not less than 5 drops (0.25 cc) of the following reagents applied to finish surface, covered with watch glass, convex side up, for 60 minutes, then washed and dried.
 - 1. Sodium hydroxide (25 percent), ammonium hydroxide (28 percent), potassium hydroxide (40 percent), saturated zinc chloride, saturated sodium chloride, saturated sodium sulphide, saturated sodium carbonate, poultice of "Tide" laundry detergent and water.
- E. Moisture Resistance: No visible effect when finish surface exposed to the following:
 - 1. Hot water at a temperature of 190 deg F (91 deg C) to 205 deg F (96 deg C), trickled down surface at 45-degree angle for 5 minutes.
 - 2. Constant Moisture using a 2-inch by 3-inch by 1-inch cellulose sponge, soaked with water, in contact with surface for 100 hours.

2.03 FINISH FOR WOOD LABORATORY CASEWORK

A. General: Provide exposed portions of wood laboratory casework with a clear factory finish that complies with chemical and physical resistance requirements specified.

- B. Preparation: Sand exposed and semiexposed components, using machine and hand methods. Machine marks, cross-sanding, tool marks, or other surface blemishes are not acceptable.
- C. Exposed Portions: Carefully sand finishes after each surface treatment. Apply finishes as follows: 1. Sealer coat, if required.
 - 1. Sealer coat, if required.
 - 2. Stain to match color selected, if required.
 - 3. Mineral filler for open-grained wood, if required.
 - 4. Multiple coats of highly chemical-resistant finish, heat-dried and sanded between each coat to produce a smooth, satin luster free of imperfections.
- D. Semiexposed Portions: Apply sealer coat, colored to match exposed portions, and follow with heavy application of clear, water-repellant finish coat to provide a smooth, washable surface.
- E. Concealed Portions: One heavy coat of water-repellant finish.

2.04 CASEWORK HARDWARE AND ACCESSORIES

- A. Hardware, General: Provide manufacturer's standard satin finish, commercial quality, heavy-duty hardware complying with requirements indicated for each type.
- B. Hinges: Institutional 5-knuckle, 2-3/4 inch., overlay type, hospital tip, 0.95 inch thick steel. Provide one pair for doors less than 4 feet high and 1-1/2 pair for doors over 4 feet high. Hinges shall have a minimum of eight (8) edge and leaf fastening.
- C. Pulls: Solid metal for drawers and swing doors, mounted with 2 screws fastened from back. Provide 2 wire pulls, 4" wide for drawers over 24 inches wide.
- D. Door Catches: Catches for doors on wall and base cabinets shall be double action, springs tension nylon roller catches, or magnetic catches with a minimum ten (10) pound pull, attached with screws and slotted for adjustment.
- E. Drawer Guides: Provide nylon-tired, ball-bearing rollers with metal guide channels and integral stops to eliminate accidental removal of drawer. Provide guides designed to provide self-closing of drawer and to prevent rebounding action when drawers are closed. Guides shall have a 100 lb. load rating at 3/4 extension. Guides shall have a life time warranty as offered by the Slide Manufacturer.
- F. Drawer Stops: Designed to permit easy removal, and yet prevent inadvertent drawer removal. Provide on all drawers, located on the inside.
- G. Filler Strips: Provide where required for closing space between cabinets and walls and ceilings, of same material and finish as cabinets.
- H. Drawer and Cupboard Locks: Half-mortise type, 5-pin tumbler and dead bolt, round cylinder only exposed, brass with plated finish. Locks shall be keyed and master-keyed as specified.
- I. Cabinet Base Molding: Extruded vinyl 4 inches high. Provide on exposed sides and fronts of floor-mounted cabinets.
- J. Adjustable Shelf Supports: Wrought steel, mortise-mounted.
- K. Countertop/Shelf Support: Provide countertop/shelf supports equivalent to A & M Hardware, Inc. workstation brackets, size brackets to suit installation.

2.05 TOPS, SINKS, AND ACCESSORIES

- A. Tops, Box Curbs, Splash Rim: Provide smooth, clean exposed tops and edges in uniform plane free of defects. Make exposed edges and corners uniformly rounded.
- B. Epoxy Resin Top Thickness: 1-inch thickness, with tolerance not exceeding plus or minus 1/32 inch. Provide front and end overhang of 1 inch over base cabinets, formed with continuous drip groove on under surface 1/2 inch from edge.

- C. Modified Epoxy Resin Tops: Tops and curbs shall be molded from a silica filled epoxy-resin that has been especially compounded and cured to provide optimum physical and chemical resistance required for laboratory working surfaces. Tops and curbs shall be a uniform mixture throughout and shall not depend on a surface coating which can be readily removed by chemical or physical abuse. Tops and curbs are molded to counter top configurations and then finished off by cutting sink cut outs, hole drillings and other field conditions.
 - 1. Tops and curbs shall be non-glaring matte finish and black in color.
 - 2. Tops shall be 1" thickness as required with a drip groove provided on underside, where noted only. All edges shall have a slight radius.
 - 3. Curbs shall be 3/4" thickness as required, bonded to the surface on the top to form a square water tight joint. All joints in tops to be bonded with an approved epoxy cement and shall be smooth and water tight.
 - 4. Counters with a marine edge to have 1" wide by 1/4" high raised edge, front and exposed ends, and a drip groove on the countertops underside. Fume hood counters are specified to have marine edge on four (4) sides.
 - 5. Fabricate counter top from longest lengths possible, 8' minimum length typical. Submit shop drawings showing seaming diagram for approval prior to fabrication and installation.
 - Physical Properties: Comply with the following minimum requirements:
 - 1) Flexural strength:15,000 psi.
 - 2) Compressive strength:35,000 psi.
 - 3) Hardness (Rockwell M):100.
 - 4) Water absorption (24 hrs): 0.02 percent (maximum).
 - 5) Heat distortion point: 350 deg F (176 deg C).
 - 6) Thermal shock resistance: Highly resistant.
 - b. Chemical Resistance: Spot test with the following reagents in standard laboratory concentrations, in contact with finished top for 24 hours; top shall be entirely unaffected or show only slight dulling of finish:
 - Glacial acetic acid, nitric acid, sulfuric acid, ammonium hydroxide, sodium hydroxide, amyl acetate, benzene, ethyl acetate, ethyl ether, hydrogen peroxide, methyl ethyl ketone, phenol, trichloroethylene, zinc chloride, hydrochloric acid, phosphoric acid, chromic acid, calcium hypochlorite, acetone, aqua regia, butyl alcohol, ethyl alcohol, formaldehyde, methyl alcohol, kerosene, silver nitrate, xylene.
 - c. Workmanship: Cast surfaces very smooth, with factory cutouts for sinks and drip grooves. Fabricate plain butt-type joints assembled with epoxy adhesive and prefitted, concealed metal spline.

2.06 SINKS, CUP SINKS, TROUGHS

a.

- A. Sizes: As indicated or manufacturer's closest stock size of equal or greater volume, as acceptable to Architect.
- B. Cast Epoxy Resin Sinks: Nonspecular black, molded in one piece with surfaces smooth, corners coved to 1¹/₂" radius and bottom sloped to outlet. Minimum physical properties and chemical resistance as specified for cast epoxy resin tops; 1/2-inch minimum thickness.
 - 1. Refer to the epoxy sink legend on the architectural drawings for sink sizes.
- C. Epoxy Resin Countertops Associated Fixtures: Subject to compliance with requirements, provide faucets and gas cocks produced by the following or approved equivalent:
 - 1. Chicago Faucet Company
 - 2. Sprakman Inc.
 - 3. T&S Brass Inc.
 - a. Chicago Faucet Co. Water Fitting No.930
 - 1) GN2BVB 6" Vacuum Breaker Spout.
 - 2) E7 Serrated Nozzle Outlet.
 - 3) 204 Handles.

- 4) Chicago Faucet Co. Turret No.981
 - (a) Two outlets, 180 deg.
- 5) Chicago Faucet Co. Flange No.907

2.07 MECHANICAL SERVICE FITTINGS

- A. Service Fittings: Provide units complete with washers, locknuts, unions, nipples and other accessories for positive mounting to supporting laboratory units. Include wall and deck flanges, escutcheons, handle extension rods, remote valves, and similar items required. Fabricate units to withstand test pressure of 100 psig.
- B. Material and Finish: Fabricate service fittings from cast or forged red brass containing a minimum of 85 percent copper. Provide exposed surfaces, including fittings, escutcheons, and trim, with a polished chrome-plated finish.
 - 1. For fittings inside fume hoods, coat with acid- and solvent-resistant baked-on plastic coating in manufacturer's standard metallic brown, aluminum, or other color as acceptable to Architect.

PART 3 EXECUTION

3.01 CASEWORK INSTALLATION

- A. Install plumb, level, true and aligned with no distortions. Shim as required, using concealed shims. Where laboratory casework abuts other finished work, scribe and apply filler strips for accurate fit with fasteners concealed where practicable.
- Base Cabinets: Set cabinets straight, plumb, and level. Adjust sub-tops within 1/16 inch of a single plane. Fasten each individual cabinet to floor at toe space with fasteners spaced 24 inches on center. Bolt continuous cabinets together. Secure individual cabinets with not less than 2 fasteners into floor where they do not adjoin other cabinets.
 - 1. Where required, assemble units into one integral unit with joints flush, tight, and uniform. Align similar adjoining doors and drawers to a tolerance of 1/16 inch.
- C. Install hardware uniformly and precisely after final finishing is complete. Set hinges snug and flat in mortises unless otherwise indicated. Turn screws to flat seat. Adjust and align hardware so that moving parts operate freely and contact points meet accurately. Allow for final field adjustment after installation.
- D. Adjust casework and hardware so that doors and drawers operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

3.02 INSTALLATION OF TOPS

- A. Field Jointing: Where practicable, make in same manner as factory jointing using dowels, splines, adhesives, and fasteners recommended by manufacturer. Locate field joints as shown on accepted shop drawings, factory-prepared so there is no jobsite processing of top and edge surfaces.
- B. Abut top and edge surfaces in one true plane, with internal supports placed to prevent any deflection. Provide flush hairline joints in top units using clamping devices. At stone-type material joints, use manufacturer's recommended adhesives and holding devices to provide joint widths not more than 1/16 inch wide at any location, completely filled and flush with abutting edges.
- C. Provide holes and cutouts as required for mechanical and electrical service fittings.
- D. Carefully dress joints smooth, remove any surface scratches, clean and polish entire surface.
- E. Provide scribe moldings for closures at junctures of top, curb, and splash with walls as recommended by manufacturer for materials involved. Use chemical-resistant, permanently elastic sealing compound where recommended by manufacturer.

3.03 INSTALLATION OF SINKS

- A. Underside Installation: Use manufacturer's recommended adjustable support system for table-type and cabinet-type installations.
- B. Set top edge of sink unit in manufacturer's recommended chemical-resistant sealing compound and firmly secure to produce a tight and fully leakproof joint. Adjust sink and securely support to prevent movement.
- C. Semiflush Installation: Use stainless steel sink frame, complete with clamping lugs and pads. Before setting, apply a full coat of manufacturer's recommended sealant under rim lip and along top. Omit sink frame if sink fabricated with integral rim seal.

3.04 INSTALLATION OF ACCESSORIES

A. Install accessories in accordance with approved location drawings and manufacturer's installation recommendations. Turn screws to a flat seat; do not drive. Adjust moving parts to operate freely and smoothly without binding.

3.05 CLEANING AND PROTECTION

- A. Repair or remove and replace defective work as directed upon completion of installation.
- B. Clean factory- and shop-finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as acceptable to Designer/Architect.
- C. Protection: Provide 6-mil plastic or other suitable water-resistant covering over countertop surfaces. Tape to underside of countertop at minimum of 4 feet on center. Advise Contractor of procedures and precautions for subsequent protection of installed laboratory casework and fittings from damage by work of other trades.

END OF SECTION

SECTION 200100 - GENERAL PROVISIONS - MECHANICAL

1. GENERAL

- A. The Advertisement for Bids, Instructions to Bidders, Bidding Requirements, General, Special and Supplementary Conditions, and all other contract documents shall apply to the Contractor's work as well as to each of his Sub-Contractor's work. All manufacturers, suppliers, fabricators, contractors, etc. submitting proposals to any part if for work, services, materials or equipment to be used on or applied to this project are hereby directed to familiarize themselves with all documents pertinent to this Contract. In case of conflict between these General Provisions and the General and/or Special Conditions, the affected Contractor shall contact the Engineer for clarification and final determination.
- B. Each Proposer shall also be governed by any unit prices and Addenda insofar as they may affect his part of the work or services.
- C. The work included in this division consists of the furnishing of all labor, equipment, transportation, excavation, backfill, supplies, material, appurtenances and services necessary for the satisfactory installation of the complete and operating Mechanical System(s) indicated or specified in the Contract Documents.
- D. Any materials, labor, equipment or services not mentioned specifically herein which may be necessary to complete or perfect any part of the Mechanical Systems in a substantial manner, in compliance with the requirements stated, implied or intended in the drawings and/or specifications, shall be included as part of this Contract.
- E. It is not the intent of this section of the specifications to make any Contractor, other than the General Contractor responsible to the Owner, Architect and Engineer. All transactions such as submittal of shop drawings, claims for extra costs, requests for equipment or materials substitution, shall be routed through the General Contractor to the Architect (if applicable), then to the Engineer. Also, this section of the specifications shall not be construed as an attempt to arbitrarily assign responsibility of work, material, equipment or services to a particular trade or Contractor. Unless stated otherwise, the subdivision and assignment of work under the various sections shall be optional.
- F. It is the intent of this Contract to deliver to the Owners a "like new" project once work is complete. Although plans and specifications are complete to the extent possible, it shall be the responsibility of the Contractors involved to remove and/or relocate or re-attach any existing or new systems which interfere with new equipment or materials required for the complete installation without additional cost to the Owner.
- G. In general, and to the extent possible, all work shall be accomplished without interruption of existing facilities operations. The Contractor shall advise the Owners at least two weeks prior to the interruption of any services or utilities. The Owners shall be advised of the exact time that interruption will occur and the length of time the interruption will last. Failure to comply with this requirement may result in complete work stoppage by the Contractors involved until a complete schedule of interruptions can be developed.
- H. Definitions and Abbreviations
 - Contractor Any Contractor whether proposing or working independently or under the supervision of a General Contractor and who installs any type of mechanical work (Controls, Plumbing, HVAC, Sprinkler, Gas Systems, etc.) or, the General Contractor.
 - (2) Engineer The Consulting Mechanical-Electrical Engineers either consulting to the Owners, Architect, other Engineers, etc. In this case: CMTA, Inc., Consulting Engineers.

- (3) Architect The Architect of Record for the project.
- (4) Furnish Deliver to the site in good condition and turn over to the Contractor who is to install.
- (5) Provide Furnish and install complete, tested and ready for operation.
- (6) Install Receive and place in satisfactory operation.
- (7) Indicated Listed in the Specifications, shown on the Drawings or Addenda thereto.
- (8) Typical Where indicated repeat this work, method or means each time the same or similar condition occurs whether indicated or not.
- (9) Contract Documents All documents pertinent to the quality and quantity of work to be performed on this project. Includes, but not limited to: Plans, Specifications, Instructions to Bidders, General and Special Conditions, Addenda, Alternates, Lists of Materials, Lists of Sub-Contractors, Unit Prices, Shop Drawings, Field Orders, Change Orders, Cost Breakdowns, Schedules of Value, Periodical Payment Requests, Construction Contract with Owners, etc.
- (10) Proposer Any person, agency or entity submitting a proposal to any person, agency or entity for any part of the work required under this contract.
- (11) OSHA Office of Safety and Health Administration.
- (12) KBC Kentucky Building Code.
- (13) The Project All of the work required under this Contract.
- (14) NEC National Electrical Code.
- (15) NFPA National Fire Protection Association.
- (16) ASME American Society of Mechanical Engineers.
- (17) AGA American Gas Association.
- (18) SMACNA Sheet Metal and Air Conditioning Contractors National Association.
- (19) ANSI American National Standards Institute.
- (20) ASHRAE American Society of Heating, Refrigeration and Air Conditioning Engineers.
- (21) NEMA National Electrical Manufacturers Association.
- (22) UL Underwriters Laboratories.
- (23) ADA Americans with Disabilities Act.
- (24) IMC International Mechanical Code.
- (25) IECC International Energy Conservation Code.

- (26) IFGC International Fuel Gas Code.
- I. Required Notices:
 - (1) Ten days prior to the submission of a proposal, each proposer shall give written notice to the Engineer of any materials or apparatus believed inadequate or unsuitable; in violation of laws, ordinances, rules or regulations of authorities having jurisdiction; and any necessary items of work omitted. In the absence of such written notice, Proposers signify that they have included the cost of all required items in the proposal and that the Proposer will be responsible for the safe and satisfactory operation of the entire system.

2. INTENT

- A. It is the intention of the Contract Documents to call for finished work, tested and ready for operation.
- B. Details not usually shown or specified, but necessary for the proper installation and operation of systems, equipment, materials, etc., shall be included in the work, the same as if herein specified or indicated.

3. DRAWINGS AND SPECIFICATIONS

- A. The drawings are diagrammatic only and indicate the general arrangement of the systems and are to be followed. If deviations from the layouts are necessitated by field conditions, detailed layouts of the proposed departures shall be submitted to the Engineer for approval before proceeding with the work. The drawings are not intended to show every item which may be necessary to complete the systems. All proposers shall anticipate that additional items may be required and submit their bid accordingly.
- B. The drawings and specifications are intended to supplement each other. No Proposer shall take advantage of conflict between them, or between parts of either. Should this condition exist, the Proposer shall request a clarification not less than twelve days prior to the submission of the proposal so that the condition may be clarified by Addendum. In the event that such a condition arises after work is started, the interpretation of the Engineer shall be final.
- C. The drawings and specifications shall be considered to be cooperative and anything appearing in the specifications which may not be indicated on the drawings or conversely, shall be considered as part of the Contract and must be executed the same as though indicated by both.
- D. Contractor shall make all his own measurements in the field and shall be responsible for correct fitting. He shall coordinate this work with all other branches of work in such a manner as to cause a minimum of conflict or delay.
- E. The Engineer shall reserve the right to make adjustments in location of piping, ductwork, equipment, etc. where such adjustments are in the interest of improving the project.
- F. Should conflict or overlap (duplication) of work between the various trades become evident, this shall be called to the attention of the Engineer. In such event neither trade shall assume that he is to be relieved of the work which is specified under his branch until instructions in writing are received from the Engineer.
- G. Unless dimensioned, the mechanical drawings only indicate approximate locations of equipment, piping, ductwork, etc. Dimensions given in figures on the drawings shall take precedence over scaled dimensions and all dimensions, whether given in figures or scaled, shall be verified in the field to ensure no conflict with other work.

- H. Each Proposer shall review all drawings including Architectural, Mechanical, Electrical, Fire Protection, Landscaping, Structural, Surveys, etc., to ensure that the work he intends to provide does not encroach a conflict with or affect the work of others in any way. Where such effect does occur it shall be the Proposer's responsibility to satisfactorily eliminate any such encroachment conflict or effect prior to the submission of his proposal. Each Proposer shall in particular ensure that there is adequate space to install his equipment and materials. Failure to do so shall result in the correction of such encroachment conflict or effect of any work awarded the proposer and shall be accomplished fully without expense to others and that they are reasonably accessible for maintenance. Check closely all mechanical and electrical closets, chases, ceiling voids, wall voids, crawl spaces, etc., to ensure adequate spaces.
- I. Where on the drawings a portion of the work is drawn out and the remainder is indicated in outline, or not indicated at all, the parts drawn out shall apply to all other like portions of the work. Where ornamentation or other detail is indicated by starting only, such detail shall be continued throughout the courses or parts in which it occurs and shall also apply to all other similar parts of the work, unless otherwise indicated.
- J. Details not usually shown or specified, but necessary for the proper installation and operation of systems, equipment, materials, etc., shall be included in the work, the same as if herein specified or indicated.
- K. Where on the Drawings or Addenda the word typical is used, it shall mean that the work method or means indicated as typical shall be repeated in and each time it occurs whether indicated or not.
- L. <u>Special Note</u>: Always check ceiling heights indicated on Architectural Drawings and Schedules and ensure that they may be maintained after all mechanical and electrical equipment is installed. Do not install equipment in the affected area until the conflict is resolved.

4. EXAMINATION OF SITE AND CONDITIONS

A. Each Proposer shall inform himself of all of the conditions under which the work is to be performed, the site of the work, the structure of the ground, above and below grade, the obstacles that may be encountered, the availability and location of necessary facilities and all relevant matters concerning the work. Each Proposer shall also fully acquaint himself with all existing conditions as to ingress and egress, distance of haul from supply points, routes for transportation of materials, facilities and services, availability of utilities, etc. His proposal shall cover all expenses or disbursements in connection with such matters and conditions. No allowance will be made for lack of knowledge concerning such conditions after bids are accepted.

5. EQUIPMENT AND MATERIALS SUBSTITUTIONS OR DEVIATIONS

- A. When any Contractor requests approval of materials and/or equipment of different physical size, capacity, function, color, access, it shall be understood that such substitution, if approved, will be made without additional cost to anyone other than the Contractor requesting the change regardless of changes in connections, space requirements, electrical characteristics, electrical services, etc., from that indicated. In all cases where substitutions affect other trades, the Contractor requesting such substitutions shall advise all such Contractors of the change and shall remunerate them for all necessary changes in their work. Any drawings, Specifications, Diagrams, etc., required to describe and coordinate such substitutions or deviations shall be professionally prepared at the responsible Contractor's expense. Review of Shop Drawings by the Engineers does not in any way absolve the Contractor of this responsibility.
- B. Notwithstanding any reference in the specifications to any article, device, product, material, fixture, form, or type of construction by name, make or catalog number, such reference shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition; any devices, products, materials, fixtures, forms, or types of construction which, in the judgment of the Engineer, are equivalent to those

specified are acceptable, provided the provisions of Paragraph (A) immediately preceding are met. Requested substitutions shall be submitted to the Engineer a minimum of twelve days prior to bids.

- C. Wherever any equipment and material is specified exclusively only such items shall be used unless substitution is accepted in writing by the Engineers.
- D. Each Proposer shall furnish along with his proposal a list of specified equipment and materials which he is to provide. Where several makes are mentioned in the specifications and the Contractor fails to state which he proposes to furnish, the Engineer shall choose any of the makes mentioned without change in price. Inclusion in this list shall not ensure that the Engineers will approve shop drawings unless the equipment, materials, etc., submitted in shop drawings is satisfactorily comparable to the items specified and/or indicated.

6. SUPERVISION OF WORK

A. The Contractor shall personally supervise the work for which he is responsible or have a competent superintendent, approved by the Engineers, on the work at all times during progress with full authority to act for him.

7. CODES, RULES, PERMITS, FEES, INSPECTIONS, REGULATIONS, ETC.

- A. The Contractor shall give all necessary notices, obtain and pay for all permits, government sales taxes, fees, inspections and other costs, including all utility connections, meters, meter settings, taps, tap fees, extensions, water and/or sewer system development charge, etc. in connection with his work. He shall also file all necessary plans, prepare all documents and obtain all necessary approvals of all governmental departments and/or the appropriate municipality or utility company having jurisdiction, whether indicated or specified or not. He shall hire an independent Registered Engineer to witness installations and provide necessary certifications where required by utility companies, municipal agencies or others that have review authority. He shall also obtain all required certificates of inspection for his work and deliver same to the Engineers before request for acceptance and final payment for the work. Ignorance of Codes, Rules, Regulations, Laws, etc. shall not render the Contractor irresponsible for compliance. The Contractor shall also be versed in all Codes, Rules and Regulations pertinent to his part of the work prior to submission of a proposal.
- B. The Contractor shall include in his work, without extra cost, any labor, materials, services, apparatus and drawings in order to comply with all applicable laws, ordinances, rules and regulations, whether or not indicated or specified.
- C. All materials furnished and all work installed shall comply with the National Fire Codes of the National Fire Protection Association, with the requirements of local utility companies, or municipalities and with the requirements of all governmental agencies having jurisdiction.
- D. All materials and equipment so indicated and all equipment and materials for the electrical portion of the mechanical systems shall bear the approval label of, or shall be listed by the Underwriters' Laboratories (UL), Incorporated. Each packaged assembly shall be approved as a package. Approval of components of a package shall not be acceptable. Where required by the Code and/or the Authority Having Jurisdiction, provide the services of a field labeling agency to provide a UL label for the entire system in the field under evaluation.
- E. All plumbing work is to be constructed and installed in accordance with plans and specifications which have been approved in their entirety and/or reflect any changes requested by the State Department of Health. Plumbing work shall not commence until such plans are in the hands of the Contractor.

- F. All Heating, Ventilation and Air Conditioning work shall be accomplished in accordance with the Kentucky Building Code (KBC) and amendments thereto, the latest standards recognized by the American Society of Heating, Refrigerating and Air Conditioning and the National Fire Protection Association. Contractor shall secure a permit from the Division of HVAC. Final inspection certificate shall be provided by Contractor and a copy included in Operation and Maintenance Manuals.
- G. The Contractor shall furnish three (3) copies of all Final Inspection Certificates obtained to the Engineer when work is complete. Final payment for work will be contingent upon compliance with this requirement.
- H. Where minimum code requirements are exceeded in the Design, the Design shall govern.
- I. The Contractor shall ensure that his work is accomplished in accord with the OSHA Standards and that he conducts his work and the work of his personnel in accord with same.
- J. Work in elevators, elevator shafts and elevator equipment rooms shall comply with the Elevator Code enforced by the Commonwealth of Kentucky.
- K. All work relating to the handicapped shall be in accord with regulations currently enforced by the Department of Housing, Buildings and Construction, Commonwealth of Kentucky and the American Disabilities Act.
- L. All work in conjunction with a natural gas installation shall, in addition to all other Codes, Rules, Regulations, Standards, etc., comply with the requirements of the local gas supplier and/or standards and recommendations of the American Gas Association.
- M. All work in relation to domestic water systems shall, in addition to all other Codes, Rules, Regulations and Standards, be in compliance with the requirements of the local water utility company and the adopted edition of the 10 States Standards.
- N. All work in relation to the installation of sanitary or storm sewers shall, in addition to all other Codes, Rules, Regulations and Standards, be in compliance with the local agency governing such installations and the adopted edition of the 10 States Standards.
- O. All work relating to the handicapped shall be in accord with regulations currently enforced by the Department of Housing, Buildings, and Construction, Commonwealth of Kentucky and the American Disabilities Act.
- P. The Contractor shall provide the services of a qualified third party independent inspector to perform all required special inspections required by KBC, as follows:
 - (1) Mechanical and Electrical Component Seismic Bracing per KBC 1705.

8. EQUIPMENT AND PIPING SUPPORT

A. Each piece of equipment, apparatus, piping, or conduit suspended from the structure or mounted above the floor level shall be provided with suitable structural support, pipe stand, platform or carrier in accordance with the best recognized practice. Such supporting or mounting means shall be provided by the Contractor for all equipment and piping. Exercise extreme care that structural members of building are not overloaded by such equipment. Provide any required additional bracing, cross members, angles, support, etc., as indicated or required by the Structural Engineer. This, in some instances, will require the Contractor to add an angle to a joist to transfer the load to a panel point. If in doubt, contact the Structural Engineer.

9. DUCT AND PIPE MOUNTING HEIGHTS

A. All exposed or concealed ductwork, piping, etc., shall be held as high as possible unless otherwise noted and coordinated with all other trades. Exposed piping and ductwork shall, insofar as possible, run perpendicular or parallel to the building structure.

10. COST BREAKDOWNS (SCHEDULE OF VALUES)

A. Within thirty days after acceptance of the Contract, the Contractor shall furnish to the Engineer, one copy of a detailed cost breakdown on each respective area of work. These cost breakdowns shall be made in a format approved by the Engineer. Payments will not be made until satisfactory cost breakdowns are submitted.

11. CORRECTION PERIOD

- A. All equipment, apparatus, materials, and workmanship shall be the best of its respective kind. The Contractor shall replace all parts at his own expense, which are proven defective as described in the General Conditions. The effective date of completion of the work shall be the date of the Architect's or Engineer's <u>Statement of Substantial Completion</u>. Items of equipment which have longer guarantees, as called for in these specifications, shall have warranties and guarantees completed in order, and shall be in effect at the time of final acceptance of the work by the Engineer. The Contractor shall present the Engineer with such warranties and guarantees at the time of final acceptance. Such use of equipment shall not invalidate the guarantee except that the Owner shall be liable for any damage to equipment during this period, due to negligence of his operator or other employees. Refer to other sections for any special or extra warranty requirements.
- B. It is further clarified that all required and specified warranties shall begin on the date of Substantial Completion, not at the time of equipment start-up.
- C. All gas fired heat exchangers shall have 20 year warranty.
- D. All compressors shall have five year warranty.

12. COMPUTER-BASED SYSTEM SOFTWARE

A. For all equipment, controls, hardware, computer-based systems, programmable logic controllers, and other materials provided as a part of the work, software that is installed shall be certified in writing to the Engineer and Owner by the manufacturer and/or writer to be free of programming errors that might affect the functionality of the intended use.

13. CHANGES IN MECHANICAL WORK

REFER TO GENERAL AND SPECIAL CONDITIONS.

14. CLAIMS FOR EXTRA COST

REFER TO GENERAL AND SPECIAL CONDITIONS.

15. SURVEY, MEASUREMENTS AND GRADE

- A. The Contractor shall lay out his work and be responsible for all necessary lines, levels, elevations and measurements. He must verify the figures shown on the drawings before laying out the work and will be held responsible for any error resulting from his failure to do so.
- B. The Contractor shall base all measurements, both horizontal and vertical from established bench marks. All work shall agree with these established lines and levels. Verify all measurements at the site and check the correctness of same as related to the work.
- C. Should the Contractor discover any discrepancy between actual measurements and those indicated, which prevents following good practice or the intent of the contract documents, he shall promptly notify the Engineer and shall not proceed with this work until he has received instructions from the Engineer on the disposition of the work.

16. TEMPORARY USE OF EQUIPMENT

- A. The permanent heating and plumbing equipment, when installed, may be used for temporary services, with the consent of the Engineers. Should the permanent systems be used for this purpose the Contractors shall make all temporary connections required at their expense. They shall also make any replacement required due to damage wear and tear, etc., leaving the same in "as new" condition.
- B. Permission to use the permanent equipment does not relieve the Contractors from the responsibility for any damages to the building construction and/or equipment which might result because of its use.
- C. A pre-start-up conference shall be held with the Architect, Owner, General Contractor and the Mechanical Contractor. Equipment shall not be started until after this meeting.
- D. During all phases of construction:
 - (1) Rooftop Units (Auxiliary Gym)
 - At a minimum, four complete sets of filter media are required for each unit. In each unit, install two sets of filter media during construction (more shall be required if construction activities dictate more frequent changes). In each unit, install one set of filter media at substantial completion. Leave one set of filter media in boxes in appropriate mechanical room as a spare set for the Owner. All other filters shall be used by the Contractor during construction. Dispose of all construction filter media.
 - b. On the outside of all return air openings install a minimum of two sets of fiberglass filter media, such as cheesecloth, to be utilized as pre-filters for the "construction" filters. Install first set upon start-up and then install second set when first set is dirty. Dispose of all dirty construction filters. Change filters as often as necessary to keep units from becoming dirty at no additional cost.
 - c. At substantial completion of the project the entire unit shall be cleaned to present a like "new" unit for the Owner and all filters shall be replaced with new.
 - (2) Heat Pump Units/Split System Air Handlers in Auxiliary Gym:
 - At a minimum, four complete sets of filter media are required for each unit. In each unit, install two sets of filter media during construction (more shall be required if construction activities dictate more frequent changes). In each unit, install one set of filter media at substantial completion. Leave one set of filter media in boxes in appropriate mechanical room as a spare set for the Owner. All other filters shall be used by the Contractor during construction. Dispose of all construction filter media.

- b. On the outside of all return air openings install a minimum of two sets of fiberglass filter media, such as cheesecloth, to be utilized as pre-filters for the "construction" filters. Install first set upon start-up and then install second set when first set is dirty. Dispose of all dirty construction filters. Change filters as often as necessary to keep units from becoming dirty at no additional cost.
- c. At substantial completion of the project the entire unit shall be cleaned to present a like "new" unit for the Owner and all filters shall be replaced with new.
- (3) Outside Air Units:
 - a. These units shall not be used for temporary heating and cooling by the Contractor. They shall, however, be made operational, tested, etc. as specified during construction by the Contractor. Three complete sets of filters are required for each unit. In each unit, install one set of filters during construction. In each unit, install one set of filters at substantial completion. For each unit, leave third set of filters in boxes in appropriate mechanical room as a spare set for the Owner. Dispose of all construction filters.
 - b. At substantial completion of the project the entire unit shall be cleaned to present a like "new" unit for the Owner and all filters shall be replaced with new.

17. TEMPORARY SERVICES

A. The Contractor shall arrange any temporary water, electrical and other services which he may require to accomplish his work. Refer also to General and Special Conditions.

18. RECORD DRAWINGS

A. The Contractor shall ensure that any deviations from the Design are as they occur recorded in red, erasable pencil on record drawings kept at the jobsite. The Engineer shall review the record documents from time to time to ensure compliance with this specification. Compliance shall be a contingency of final payment. Pay particular attention to the location of under floor sanitary and water lines, shut-off valves, cleanouts and other appurtenances important to the maintenance and operation of Mechanical Systems. Also, pay particular attention to Deviations in the Control Systems and all exterior utilities. Keep information in a set of drawings set aside at the job site especially for this purpose. Deliver these record drawings electronically in AutoCAD 2000 format along with the hand marked field set to the Engineer. Electronic bid drawings will be furnished to the Contractor for his use.

19. MATERIALS AND WORKMANSHIP

- A. All equipment, materials and articles incorporated in the work shall be new and of comparable quality to that specified. Each Proposer shall determine that the materials and/or equipment he proposes to furnish can be brought into the building(s) and installed within the space available. In certain cases, it may be necessary to remove and replace walls, floors and/or ceilings and this work shall be the responsibility of the Contractor. All equipment shall be installed so that all parts are readily accessible for inspection, maintenance, replacement of filters, etc. Extra compensation will not be allowed for relocation of equipment for accessibility or for dismantling equipment to obtain entrance into the building(s). Ensure, through coordination, that no other Contractor seals off access to space required for equipment, materials, etc.
- B. Materials and equipment, where applicable, shall bear Underwriters' Laboratories label where such a standard has been established.

- C. Use extreme care in the selection of equipment and its installation to ensure that noise and vibration are kept at a minimum. The Engineer's determination shall be final and corrections to such discrepancies shall be made at the cost of the Contractor.
- D. Each length of pipe, fitting, trap, fixture and device used in the plumbing or drainage systems shall be stamped or indelibly marked with the weight or quality thereof and with the manufacturer's mark or name.
- E. All equipment shall bear the manufacturer's name and address. All electrically operated equipment shall bear a data plate indicating required horsepower, voltage, phase and ampacity.

20. COOPERATION AND COORDINATION WITH OTHER TRADES

- A. The Contractor shall give full cooperation to all other trades and shall furnish in writing with copies to the Engineer, any information necessary to permit the work of other trades to be installed satisfactorily and with the least possible interference or delay.
- B. Where any work is to be installed in close proximity to, or will interfere with work of other trades, each shall cooperate in working out space conditions to make a satisfactory adjustment. If so directed by the Engineer, the Contractor shall prepare composite working drawings and sections at a suitable scale not less than $1/4^{"} = 1'$ -0", clearly indicating how his work is to be installed in relation to the work of other trades, or so as not to cause any interference with work of other trades. He shall make the necessary changes in his work to correct the condition without extra charge.
- C. The Contractor shall furnish to other trades, as required, all necessary templates, patterns, setting plans, and shop details for the proper installation of work and for the purpose of coordinating adjacent work.

21. QUALIFICATIONS OF WORKMEN

- A. All mechanical work shall be accomplished by qualified workmen competent in the area of work for which they are responsible. Untrained and incompetent workmen, as evidenced by their workmanship, shall be summarily relieved of their responsibilities in areas of incompetency. The Engineer shall reserve the right to determine the quality of workmanship of any workman and unqualified or incompetent workman shall refrain from work in areas not satisfactory to him. Requests for relief of a workman shall be made through the normal channels of Architect, Contractor, etc.
- B. All plumbing work shall be accomplished by Journeymen Plumbers under the direct supervision of a Master Plumber as defined and clarified under Kentucky State Plumbing Law Regulations and Code. Proof and Certification may be requested by the Engineer.
- C. All sheet metal, insulation and pipe fitting work shall be installed by workmen normally engaged or employed in these respective trades, except where only small amounts of such work are required and are within the competency of workmen directly employed by the Contractor involved.
- D. All automatic control systems shall be installed by workmen normally engaged or employed in this type work, except in the case of minor control requirements (residential type furnaces, packaged HVAC equipment with integral controls, etc.) in which case, if a competent workman is the employee of this Contractor, he may be utilized subject to review of his qualifications by the Engineer and after written approval from same.
- E. All special systems (Automatic Sprinkler Equipment, etc.) shall be installed only by workmen normally engaged in such services. Exception to this specification may only be made in writing by the Engineer.

F. All electrical work shall be installed only by competent workmen under direct supervision of a fully qualified Electrician.

22. CONDUCT OF WORKMEN

A. The Contractor shall be responsible for the conduct of all workmen under his supervision. Misconduct on the part of any workman to the extent of creating a safety hazard, or endangering the lives and property of others, shall result in the prompt relief of that workman. The consumption of alcoholic beverages or other intoxicants, narcotics, barbiturates, hallucinogens or debilitating drugs on the job site is strictly forbidden.

23. PROTECTION OF MATERIALS AND EQUIPMENT

A. The Contractor shall be entirely responsible for all material and equipment furnished by him in connection with his work and special care shall be taken to properly protect all parts thereof from physical, sun, and weather damage during the construction period. Such protection shall be by a means acceptable to the manufacturer and Engineer. All rough-in soil, waste, vent and storm piping, ductwork, etc., shall be properly plugged or capped during construction in a manner approved by the Engineer. Equipment damaged, stolen or vandalized while stored on site, either before or after installation, shall be repaired or replaced by the Contractor at his own expense.

24. SCAFFOLDING, RIGGING AND HOISTING

A. The Contractor shall furnish all scaffolding, rigging, hoisting and services necessary for erection and delivery onto the premises of any equipment and apparatus furnished. All such temporary appurtenances shall be set up in strict accord with OSHA Standards and Requirements. Remove same from premises when no longer required.

25. BROKEN LINES AND PROTECTION AGAINST FREEZING

A. No conduits, piping, troughs, etc. carrying water or any other fluid subject to freezing shall be installed in any part of the building where danger of freezing may exist without adequate protection being given by the Contractor whether or not insulation is specified or indicated on the particular piping. All damages resulting from broken and/or leaking lines shall be replaced or repaired at the Contractor's own expense. If in doubt, contact the Engineer. Do not install piping across or near openings to the outside whether they are carrying static or moving fluids or not. Special Note: Insulation on piping does not necessarily ensure that freezing will not occur.

26. CLEANING

- A. The Contractor shall, at all times, keep the area of his work presentable to the public and clean of rubbish and debris caused by his operations; and at the completion of the work, shall remove all rubbish, debris, all of his tools, equipment, temporary work and surplus materials from and about the premises, and shall leave the area clean and ready for use. If the Contractor does not attend to such cleaning upon request, the Engineer may cause cleaning to be done by others and charge the cost of same to the Contractor. The Contractor shall be responsible for all damage from fire which originates in, or is propagated by, accumulations of his rubbish or debris.
- B. After completion of all work and before final acceptance of the work, the Contractor shall thoroughly clean all equipment and materials and shall remove all foreign matter such as grease, dirt, plaster, labels, stickers, etc., from the exterior of piping, equipment, fixtures and all other associated or adjacent fabrication.

27. CONCRETE WORK

- A. The Contractor shall be finally responsible for the provisions of all concrete work required for the installation of any of his systems or equipment. He may, at his option, arrange with the others to provide the work. This option, however, will not relieve the Contractor of his responsibilities relative to dimensions, quality of workmanship, locations, etc. In the absence of other concrete specifications, all concrete related to Mechanical work shall be 3000 psi minimum compression strength at 28 days curing and shall conform to the standards of the American Concrete Institute Publication AC1-318. Heavy equipment shall not be set on pads for at least seven (7) days after pour. Insert 6-inch steel dowel rods into floors to anchor pads.
- B. All mechanical equipment (tanks, heaters, chillers, boilers, pumps, air handling units, etc.) shall be set on a minimum of 4" tall concrete pads. Pads shall be taller where required for condensate traps. All concrete pads shall be complete with all pipe sleeves, anchor bolts, reinforcing steel, concrete, etc. as required. Pads larger than 18" in width shall be reinforced with ½" round bars on 6" centers both ways. Bars shall be approximately 3" above the bottom of the pad. All parts of pads and foundations shall be properly rodded or vibrated. If exposed parts of the pads and foundations are rough or show honeycomb after removing forms, all surfaces shall be rubbed to a smooth surface. Chamfer all square edges one-half inch.
- C. In general, concrete pads for equipment shall extend four (4) inches beyond the equipment's base dimensions. Where necessary, extend pads 30 inches beyond base or overall dimensions to allow walking and servicing space.
- D. Exterior concrete pads shall be four (4) inches minimum above grade and four (4) inches below grade on a tamped four (4) inch dense grade rock base unless otherwise indicated or specified. Surfaces of all foundations and bases shall have a smooth finish with one-half (1/2) inch chamfer on exposed edges.
- E. All exterior below grade concrete structures (utility vaults, grease traps, manholes, etc.) shall be provided with exterior waterproofing. Waterproofing shall be hot-fluid applied rubberized-asphalt waterproofing membrane with elastomeric sheets at edges, corners, and terminations of membrane for continuous watertight construction. Apply in layers and reinforce as required to provide uniform seamless membrane minimum 4mm thickness. Also, seal penetrations into and out of the structure watertight. Provide Link-Seal modular seal or equal.

28. NOISE, VIBRATION OR OSCILLATION

- A. All work shall operate under all conditions of load without any sound or vibration which is objectionable in the opinion of the Engineer. In case of moving machinery, sound or vibration noticeable outside of room in which it is installed, or annoyingly noticeable inside its own room, will be considered objectionable. Sound or vibration conditions considered objectionable by the Engineer shall be corrected in an approved manner by the Contractor at his expense.
- B. All equipment subject to vibration and/or oscillation shall be mounted on vibration supports whether indicated or not suitable for the purpose of minimizing noise and vibration transmission, and shall be isolated from external connections such as piping, ducts, etc. by means of flexible connectors, vibration absorbers, or other approved means. Unitary equipment, such as small room heating units, small exhaust fans, etc., shall be rigidly braced and mounted to wall, floor or ceiling as required and tightly gasketed and sealed to mounting surface to prevent air leakage and to obtain quiet operation. Flush and surface mounted equipment such as diffusers, etc., shall be gasketed and affixed tightly to their mounting surface.
- C. The Contractor shall provide supports for all equipment furnished by him. Supports shall be liberally sized and adequate to carry the load of the equipment and the loads of attached equipment, piping, etc. All equipment shall be securely fastened to the structure either directly or indirectly through supporting

members by means of bolts or equally effective means. If strength of supporting structural members is questionable, contact Engineers.

29. ACCESSIBILITY

- A. The Contractor shall be responsible for the sufficiency of the size of shafts and chases, the adequate clearance in double partitions and hung ceilings for the proper installation of his work. He shall cooperate with all others whose work is in the same space. Such spaces and clearances shall, however, be kept to the minimum size required.
- B. The Contractor shall locate and install all equipment so that it may be serviced, and maintained as recommended by the manufacturer. Allow ready access and removal of the entire unit and/or parts such as valves, filters, fan belts, motors, prime shafts, etc.
- C. The Contractor shall provide access panels for each concealed valve, control damper or other device requiring service as shown on engineer's plans or as required. Locations of these panels shall be identified in sufficient time to be installed in the normal course of work.

30. RESTORATION OF NEW OR EXISTING SHRUBS, PAVING, SURFACES, ETC.

A. The Contractor shall at his expense restore to their original conditions all paving, curbing, surfaces, drainage ditches, structures, fences, shrubs, existing or new building surfaces and appurtenances, and any other items damaged or removed by his operations. Replacement and repairs shall be in accordance with good construction practice and shall match materials employed in the original construction of the item and shall be to the satisfaction of the Architect and/or Engineer.

31. MAINTENANCE OF EXISTING UTILITIES AND LINES

- A. The locations of all piping, conduits, cables, utilities and manholes existing, or otherwise, that comes within the contract construction site, shall be subject to continuous uninterrupted service with no other exception than the Owner of the utilities permission to interrupt same temporarily.
- B. Utilities and lines, where known, are indicated on the drawings. Locations and sizes are approximate. Prior to any excavation being performed, the Contractor shall ascertain that no utilities or lines are endangered by new excavation. Exercise extreme caution in all excavation work.
- C. If utilities or lines occur in the earth within the construction site, the Contractor shall probe and locate the lines prior to machine excavation or blasting in the respective area.
- D. Cutting into existing utilities and services where required shall be done in coordination with and only at times designated by the Owner of the utility.
- E. The Contractor shall repair to the satisfaction of the Engineer, any surfaces or subsurface improvements damaged during the course of the work, unless such improvement is shown to be abandoned or removed.
- F. Machine excavation shall not be permitted with ten feet of electrical lines or lines carrying combustible and/or explosive materials. Hand excavate only.
- G. Protect all new or existing lines from damage by traffic, etc. during construction. Repairs or replacement of such damage shall be at the sole expense of the party responsible.

32. SMOKE AND FIRE PROOFING

A. The Contractor shall fire and smoke stop all openings made in fire or smoke rated walls, chases, ceilings and floors in accord with the KBC. Patch all openings around ductwork and piping with appropriate type material to stop smoke at smoke walls and provide commensurate fire rating at fire walls, floors, ceilings, roofs, etc. Back boxes in rated walls shall be a minimum distance apart as allowed by code to maintain the rating. If closer provide rated box or fireproofing in code approved manner.

33. MOTORS

- A. Motors shall be built in accordance with the latest standards of NEMA and as specified. Motors shall be tested in accordance with standards of A.S.A. C50, conforming to this and all applicable standards for insulation resistance and dielectric strength.
- B. Each motor shall be provided by the equipment supplier, installer or manufacturer with conduit terminal box, and N.E.C. required disconnecting means as specified or required. Three-phase motors shall be provided with external thermal overload protection in their starter units. Single-phase motors shall be provided with thermal overload protection, integral to their windings or external, in control unit. All motors shall be installed with NEMA-rated starters as specified and shall be connected per the National Electrical Code.
- C. The capacity of each motor shall be sufficient to operate associated driven devices under all conditions of operation and load and without overload, and at least of the horsepower indicated or specified. Each motor shall be selected for quiet operation, maximum efficiency and lowest starting KVA per horsepower. Motors producing excessive noise or vibration shall be replaced by the responsible contractor. See Division 26 of Specifications for further requirements related to installation of motors.

34. CUTTING AND PATCHING

- A. The Contractor shall provide his own cutting and patching necessary to install his work. Patching shall match adjacent surfaces and shall be to the satisfaction of the Architect and Engineer.
- B. No structural members shall be cut without the approval of the Engineer and all such cutting shall be done in a manner directed by him.
- C. When installing conduit, pipe, or any other work in insulated concrete form (ICF) walls, the responsible subcontractor for the work shall provide spray foam insulation to patch the rigid insulation to maintain full integrity of the insulating value of the wall after the mechanical and electrical work is complete. Furthermore all new work shall NOT be installed in concrete center of wall. All mechanical and electrical installations shall be on the interior side of the concrete.

35. CURBS, PLATES, ESCUTCHEONS & AIR TIGHT PENETRATIONS

- A. In all areas where ducts are exposed and ducts pass thru floors, the opening shall be surrounded by a 4 inch high by 3 inch wide concrete curb.
- B. Escutcheon plates shall be provided for all pipes and conduit passing thru walls, floors and ceilings. Plates shall be nickel plated, of the split ring type, of size to match the pipe or conduit. Where plates are provided for pipes passing thru sleeves which extend above the floor surface, provide deep recessed plates to conceal the pipe sleeves.
- C. Seal all duct, pipe, conduit, etc., penetrations through walls and floors air tight. If wall or floor assembly is rated then use similarly rated sealing method.

36. WEATHERPROOFING

A. Where any work pierces waterproofing including waterproof concrete, the method of installation shall be as approved by the Engineer before work is done. The Contractor shall furnish all necessary sleeves, caulking and flashing required to make openings permanently watertight.

37. OPERATING INSTRUCTIONS, MAINTENANCE MANUALS AND PARTS LISTS

- A. Upon completion of all work tests, the Contractor shall instruct the Owner or his representative(s) fully in the operations, adjustment and maintenance of all equipment furnished. The time and a list of representatives required to be present will be as directed by the Engineer. Turn over all special wrenches, keys, etc., to the owner at this time.
- B. The Contractor shall furnish three (3) complete bound sets for delivery to the Engineer of typewritten and/or blueprinted instructions for operating and maintaining all systems and equipment included in this contract. All instructions shall be submitted in draft, for approval, prior to final issue. Manufacturer's advertising literature or catalogs alone will not be acceptable for operating and maintenance instructions.
- C. The Contractor, in the instructions, shall include a preventive maintenance schedule for the principal items of equipment furnished under this contract and a detailed, parts list and the name and address of the nearest source of supply.
- D. The Contractor shall frame under Lexan in the main mechanical room all temperature control diagrams and all piping diagrams.

38. PAINTING

- A. In general, all finish painting shall be accomplished under the Painting Section of the specifications by the Contractor; however, unless otherwise specified under other sections of these specifications, the following items shall be painted:
 - (1) All exposed piping, valve bodies and fittings (bare and insulated), including hangers, platforms, etc.
 - (2) All mechanical equipment not factory finished. Aluminum and stainless steel equipment, motors, identification plates, tags, etc. shall not be painted. All rust and foreign matter shall be thoroughly removed from surfaces prior to painting. All baked enamel factory finish of equipment which may have been scratched or chipped shall be touched up with the proper paint as recommended and supplied by the manufacturer.
 - (3) All ductwork exposed in finished areas (bare and insulated), all grilles, diffusers, etc. not factory finished. Paint the inside surfaces of all interior duct surfaces visible from any register, grille or diffuser opening on all jobs; surfaces shall receive one (1) prime coat of Rustoleum 1225 red "galvinoleum" or other approved equivalent primer and rust inhibitor and one (1) coat of Rustoleum 1579 jet black "Speedy Dry" enamel or approved equivalent applied in accordance with the manufacturer's recommendations.
 - (4) All insulated piping, ductwork and equipment shall be properly prepared for painting by the Contractor where mechanical items are to be painted. In the case of externally insulated duct and pipe, the Contractor shall provide 6 oz. canvas jacket with fire retardant lagging. The jacket shall be allowed to dry properly before applying paint to avoid shrinking after painting and exposing unpainted surfaces.

The Contractor, at his option, may provide double wall ductwork in lieu of externally insulated ductwork with canvas jacket and lagging.

39. ELECTRICAL CONNECTIONS

- A. The Contractor shall furnish and install all (1) temperature control wiring; (2) equipment control wiring and (3) interlock wiring. The Contractor shall furnish and install all power wiring complete from power source to motor or equipment junction box, including power wiring thru starters, and shall furnish and install all required starters not factory mounted on equipment.
- B. The Contractor shall, regardless of voltage, furnish and install all temperature control wiring and all associated interlock wiring, all equipment control wiring and conduit for the equipment that the Contractor furnishes. He may, at his option, employ at his own expense, the Electrical Contractor to accomplish this work.
- C. After all circuits are energized and completed, the Contractor shall be responsible for all power wiring, and all control wiring shall be the responsibility of the Contractor. Motors and equipment shall be provided for current characteristics as shown on the drawings.
- D. The Contractor shall furnish motor starters of the type and size required by the manufacturer for all equipment provided by him, where such starters are necessary. Starters shall have overloads for each phase.

40. FINAL CONNECTIONS TO EQUIPMENT

A. The Contractor shall finally connect to mechanical services, any terminal equipment, appliances, etc., provided under this and other divisions of the work. Such connections shall be made in strict accord with current codes, safety regulations and the equipment manufacturer's recommendations. If in doubt, contact the Engineers prior to installation.

41. REQUIRED CLEARANCE FOR ELECTRICAL EQUIPMENT

A. The NEC has specific required clearances above, in front, and around electrical gear, panels etc. The Contractor shall not install any piping, ductwork, etc., in the required clearance. If any appurtenance is located in the NEC required clearance, it shall be relocated at no additional cost.

42. INDEMNIFICATION

A. The Contractor shall hold harmless and indemnify the Engineer, employees, officers, agents and consultants from all claims, loss, damage, actions, causes of actions, expense and/or liability resulting from, brought for, or on account of any personal injury or property damage received or sustained by any person, persons, (including third parties), or any property growing out of, occurring, or attributable to any work performed under or related to this contract, resulting in whole or in part from the negligence of the Contractor, any subcontractor, any employee, agent or representative.

43. HAZARDOUS MATERIALS

A. The Contractor is hereby advised that it is possible that asbestos and/or other hazardous materials are or were present in this building(s). Any worker, occupant, visitor, inspector, etc., who encounters any material of whose content they are not certain shall promptly report the existence and location of that material to the Contractor and/or Owner. The Contractor shall, as a part of his work, ensure that his workers are aware of this potential and what they are to do in the event of suspicion. He shall also keep uninformed persons from

the premises during construction. Furthermore, the Contractor shall ensure that no one comes near to or in contact with any such material or fumes therefrom until its content can be ascertained to be non-hazardous.

- B. CMTA, Inc., Consulting Engineers, have no expertise in the determination of the presence of hazardous materials. Therefore, no attempt has been made by them to identify the existence or location of any such material. Furthermore, CMTA nor any affiliate thereof will neither offer nor make any recommendations relative to the removal, handling or disposal of such material.
- C. If the work interfaces, connects or relates in any way with or to existing components which contain or bear any hazardous material, asbestos being one, then, it shall be the Contractor's sole responsibility to contact the Owner and so advise him immediately.
- D. The Contractor by execution of the contract for any work and/or by the accomplishment of any work thereby agrees to bring no claim relative to hazardous materials for negligence, breach of contract, indemnity, or any other such item against CMTA, its principals, employees, agents or consultants. Also, the Contractor further agrees to defend, indemnify and hold CMTA, its principals, employees, agents and consultants, harmless from any such related claims which may be brought by any subcontractors, suppliers or any other third parties.

44. ABOVE-CEILING AND FINAL PUNCH LISTS

- A. The Contractor shall review each area and prepare a punch list for each of the subcontractors, as applicable, for at least two stages of the project:
 - (1) For review of above-ceiling work that will be concealed by tile or other materials well before substantial completion.
 - (2) For review of all other work as the project nears substantial completion.
- B. When <u>all</u> work from the Contractor's punch list is complete at each of these stages and <u>prior</u> to completing ceiling installations (or at the final punch list stage), the Contractor shall request that the Engineer develop a punch list. This request is to be made in writing seven days prior to the proposed date. After all corrections have been made from the Engineer's punch list, the Contractor shall review and initial off on <u>each</u> item. This signed-off punch list shall be submitted to the Engineer. The Engineer shall return to the site <u>once</u> to review each punch list and all work <u>prior to</u> the ceilings being installed and at the final punch list review.
- C. If additional visits are required by the Engineer to review work not completed by this review, the Engineer shall be reimbursed directly by the Contractor at a rate of \$140.00 per hour for extra trips required to complete either of the above-ceiling or final punch lists.



The following is CMTA's guide for Division 20-25 required information relative to the Schedule of Values. Please utilize all items that pertain to this project and add any specialized system as required. A thorough and detailed schedule of values will allow for fair and equitable Pay Application approval and minimize any discrepancies as to the status of the job.

DIVISION 20-25 – MECHANICAL Field Representative: Project Engineer:				
Description of Work	Scheduled Value	Labor	Material	
Shop Drawings				
Mobilization/Permits				
Demolition				
Geothermal Horizontal Piping and Vault				
Geothermal Wells, Vertical pipe and grout				
Plumbing Underslab				
Sanitary Above Slab Rough-in				
Plumbing Fixtures				
Plumbing Inspections				
Sprinkler Plan Submittals				
Fire Protection Exterior				
Fire Protection Vault				
Fire Protection Interior				
Storm Piping Exterior				
Storm Piping Interior				
Plumbing Shop Drawings				
Mechanical Shop Drawings				
Domestic Water Piping				

Domestic Water Insulation		
Hydronic Piping		
Gas Piping Exterior		
Gas Piping Interior		
HVAC Sheet Metal		
Heat Pumps		
Pumps & Assoc. Equipment		
Grilles & Diffusers		
Insulation		
Controls		
Air Balance		
Water Balance		
Chemical Treatment		
Factory Start-Up Reports		
Owner Training		
Record Drawings		
O & M Manuals		
Punchlist/Closeout		
Controls Check-out		

END OF SECTION 200100

SECTION 200200- SCOPE OF THE MECHANICAL WORK

1. GENERAL

- A. The Mechanical work for this Contract shall include all labor, materials, equipment, fixtures, excavation, backfill and related items required to completely install, test, place in service and deliver to the Owner the complete mechanical systems in accordance with the accompanying plans and all provisions of these specifications. This work shall primarily include, but is not necessarily limited to the following:
 - (1) Complete exterior sanitary sewer system connected to manhole.
 - (2) Interior domestic hot, cold and recirculating hot water system.
 - (3) Interior soil, waste and vent systems.
 - (4) Roof drainage system with connection to points supplied by site contractor 5' outside of building perimeter.
 - (5) All plumbing equipment, fixtures and fittings.
 - (6) 100% automatic sprinkler system.
 - (7) All mechanical exhaust systems.
 - (8) All insulation associated with mechanical systems.
 - (9) Condensate drainage systems with exterior piping as required to tie in points provided by site contractor.
 - (10) Complete heating, ventilation and air conditioning systems.
 - (11) Final connection of all mechanical equipment furnished by others (Laboratory Casework)
 - (12) Coordination with independent test and balance contractor. (refer to Test and Balance Specifications).
 - (13) All applicable services and work specified in Section 200100; General Provisions Mechanical.
 - (14) All specified or required control work.
 - (15) Provide all required motor starters, etc. not provided under the electrical sections.
 - (16) **One** year guarantee of all mechanical equipment, materials and workmanship, starting at Architect's date of substantial completion.
 - (17) Thorough instruction of the owner's maintenance personnel in the operation and maintenance of all mechanical equipment.
 - (18) Thorough coordination of the installation of all piping, equipment and any other material with other trades to ensure that no conflict in installation.
 - (19) Approved supervision of the mechanical work.
 - (20) Excavation, backfilling, cutting, patching, sleeving, concrete work, etc., required to construct the plumbing system.

- (21) Procurement of all required permits and inspections, including fees for all permits and inspection services and submission of final certificates of inspection to the Engineers (Plumbing, Boiler, HVAC, etc.).
- (22) Factory start-up of all major equipment (including terminal HVAC equipment) and submission of associated factory start-up reports to the Engineer.

END OF SECTION 200200

SECTION 200300 - SHOP DRAWINGS, DESCRIPTIVE LITERATURE, MAINTENANCE MANUALS, PARTS LISTS, SPECIAL KEYS & TOOLS

1. GENERAL

- A. The Contractor's attention is directed also to the General and Special Conditions and Section 200100 General Provisions Mechanical as well as to all other Contract Documents as they may apply to his work.
- B. The Contractor shall prepare and submit to the Engineer, through the General Contractor and the Architect (where applicable) within thirty (30) days after the date of the Contract, a minimum of seven (7) copies of all shop drawings, certified equipment drawings, installation, operating and maintenance instructions, samples, wiring diagrams, etc. on all items of equipment specified hereinafter.
- C. Submittal data shall include specification data including metal gauges, finishes, accessories, etc. Also, the submittal data shall include certified performance data, wiring diagrams, dimensional data, and a spare parts list. Submittal data shall be reviewed by the Engineer before any equipment or materials is ordered or any work is begun in the area requiring the equipment.
- D. All submittal data shall have the stamp of approval of the Contractor submitting the data as well as the General Contractor and the Architect (if applicable) to show that the drawings have been reviewed by the Contractor. Any drawings submitted without these stamps of approval may not be considered and will be returned for proper resubmission.
- E. It shall be noted that review of shop drawings by the Engineer applies only to conformance with the design concept of the project and general compliance with the information given in the contract documents. In all cases, the Contractor alone shall be responsible for furnishing the proper quantity of equipment and/or materials required, for seeing that all equipment fits the available space in a satisfactory manner and that piping, electrical and all other connections are suitably located.
- F. The Engineers review of shop drawings, schedules or other required submittal data shall not relieve the Contractor from responsibility for: adaptability of the item to the project; compliance with applicable codes, rules, regulations and information that pertains to fabrication and installation; dimensions and quantities; electrical characteristics; and coordination of the work with all other trades involved in this project. Any items that differ from the Drawings or Specifications shall be flagged by the Contractor so the Engineer will be sure to see the item. Do not rely on the Engineer to "catch" items that do not comply with the Drawings or Specifications. The Contractor is responsible for meeting the Drawings and Specification requirements, regardless of whether or not something does not get caught by the Contractor or Engineer during shop drawing reviews.
- G. Equipment shall not be ordered and no final rough-in connections, etc., shall be accomplished until reviewed equipment shop drawings are in the hands of the Contractor. It shall be the Contractor's responsibility to obtain reviewed shop drawings and to make all connections, etc. in the neatest and most workmanlike manner possible. The Contractor shall coordinate with all the other trades having any connections, roughing-in, etc. to the equipment.
- H. If the Contractor fails to comply with the requirements set forth above, the Engineer shall have the option of selecting any or all items listed in the Specifications or on the drawings; and the Contractor shall be required to furnish all materials in accordance with this list.
- I. Colors for equipment in other than mechanical spaces shall be selected from the Manufacturer's standard and factory optional colors. Color samples shall be furnished with the shop drawing submission for such equipment.
- J. Shop Drawing Submittals
 - (1) All submittals for HVAC equipment shall include all information specified. This shall include air and water pressure drops, RPM, noise data, face velocities, horsepower, voltage motor type, steel or aluminum construction, and all accessories clearly marked.
 - (2) All items listed in the schedules shall be submitted for review in a tabular form similar to the equipment schedule.
 - (3) All items submitted shall be designated with the same identifying tag as specified on each sheet.
 - (4) Any submittals received in an unorganized manner without options listed and with incomplete data will be returned for resubmittal.

2. SHOP DRAWINGS

Shop Drawings, descriptive literature, technical data and required schedules shall be submitted on the following:

Duct Insulation (Internal and External)	Heat Pumps
Energy Recovery units	VFD's
Pipe Insulation	
Roof Curbs	
Hydronic Specialties	
Chemical Treatment System	
Pumps and Circulators (HVAC)	
Geothermal Vault, Piping, Grout and all associated e	equipment/materials, etc.

SPECIAL NOTES:

- Upon substantial completion of the project, the Contractor shall deliver to the Engineers (in addition to the required Shop Drawings) three (3) complete copies of operation and maintenance instructions and parts lists for each item marked (1) above. These documents shall include at least:
 - (a) Detailed operating instructions
 - (b) Detailed maintenance instructions including preventive maintenance schedules.
 - (c) Addresses and phone numbers indicating where parts may be purchased.
- (2) Shop drawings for the Control Systems shall include detailed, scaled plans and schematic diagrams indicating the function and operation of the system.
- (3) Shop drawings for the Building Fire Protection System shall be prepared and stamped by a Certified Contractor and shall meet the criteria of the Department of Housing, Buildings and Construction and submitted to the Engineer. After the Engineer's review, they shall be submitted by the Contractor to the proper state authorities along with the required State review fee.
- (6) The Contractor shall submit Material Safety Data sheets for all chemical treatment and anti-freeze solutions.

3. SPECIAL WRENCHES, TOOLS, ETC.

(1) The Contractor shall furnish, along with equipment provided, any special wrenches or tools necessary to dismantle or service equipment or appliances installed under the Contract. Wrenches shall include necessary keys, handles and operators for valves, cocks, hydrants, etc. A reasonable number of each shall be furnished.

4. BALANCE REPORTS

A. Upon substantial completion of the project, the Contractor shall submit to the Engineers four (4) bound copies of the Certified Air and Hydronic Balance Report. Kitchen equipment fan balancing to be accomplished by food service equipment installer. Submit kitchen equipment balance report to Engineer as well.

SECTION 200500 - COORDINATION AMONG TRADES, SYSTEMS INTERFACING AND CONNECTION OF EQUIPMENT FURNISHED BY OTHERS

1. COORDINATION

- A. The Contractor is expressly directed to read the General Conditions and all detailed sections of these specifications for all other trades and to study all drawings applicable to his work, including Architectural and Structural drawings, to the end that complete coordination between trades will be affected. Special attention shall be given to the points where ducts or piping must cross other ducts or piping, where lighting fixtures must be recessed in ceilings, and where ducts, piping and conduit must fur into walls, soffits, columns, etc. It shall be the responsibility of the Contractor to leave the necessary room for other trades. No extra compensation will be allowed to cover the cost of removing piping, conduit, ducts, etc., or equipment found encroaching on space required by others.
- B. The Contractor shall be responsible for coordination with the Electrical trade to ensure that he has made provision for connections, operational switches, disconnect switches, fused disconnects, etc. for electrically operated equipment provided under this division of the specifications, or called for on the plans.
- C. If any discrepancies occur between accompanying drawings and these specifications and drawings and specifications covering other Contracts, each trade shall report such discrepancies to the Architect far enough in advance so that a workable solution can be presented. No extra payment will be allowed for relocation of piping, ductwork, conduit, and equipment not installed in accordance with the above instructions, and which interfered with work and equipment of other trades.
- D. In all areas where air diffusers and lighting fixtures are to be installed, the Contractor shall coordinate their respective construction and installations so as to provide a combined symmetrical arrangements.

2. INTERFACING

The Contractor shall ensure that coordination is affected relative to interfacing of systems. Some interface points are (but not necessarily all):

- A. Connection of Domestic Water System for both the high school and the auxiliary gym to a point 5' outside the building as indicate in the civil site utilities drawings.
- B. Connection of Natural Gas System for both the high school and the auxiliary gym to a point 5' outside the building as indicated in the civil site utilities drawings.
- C. Connection of Fire Protection System for both the high school and the auxiliary gym to a point 5' outside the building as indicated in the civil site utilities drawings.
- D. Connection of Sanitary sewer house line for both the high school and the auxiliary gym to a point 5' outside the building as indicated in the civil site utilities drawings.
- E. Connection of Storm Drainage System for both the high school and the auxiliary gym to a point 5' outside the building as indicated in the civil site utilities drawings.
- F. Connection of Domestic Water System to Hydronic System.
- G. Connection of all controls to equipment.
- H. Electrical power connections to electrically operated (or controlled) equipment.

3. CONNECTION OF EQUIPMENT FURNISHED BY OTHERS

- A. The Contractor shall make all connections to equipment furnished by others, or relocated from the existing structure, whenever such equipment is shown on any part of the drawings or mentioned in any part of the Specifications, unless otherwise specifically specified hereinafter.
- B. Supervision to assure proper functioning and operation shall be provided by the Contractor.
- C. Items indicated on the drawings as rough-in only (RIO) will be connected by others. The Contractor shall be responsible for rough-in provisions only.
- D. For items furnished by others, relocated, or RIO, the Contractor shall obtain from the supplier or shall field determine as appropriate, the exact rough-in locations and connection sizes for the referenced equipment.
- E. The Contractor shall be responsible for coordinating to determine any and all final connections that he is to make to equipment furnished by others.

4. RECORD DRAWINGS

(1) RECORD DRAWINGS - Each Contractor shall insure that any deviations from the Coordination Drawings are recorded as they occur, in red erasable pencil on Coordination Drawings kept at the jobsite. Upon completion of a particular phase, the Mechanical Contractor shall incorporate all field deviations into the Coordination Drawings to be utilized as Record Drawings. The Engineer shall review the Record Documents from time to time to insure compliance with this specification. Compliance shall be a contingency of final payment. Pay particular attention to the location of under floor sanitary and water lines, shut-off valves, cleanouts and other appurtenances important to the maintenance and operation of Mechanical Systems. Also, pay particular attention to Deviations in the Control Systems and all exterior utilities. Keep information in a set of drawings set aside at the job site especially for this purpose. The Record Drawings shall be distributed electronically (on CD) to the General Contractor, Owner, Architect and Engineer for their Records.

SECTION 201100 - SLEEVING, CUTTING, PATCHING AND REPAIRING

1. GENERAL

- A. The Contractor's attention is directed to the General and Special Conditions, General Conditions-Mechanical and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.
- B. The Contractor shall be responsible for all openings, sleeves, trenches, etc., that he may require in floors, roofs, ceilings, walls, etc., and shall coordinate all such work with the General Contractor and all other trades. Coordinate with the General Contractor, any openings which he is to provide before submitting a bid proposal in order to avoid conflict and disagreement during construction. Improperly located openings shall be reworked at the expense of the Contractor.
- C. The Contractor shall plan his work ahead and shall place sleeves, frames or forms through all walls, floors and ceilings during the initial construction, where it is necessary for piping, ductwork, conduit, etc., to go through; however, when this is not done, the Contractor shall do all cutting and patching required for the installation of his work, or he shall pay other trades for doing this work when so directed by the Engineer. Any damage caused to the buildings by the workmen of the responsible Contractor must be corrected or rectified by him at is own expense.
- D. The Contractor shall notify other trades in due time where he will require openings or chases in new concrete or masonry. He shall set all concrete inserts and sleeves for his work. Failing to do this, he shall cut openings for his work and patch same as required at his own expense.
- E. The Contractor shall be responsible for properly shoring, bracing, supporting, etc., any existing and/or new construction to guard against cracking, settling, collapsing, displacing or weakening while openings are being made. Any damage occurring to the existing and/or new structures, due to failure to exercise proper precautions or due to action of the elements shall be promptly and properly made good to the satisfaction of the Engineer.
- F. All work improperly done or not done at all as required by the Mechanical Trades in this section, will be performed by the Contractor at the direction of the trade whose work is affected.

2. SLEEVES, PLATES AND ESCUTCHEONS

- A. The Contractor shall provide and locate all sleeves and inserts required for his work before the floors and surface being penetrated are built, otherwise the Contractor shall core drill for pipes where sleeves and inserts were not installed, or where incorrectly located. Core drilling is the only acceptable alternative to sleeves. Do not chisel openings. Where sleeves are placed in exterior walls or in slabs on grade, the space between the pipe or conduit and the sleeves shall be made completely and permanently water tight.
- B. Pipe that penetrates fire and/or smoke rated assemblies shall have sleeves installed as required by the manufacturer of the rating seal used.
- C. At all other locations either pipe sleeves or core drilled openings are acceptable.
- D. Where thermal expansion does not occur, the wall may be sealed tight to the pipe or insulation.
- E. Insulation, that requires a vapor barrier (i.e., cold water or refrigerant piping, etc.), must be continuous through the sleeve/cored hole. For other piping, insulation may stop on either side of the sleeve.

- F. Sleeves shall be constructed of 24 gauge galvanized sheet steel with lock seam joints or Schedule 40 pipe. Sleeves in floors shall extend 1" above finished floor level.
- G. Fasten sleeves securely in floors, walls, so that they will not become displaced when concrete is poured or when other construction is built around them. Take precautions to prevent concrete, plaster or other materials being forced into the space between pipe and sleeve during construction.
- H. In all areas where ducts are exposed and ducts pass thru floors, the opening shall be surrounded by a 4 inch high by 3 inch wide concrete curb.
- I. Escutcheon plates shall be provided for all pipes and conduit passing thru walls, floors and ceilings. Plates shall be nickel plated, of the split ring type, of size to match the pipe or conduit. Where plates are provided for pipes passing thru sleeves which extend above the floor surface, provide deep recessed plates to conceal the pipe sleeves.

3. CUTTING

- A. All rectangular or special shaped openings in plaster, stucco or similar materials, including gypsum board, shall be framed by means of plaster frames, casing beads, wood or metal angle members as required. The intent of this requirement is to provide smooth even termination of wall, floor and ceiling finishes as well as to provide a fastening means for grilles, diffusers, lighting fixtures, etc.
- B. Mechanical, plumbing, and fire protection contractors shall coordinate all openings in new and existing masonry walls with the General Contractor; and, unless otherwise indicated on the Architectural drawings, provide lintels for all openings required for the work (Louvers, wall boxes, exhaust fans, etc.). Lintels shall be sized as follows:
 - (1) New Openings under 48" in width: Provide one 3-1/2"x3-1/2"x3/8" steel angle for each 4" of masonry width. Lintel shall have 8" bearing on either side.
 - (2) New Openings 48" to 96" in width: Provide one 3-1/2"x6"x3/8" steel angle for each 4" of masonry width. Lintel shall have 8" bearing on either side.
 - (3) New Openings over 96" in width: Consult the Project Structural Engineer.
- C. No cutting is to be done at points or in a manner that will weaken the structure and unnecessary cutting must be avoided. If in doubt, contact the Engineer.
- D. Pipe openings in slabs and walls shall be cut with core drill. Hammer devices will not be permitted. Edges of trenches and large openings shall be scribe cut with a masonry saw.

4. PATCHING AND REPAIRING

- A. Patching and repairing made necessary by work performed under this division shall be included as a part of the work and shall be done by skilled mechanics of the trade or trades for work cut or damaged, in strict accordance with the provisions herein before specified for work of like type to match adjacent surfaces and in a manner acceptable to the Engineer.
- B. Where portions of existing lawns, shrubs, paving, etc. are disturbed for installation of work of this Division, such items shall be repaired and/or replaced to the satisfaction of the Engineer.

- C. Where the installation of conduit, ducts, piping, etc. requires the penetration of fire or smoke rated walls, ceilings or floors, the space around such conduit, duct, pipe, etc., shall be tightly filled with an approved non-combustible fire insulating material satisfactory to maintain the rating integrity of the wall, floor or ceilings affected.
- D. Where ducts penetrate fire rated assemblies, fire dampers shall be provided with an appropriate access door.
- E. Piping passing through floors, ceilings and walls in finished areas, unless otherwise specified, shall be fitted with chrome plated brass escutcheons of sufficient outside diameter to amply cover the sleeved openings and an inside diameter to closely fit the pipe around which it is installed.
- F. Stainless steel collars shall be provided around all ducts, large pipes, etc., at all wall penetrations; both sides.
- G. Where ducts, pipes, and conduits pass through interior or exterior walls, the wall openings shall be sealed air tight. This shall include sealing on both sides of the wall to insure air does not enter or exit the wall cavity. This is especially critical on exterior walls where the wall cavity may be vented to the exterior.
- H. When installing conduit, pipe, or any other work in insulated concrete form (ICF) walls, the responsible subcontractor for the work shall provide spray foam insulation to patch the rigid insulation to maintain full integrity of the insulating value of the wall after the mechanical and electrical work is complete. Furthermore all new work shall NOT be installed in concrete center of wall. All mechanical and electrical installations shall be on the interior side of the concrete.

SECTION 201200 - EXCAVATION, TRENCHING, BACKFILLING AND GRADING

1. GENERAL

- A. The Contractor's attention is directed to the General and Special Conditions, General Conditions-Mechanical and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.
- B. The Contractor shall include all excavating, filling, grading, and related items required to complete his work as shown on the drawings and specified herein or as required to complete, connect and place all mechanical systems in satisfactory operation.
- C. Unless otherwise shown or required, provide separate trenches for sewers, water lines and other underground raceways, with a minimum of 10 feet measured from outside diameter between pipes. In locations, such as close to buildings where separate trenches for sewers and water lines are impractical, lay the water pipe on a solid shelf at least 2'-0" above the top of the sewer and 2-0" to the side. Electric and fuel lines shall always be placed in a separate trench. All exterior lines shall have a minimum earth cover of thirty (30) inches to top of pipe, unless otherwise indicated.
- D. Water lines crossing under sewer lines, or crossing less than 2 feet above sewer lines, must be encased for a distance not less than 5 feet on either side of the point of crossover.

2. SUBSURFACE DATA

- A. Materials to be excavated shall be unclassified, and shall include earth, rock, or any other material encountered in the excavating to the depth and extent indicated on the drawings and specified herein. No adjustment in the Contract sum will be made on account of the presence or absence of rock, shale, or other materials encountered in the excavating. This paragraph is written to include the removal of all rock with no extras, whether rock is indicated or not.
- B. The contractor's attention is called to the geotechnical engineer's boring report for this project which indicates shallower rock towards the rear of the high school.

3. BENCH MARKS AND MONUMENTS

A. Maintain carefully all bench marks, monuments and other reference points. If disturbed or destroyed, replace as directed.

4. EXCAVATION

- A. Excavate trenches of sufficient width for proper installation of the work. When the depth of backfill over sewer pipe exceeds 10 feet, keep the trench at the level of the top of the pipe as narrow as practicable. Trench excavation for piping eight inches and smaller shall not exceed thirty inch width for exterior lines and twenty-four inch width for interior lines.
- B. Sheet and brace trenches as necessary to protect workmen and adjacent structures. Comply with local regulations or, in the absence thereof, with the "Manual of Accident Prevention in Construction" of the Associated General Contractors of America, Inc., and current OSHA Standards. Do not remove sheeting until trench is backfilled sufficiently to protect pipe and prevent injurious caving. Where removal of sheeting and/or bracing is hazardous, leave in place. Cut off such sheeting not to be removed at least 3 feet below finished grade.

- C. Rules and regulations governing the respective utilities shall be observed in executing all work under this heading. Active utilities discovered in the course of excavation shall be protected or relocated in accordance with written instructions from the Engineer. Inactive and abandoned utilities encountered in trenching operations shall be removed and abandoned with ends plugged or capped in accord with current codes and safe practice. If in doubt, contact Engineers. Machine excavation shall not be allowed within ten (10) feet of existing electric lines or lines carrying combustible materials. Use only hand tools.
- D. The removal of rock shall be accomplished by use of hand or power tools only. Blasting shall not be permitted unless authorized in writing by the Engineer. Any damage to existing structures, exterior services, or rock intended for bearing, shall be corrected at the Contractor's expense.
- E. Perform final grading of trench bottoms by hand tools; carry machine excavation only to such depth that soil bearing for pipes and raceways will not be disturbed. Grade the bottom of trenches evenly to insure uniform bearing for all piping and raceways. Cut bell holes as necessary for joints and jointmaking. Except as hereinafter specified, bottom of trenches for bell and spigot pipe, flanged pipe, etc. shall be shaped to the lower quadrant of pipe with additional excavation for bell or flange. Piping installed where it rests on bell, or flange and/or is supported with blocks or wedges will not be accepted.
- F. Keep trenches free from water while construction therein is in progress. Under no circumstances lay pipe or appurtenances in water. Pump or bail water from bell holes to permit proper jointing of pipe. Any water pumping from this Contractor's trenches which is required during construction, shall be included in this Contract.
- G. In no case shall excavation work be accomplished that will damage in any way the new structure, existing structures, equipment, utility lines, large trees to remain, etc. The Contractors shall take the necessary steps to prevent flow of eroded earth by water or landslide onto the property of others, or against the structures. The repair of all such damage or any other damage incurred in the course of excavation shall be borne by the responsible Contractor.
- H. Use surveyor's level to establish elevations and grades.
- I. The Contractor shall accept the site as he finds it and remove all trash, rubbish and material from the site prior to starting excavation of his work.
- J. The Contractor shall provide and maintain barricades and temporary bridges around excavations as required for safety. Temporary bridges shall be provided where excavations cross paved areas and walks. The Contractor shall maintain these bridges in a safe and passable condition for all traffic until removal. Refer to OSHA Standards for such installations and comply with same in all details.
- K. Pay particular attention to existing utilities and lines to avoid damage. The locations of existing lines which are indicated on the plans were taken unconfirmed from drawings prepared for previous construction and locations are approximate only. Also, certain water, gas, electric, storm and sanitary sewer lines and other underground appurtenances, active or abandoned, may not appear on the drawings. It shall be each Mechanical Contractor's responsibility to ascertain the location of all lines and excavate with caution in their area.

5. BACKFILL AND SURFACE REPAIR

A. Backfilling for mechanical work shall include all trenches, manhole pits, storage tank pits, and/or any other earth and/or rock openings which are excavated under this Contract. Backfilling shall be carefully performed and the surface restored to its original level to receive new finish. Wherever trenches and earth

openings have not been properly filled and/or settlement occurs, they shall be re-excavated, re-filled and properly compacted, smoothed off and finally made to conform to the level of the original ground surface.

- B. Unless otherwise indicated or specified, all piping shall be bedded on four (4) inches minimum of compacted naturally or artificially graded mixture of crushed gravel, crushed stone, or crushed sand with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve on undisturbed soil excavated as described hereinbefore. Install tracer wire above pipe. Cover the pipe with twelve (12) inches of compacted backfill to prevent settlement above and around the new pipe. The backfill shall be naturally or artificially graded mixture of crushed gravel, crushed stone, or crushed sand with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve. The backfill shall be naturally or artificially graded mixture of crushed gravel, crushed stone, or crushed sand with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve. Prior to placing this second level of backfill, apply all required coatings and coverings to pipe, apply required tests and check the grading of the pipe to insure that it is correct and that the pipe is free of swags, bows or bends. Also check lines for leaks at this point and repair as required. Once all of the preceding is accomplished, continue backfill with clean, debris and rock free earth tamped at six (6) inch intervals. Finish the backfill as specified following. Note: Water settling of backfill will be permitted only as an aid to mechanical compacting.
 - (1) When running any type of pipe below a footer, parallel or perpendicular to the footer, the area underneath the footer and in the zone of influence shall be backfilled with cementitious flowable fill. The zone of influence is the area within a 45 degree angle projecting down from the bottom edge of footers on all sides of the footer. Where PVC piping is used within flowable fill, the pipe shall be isolated from the fill by a layer of heavy duty felt paper or cast iron piping may be used without a barrier. Piping installed in trenches backfilled with flowable fill shall be anchored to the soil below prior to backfilling.
- C. Backfill beneath areas to be seeded or sodded within six (6) inches of finished grade. The remaining six (6) inches shall be backfilled with clean top soil.
- D. Backfill beneath paved areas, walks, etc. shall be brought to proper grade to receive the sub-base and paving. No paving shall be placed on uncompacted fill or unstable soil.
- E. Backfill for natural gas lines shall be in strict accordance with the utility company or local municipalities requirements. If in doubt, contact the utility company or local municipality and/or the Engineer.
- F. Wherever, in the opinion of the Engineer, the soil at or below the requisite pipe grade is unsuitable for supporting piping, special support shall be provided as directed by the Engineer.
- G. Unsuitable material and surplus excavated material not required for backfill shall be removed from the site. The location of dump and length of haul shall be the affected Contractor's responsibility.
- H. Provide and place any additional fill material from off the site as may be required for backfill. Fill obtained from off site shall be of kind and quality as specified for backfill and the source approved by the Engineer and shall be brought to the site by the Contractor requiring the fill.
- I. In the absence (if not specified or indicated elsewhere in the drawings or specifications to be done by others) of such work by others, the Contractor shall lay new sod over his excavation work. Level, compress and water in accord with sound sodding practice.
- J. When running any type of piping below a footer or in the zone of influence the piping shall be backfilled with cementitious flowable fill. The zone of influence is the area under the footer within a 45 degree angle projecting down from the bottom edge of the footer on all sides of the footer. Additionally, grease traps, manholes, vaults, and other underground structures shall be held away from building walls far enough to be outside of the zone of influence.

K. Warning Tape and Tracer Wire

Provide a yellow and black plastic tape in all trenches 6" above the buried utility that identifies the utility about to be encountered. For non-metallic pipe a #12 copper wire shall also be laid in the trench to aid in future location of the piping. A foil faced warning tape may be used in lieu of the plastic tape and wire.

L. All manholes, vaults, and similar underground structures shall have the top elevation set flush with finished grade unless specifically noted otherwise.

6. MINIMUM DEPTHS OF BURY (TO TOP OF PIPE)

In the absence of other indication, the following shall be the minimum depth of bury of exterior utility lines. (Check drawings for variations).

A.	Domestic Water Lines	36 inches.
B.	Fire Protection Lines	42 inches.
C.	Geothermal Lines	42 inches.
D.	Storm Lines	20 inches.
E.	Sanitary Lines (Exterior)	36 inches.
F.	Natural Gas Lines	36 inches.

SECTION 201300 - PIPE, PIPE FITTINGS AND PIPE SUPPORT

1. GENERAL

- A. The Contractor's attention is directed to the General and Special Conditions, General Conditions-Mechanical and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.
- B. When a pipe size is not indicated, the Contractor shall request the pipe size from the Engineers. All piping shall be installed straight and true, parallel or perpendicular to the building construction. Piping shall be installed so as to allow for expansion without damage to the building finishes, structure, pipe, equipment, etc., use offsets, U-bends or expansion joints as required. Where a section of piping is not indicated but is obviously required for completion of the system, the Contractor shall provide same at no additional cost to the project. No mitered joints or field fabricated pipe bends shall be accepted. Pipe shall clear all windows, doors, louvers and other building openings.
- C. All pipe shall be supported in a neat and workmanlike manner and wherever possible, parallel runs of horizontal piping shall be grouped together on trapeze type hangers. Vertical risers shall be supported at each floor line with approved steel pipe riser clamps. The use of wire or perforated metal to support pipes will not be permitted. Hanging pipes from other pipes shall not be permitted. Spacing of pipe supports shall not exceed eight feet for pipes up to 1-1/4 inches and ten feet on all other piping. Small vertical pipes (1 inch and less) shall be bracketed to walls, structural members, etc. at four (4) foot intervals so as to prevent vibration or damage by occupants. Insulated piping shall be supported on a rigid insulation block at each hanger so as to prevent crushing of insulation by hangers. Hangers shall pass completely around the insulation jacket and a steel protective saddle shall be applied to prevent compression of the insulation. (Refer to Specifications Section entitled INSULATION-MECHANICAL).
- D. Where piping rests directly on a hanger, clip, bracket or other means of support, the support element shall be of the same material as the pipe, (e.g., copper to copper, ferrous to ferrous, etc.) or shall be electrically isolated one from the other so as to prevent pipe damage by electrolysis. Pay particular attention and do not allow copper pipe to rest on ferrous structural members, equipment, etc. without electrolytic isolation.
- E. In general, piping shall be installed concealed except in Mechanical, Janitor Rooms, etc. unless otherwise indicated, and shall be installed underground or beneath concrete slabs only where indicated. All lines at ceilings shall be held as high as possible and shall run so as to avoid conflicts with other trades, and to facilitate the Owner's use and maintenance. Location of pipe in interior partitions shall be carefully coordinated with whoever will construct the partitions after the piping is in place. Where exposed risers occur they shall be kept as close to walls as possible.
- F. Installation of pipe shall be in such a manner as to provide complete drainage of the system toward the source. Drain valves shall be provided at all drainage points on pipes. Drain valves shall be 1/2" size gate type with 3/4" hose thread end and vacuum breaker. Label each drain valve.
- G. All hot and cold water piping shall be kept a sufficient distance apart so as to prevent heat transfer between them. Cold water piping shall also be kept apart from refrigerant hot gas lines.
- H. Piping carrying water or other fluids subject to freezing shall not be installed in locations subject to freezing; if in doubt, consult Engineer.
- I. Piping for all drainage systems shall be installed to permit flow, trapping, and venting in accord with current codes and sound practice.

- J. All cast iron soil pipe and fittings shall be coated inside and out with coal tar varnish.
- K. Non-metallic piping shall be installed in strict accordance with the manufacturer's instructions. If no such instructions are available, consult Engineers.
- L. Nipples shall be of the same material, composition and weight classification as pipe with which installed.
- M. Where piping is not indicated on the plans, but is obviously or apparently required, contact the Engineers prior to submission of a bid proposal.
- N. Pay particular attention to conflict of piping with other work. Do not install until conflict is resolved. If necessary, contact Engineers.
- O. Piping materials in each system shall, to the extent practicable, be of the same material. Frequent changes of material (for example, from copper to steel) shall be avoided and in no case shall be accomplished without use of insulating unions and permission of the Engineers.
- P. Apply approved pipe dope (for service intended) to <u>all</u> male threaded joints. Pay particular attention to dope for fuel gas lines. The dope shall be listed for such use.
- Q. High points of closed loop hot water heating systems shall have manual or automatic air vents as indicated or required unless automatic air vents are specifically indicated. Pipe to suitable drainage point.
- R. All piping shall be capped or plugged during erection as required to keep clean and debris and moisture free.
- S. The entire domestic hot, cold and recirculating hot water piping system shall be sterilized in strict accord with requirements of the Department of Health Codes, Rules and Regulations for the State which the work is being accomplished in.
- T. Provide expansion joints where shown on the plans and where required by good practice. Expansion joints shall be guided and anchored in accordance with the recommendations of the Expansion Joint Manufacturer's Association.
- U. Where plastic pipe penetrates a fire rated assembly, it shall be replaced with a metal threaded adapter and a metal pipe per code.
- V. Foam Core PVC is not permitted
- W. Where piping penetrates interior or exterior walls, the wall shall be sealed air tight. Refer to the sleeving, cutting, patching and repairing section of the specifications for additional requirements.
- X. Provide thrust blocks on all storm, sanitary, water, steam, hot, chilled, condenser, etc., and any other piping subject to hammering. Thrust blocks shall be provided at all turns.
- Y. All piping to hydronic coils shall be full size all the way to the coil connection on the unit. If control valve is smaller than pipe size indicated, transition immediately before and after control valve. Also, if coil connection at unit is a different size than the branch pipe size indicated, provide transition at coil connection to unit. <u>On 3-way valve applications, the coil bypass pipe shall be full size.</u>

Z. Provide check valves on individual hot and cold water supplies to each mixing valve (including each sensor style faucet, safety shower, mop sink, etc.) and each showerhead with a diverter valve (including all ADA showers). This requirement shall not be satisfied by mixing valves or fixtures with internal check valves. Independent external check valves are required.

2. UNIONS AND FLANGES AND WELDED TEES

- A. Screwed unions, soldered unions or bolted flanges shall be provided as required to permit removal of equipment, valves and piping accessories from the piping system. Keep adequate clearances for coil removal, rodding, tube replacement, motor lubrication, filter replacement, etc. Flanged joints shall be assembled with appropriate flanges, gaskets and bolting. Gaskets for steam piping systems shall be flexitalic spiral wound type. The clearance between flange faces shall be such that the connections can be gasketed and bolted tight without imposing undue strain on the piping system.
- B. Dielectric insulating unions or couplings shall be used wherever the adjoining materials being connected are of dissimilar metals such as connections between copper and steel pipe.
- C. Tee connections for welded pipe shall be made up with welding fittings. Where the size of the side outlet is such that a different connection technique than on the run is required, a weldolet, sockolet, or threadolet type fitting may be used for the branch in place of reducing tees only where the branch is 2/3 the run size or smaller.

3. SPECIFICATIONS STANDARDS

All piping and material shall be new, made in the United States and shall conform to the following minimum applicable standards:

- A. Steel pipe; ASTM A-120, A-53 Grade A, A-53 Grade B.
- B. Copper tube; Type K, L, M; ASTM B88-62; Type DWV ASTM B306-62.
- C. Cast iron soil pipe; ASA A-40.1 and CS 188-59.
- D. Cast iron drainage fittings; ASA B16.12.
- E. Cast iron screwed fittings; ASA B16.4.
- F. Welding fittings; ASA B16.9.
- G. Cast brass and wrought copper fittings; ASA B16.18.
- H. Cast brass drainage fittings; ASA B16.23.
- I. Reinforced concrete pipe; ASTM-C-76-64T.
- J. Solder; Handy and Harmon, United Wire and Supply; Air Reduction Co. or equivalent.
- K. CPVC Plastic pipe; ASTM D2846.
- L. PVC plastic pipe; ASTM D1785.
- M. ABS plastic pipe; ASTM D1788-73.

- N. Cross-linked polyethylene (PEX) pipe; ASTM F876 and ASTM F877.
- O. Cross-linked polyethylene (PEX) fittings; ASTM F1960

4. PITCH OF PIPING

All piping systems shall be installed so as to drain to a low point. Certain minimum pitches shall be required for this drainage. For proper flow and/or for proper operation, the following pitches shall be required:

A. Interior Soil, Waste and Vent Piping:

1/4 inch per foot in direction of flow where possible but in no case less than 1/8" per foot.

B. Exterior Sanitary Lines:

Not less than one (1) percent fall in direction of flow and no greater than indicated.

C. Roof Leaders:

1/8 inch per foot where possible. Where not possible, run dead level.

D. Condensate Drain Lines From Cooling Equipment:

Not less than 1/4 inch per foot in direction of flow.

E. Exterior Storm Lines:

Not less than 1 percent grade in direction of flow.

F. All Other Lines:

Provide ample pitch to a low point to allow 100 percent drainage of the system.

5. APPLICATIONS

- A. General Notes
 - (1) Where plastic piping penetrates a fire rated assembly, it shall be replaced with a threaded metal adapter and metal pipe or whatever means necessary to maintain the separation rating in accordance with local plumbing and fire codes.
 - (2) Plastic piping or any materials with a flame and smoke spread rating not approved for plenum use shall not be permitted in supply, return, relief or exhaust plenums.
 - (3) PVC, CPVC, or plastic piping shall not be used under paving, roads or areas where vehicular traffic is expected.
 - (4) PVC or plastic piping whether specifically listed or not may not be used in high rise buildings or anywhere else prohibited by code.
- B. Sanitary Sewer Exterior

- (1) Service weight cast iron piping with bell and spigot fittings complying with ASTM A 74. All joints shall be compression gasket type.
- (2) SDR 35 PVC pipe extruded from Type 1, Grade 1 polyvinyl chloride material. PVC pipe shall have a bell type fitting on one end. All joints shall be solvent cement type, made in accordance with the Kentucky Plumbing Code.
- (3) Service weight hubless cast iron with manufacturer's approved bands.
- C. Storm Sewer Exterior
 - Class II reinforced concrete pipe (RCP) with tongue and groove gasketed joints conforming to ASTM C-443.
 - (2) Service weight cast iron piping with bell and spigot fittings complying with ASTM A 74. All joints shall be lead and oakum caulked type or compression gasket type.
 - (3) SDR 35 PVC pipe extruded from Type 1, Grade 1 polyvinyl chloride material. PVC pipe shall have a bell type fitting on one end. All joints shall be solvent cement type.
- D. Fire Protection Exterior and Interior

Refer to the Fire Protection System section of these specifications.

- E. Geothermal Piping Underground
 - (1) Refer to the Specification Section 201320-Geothermal Loop Piping System.
- F. Soil Waste and Vent Piping General Requirements
 - (1) Water closet floor flanges and ells shall be cast iron regardless whether PVC piping is allowed or not.
 - (2) Soil and waste piping serving mechanical rooms, laundries and kitchens shall be cast iron regardless whether PVC piping is allowed or not. Cast iron will also be required at any other location where waste water temperature can exceed 120°F. Cast iron shall extend a minimum of 35' past last waste inlet.
 - (3) Exposed waste at kitchen sinks and compression sink shall be chrome or copper.
- G. Soil, Waste and Vent Piping (Below Slab)
 - (1) Schedule 40 PVC pipe with drainage pattern fittings and solvent cement joints made in accordance with the Kentucky Plumbing Code. Foam core piping is not permitted.
 - (2) Service weight hubless cast iron with manufacturer's approved bands.
 - (3) Service weight cast iron hub and spigot piping with lead and oakum joints or compression gasket joints.
 - (4) Waste piping serving Soda Machine drains, (floor sinks or floor drains) shall be: Service weight cast iron epoxy coated no-hub cast iron pipe and fittings, as manufactured by Newage Casting or approved equal. Certified to conform to ASTM A888 & CISPI 301. The two part epoxy spray on coating shall

have a 2.5 mil. Minimum exterior thickness and a 5 mil. Minimum interior thickness for adhesion and chemical resistance. Two part epoxy is to be tested to be non reactive from 2pH-12pH. Install piping in accordance to manufacturer's instructions. This branch piping shall run as this material until connected to the main.

- H. Soil, Waste and Vent Piping (Above Slab)
 - Service weight hubless cast iron pipe with manufacturer's approved bands. Horizontal pipe and fittings 4" and larger shall be suitably braced to prevent horizontal movement. Provide bracing in accordance to CIPI 301-00. Provide "holdrite" bracing system or approved equal.
 - (2) Service weight cast iron hub and spigot piping with lead and oakum joints or compression gasket joints.
 - (3) Schedule 40 galvanized steel piping with screwed ends and cast iron drainage pattern fittings for piping 2" and less in size. Provide pipe adapters for connector of cast iron pipe at slab.
 - (4) Type DWV copper drainage piping with cast bronze drainage pattern fittings with solder joints.
 - (5) Schedule 40 PVC pipe with drainage pattern fittings and solvent cement joints made in accordance with the Kentucky Plumbing code.
- I. Roof Leaders/Interior Storm Sewer Piping
 - (1) Service weight hubless cast iron pipe with manufacturers approved bands.
 - (2) Schedule 40 PVC pipe with drainage pattern fittings and solvent cement joints.
- J. Domestic Cold, Hot and Recirculating Hot Water Piping (Above Slab)
 - (1) Type "L" hard copper tubing with wrought copper fittings with lead free solder equivalent in performance to 95/5. (Maximum lead content of solder and flux is 2%).
- K. Domestic Cold, Hot and Recirculating Hot Water Piping (Below Slab)

Type "K" hard or soft copper tubing with wrought copper fittings and brazed joints. There shall be no joints beneath slabs.

- L. Hydronic Piping (Heat Pump Supply, Return, Chilled/Hot Water System))
 - (1) 2" and Smaller: Schedule 40 black steel pipe with screwed fittings or Type "L" hard copper tubing with wrought copper fittings and 95/5 solder.
 - (2) 2-1/2" and Larger: Schedule 40 black steel pipe with 125# welded or flanged joints. Weldolets may be used for branch line connections to pipe mains. Type "L" hard copper piping with wrought copper fittings and 95/5 solder may be installed.
 - (3) Schedule 40 Victaulic or approved equivalent mechanical grooved pipe couplings and fittings with 125# rating minimum may be used. Install gaskets as recommended by the manufacturer. Piping system shall be rated for minimum of 220°F water temperature. Mechanical grooved piping may <u>not</u> be used if system water temperature exceeds 220°F.
 - (4) Special Notes:

- a. Dielectric unions shall be provided at all connections of dissimilar materials.
- b. Copper and steel piping shall not be mixed in the mechanical room.
- c. Piping shall meet all State Boiler Code requirements. Pay particular attention to welded pipe requirements for hot water systems.
- d. Takeoffs and branch piping to individual coils or heat pumps shall not be connected to the bottom of hydronic mains. Connection to mains shall be at the side of the main. Also refer to details on the drawings.
- (5) HDPE-The contractor at his option may elect to use HDPE piping for the hps.hpr piping mains within the building. If the contractor elects this option, the installation shall adhere to the following guidelines:
 - a. Mains and branches-Piping shall be virgin polyethylene with a PE 3408 piping formulation and 345464C or greater cell classification. Pipe shall be SDR 15.5 minimum pressure rating of 110 psi at 73.4°F.
 - b. Type "L" hard copper tubing with wrought copper fittings and 95/s solder. Piping in heat pump closets shall transition from HDPE to copper, provide a shutoff valve, and then all piping between the valves and heat pumps shall be copper.
 - c. Special Note: Takeoffs and branch piping to individual coils or heat pumps shall not be connected to the top of hydronic mains. Connection to mains shall be at the side of the main. Also refer to details on the drawings.
 - d. Transitions form HDPE to Copper-Factory Manufactured Transition required with brass or stainless steel threads. No metal threads shall be inserted into polyethylene piping, and no polyethylene threads shall be inserted into metal piping.
 - e. The only acceptable method for joining pipe is by a heat fusion process. Pipe shall be butt or socket fused in accordance with pipe manufacturer's procedures. All piping work shall be performed in accordance with Specification Section-Geothermal Loop System.
- M. Air Vent Discharge Lines

Type "L" soft copper; wrought copper fittings, 95/5 solder.

- N. Condensate Drain Lines
 - (1) Type "DWV" copper, wrought copper, lead free solder.
 - (2) Schedule 40 PVC with solvent welded fittings.
- O. Acid Waste and Vent Piping (Below Slab and Grade or Above Slab)
 - (1) Below slab: Schedule 40 non-flame retardant polypropylene pipe conforming to ASTM D4101 with joints made in accordance with the Kentucky Plumbing Code. Below grade piping shall be installed with fusion joint fittings.
 - (2) Above slab, pipe in non-plenum area: Schedule 40 flame retardant polypropylene pipe conforming to ASTM D4101 with joints made in accordance with the Kentucky Plumbing Code. Piping shall be installed with fusion joints within concealed spaces and with mechanical joints in accessible areas. All

mechanical couplings below casework or exposed shall have the clamp edges smoothed or covered to keep sharp edges from cutting people

- (3) Above slab, pipe in plenum: Schedule 40 PVDF per ASTM F1673 with mechanical joint fittings meeting ASTM E84 for flame spread and smoke generation (less than 25 and 50 respectively).
- (4) Piping shall be protected from sunlight in accordance with the manufacturer's recommendations.
- (5) Acceptable manufacturers of acid waste and vent piping materials: Enfield (Ipex), Orion, or G.F. Sloane.

SECTION 201310 - WELDING

1. GENERAL

- A. All welding accomplished by the Contractor shall comply with provision of the latest revision of applicable codes, whether ASME Boiler and Pressure Vessel Code for pressure piping or such State and Local requirements as may supersede these codes.
- B. Welds shall be of sound metal thoroughly fused to the base metal at all points, free from cracks and reasonably free from oxidation blow holes and non-metallic inclusions. No fins or weld metal shall project within the pipe and should they occur they shall be removed. All pipe beveling shall be done by machine. The surface of all parts to be welded shall be thoroughly cleaned free from paints, oil, rust or scale at the time of welding, except that a light coat of oil may be used to preserve the beveled surfaces from rust.
- C. Pipe and fittings shall be carefully aligned with adjacent parts and this alignment must be preserved in a rigid manner during the process of welding.
- D. Each Contractor shall be responsible for quality of welding done by his organization and shall repair or replace any work not done in accordance with specifications. If required by the Architect/Engineer, the Contractor shall cut out at least three (3) welds during the job for X-raying and testing. These welds shall be selected at random by the Resident Inspector and shall be tested as a part of the Contractor's Contract. Certifications of these tests and X-rays shall be submitted, in triplicate to the Engineer. In case a faulty weld is discovered, the Contractor shall be required to furnish additional tests.

2. WELDING QUALIFICATIONS

- A. It is required that all welding of piping covered by this specification, regardless of conditions of service, be installed as follows:
 - (1) Pipe welding shall comply with the provisions of the latest revision of the applicable codes, whether ASME Boiler and Pressure Vessel Code, ASA Code for Pressure Piping, or such state or local requirements as may supercede codes mentioned above.
 - (2) Before any pipe welding is performed, submit to the Owner or his authorized representative, a copy of the welding procedure specifications, together with proof of its qualification as outlined and required by the most recent issue of the code having jurisdiction.
 - (3) Before any welder shall perform any pipe welding, submit to the Owner or his authorized agent the operator's qualification record in conformance with the provisions of the code having jurisdiction, showing that the operator was tested under the proven procedure specifications submitted.
 - (4) Standard Procedure Specifications and Welders qualified by the National Certified Pipe Welding Bureau shall be considered as conforming to the requirements of these specifications.
 - (5) "R" Stamp: Any welder performing modifications, repairs, etc. to boilers, pressure vessels, or other pressure retaining items shall have a current R stamp issued by the National Board of Boiler and Pressure Vessel Inspectors.

B. MATERIALS

(1) Welding fittings shall conform to ASA B16.9; of the same materials, thickness, etc., as the pipe being jointed; see ASA B36.10.

SECTION 201320 - GEOTHERMAL (EARTH COUPLED) LOOP PIPING SYSTEM

1. GENERAL

A. The Contractor's attention is directed to the General and Special Conditions, General Conditions-Mechanical and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified herein.

2. INSTALLATION PERSONNEL AND TRAINING REQUIRED

- A. The loop installer must have a current International Ground Source Heat Pump Association (IGSHPA) certification, having completed an IGSHPA training course in the fundamentals of design, installation, and operation of ground source systems, and having passed the IGSHPA certification examination.
- B. Ground heat exchanger fabricators must have completed a heat fusion school in which each participant has performed a heat fusion procedure under direct supervision of a IGSHPA Certified Heat Fusion Technician. The Fusion Technician must be thoroughly familiar with heat fusion procedures, and have had formal training at a heat fusion school under direct supervision of an IGSHPA certified instructor.
- C. Local and state laws, ordinances, and regulations as they pertain to buried pipe systems shall be strictly followed.

3. GROUND HEAT EXCHANGER MATERIALS

- A. Piping shall be virgin polyethylene with a PE 4710 piping formulation and cell classification of 445576C or E per ASTM D 3350. Pressure ratings are at 73.4° F.
- B. 2" and smaller shall be SDR 9. Pressure rating of 255 PSI
- C. 3" and larger shall be SDR 15.5 or Schedule 40. Pressure rating of 135 PSI.

D. Markings

- (1) Sufficient information shall be permanently marked on the length of the pipe as defined by the appropriate ASTM pipe standard.
- (2) Piping shall also have permanent factory length markings.
- E. Certification
 - (1) Manufacturer shall supply a notarized document confirming compliance with the above standards.
- F. Manufacturers
 - (1) Centennial Plastics, Charter Plastics, Flying W Plastics, Lamson Vylon Plastics, Chevron Phillips, or Polypipe
- G. Warranty
 - (1) Manufacturer shall supply a written warranty of 25 years or greater, specifying material replacement and labor allowance. This applies to all pipe, fittings, transitions, valves, etc.

4. PIPE JOINING METHODS

GEOTHERMAL

- A. The only acceptable method for joining buried pipe systems is by a heat fusion process.
- B. Polyethylene pipe shall be butt or socket fused in accordance with pipe manufacturer's procedures.
- C. Factory installed "U" bends shall be used at the bottom well bend.

5. CASING

- A. Casing shall be steel. PVC casing is not acceptable.
- B. The actual amount of casing used per hole shall be tracked with a casing log and wellfield schematic. Schematic shall depict geothermal wells and provide labels for each. Log shall state the bore hole number (as depicted on the schematic), date and time casing was installed, and linear feet of casing left in place for **each** bore hole. For example:

Bore hole # 1	8/1/09	2 P.M.	30 feet of casing installed
Bore hole # 2	8/2/09	9 A.M.	10 feet of casing installed

This log shall be kept current at all times and be **signed daily during drilling** by the well field installer, mechanical contractor, General Contractor and Owner's representative.

- C. Contractor shall submit a unit price for steel casing left in place on the Bid Form. In no case will a unit price greater than \$19 / linear foot be accepted. Bids not complying with this requirement may be rejected.
- D. The casing log and the submitted casing unit price will be used to reconcile the Contract Amount with the actual amount of casing installed. The Contractor will only be paid the full unit price for casing left in place. Push and pull casing (temporary casing) will be paid at half the rate for casing left in place.

6. GEOTHERMAL VAULT

A. General

This specification designates the requirements for the geothermal vault including internal pipe, fittings, and valves.

B. External Shell

Shall be constructed of a high density polyethylene flat stock having a cell classification of 345444 with a UV stabilizer of C. All materials used shall have a minimum thickness of 1". Internal and external seams are heat welded using high density polyethylene welding rods having a cell classification of 345444C. Provide with a 30" manhole. The manhole lid is connected with 8-3/8" stainless steel counter sunk bolts. Lid to have 5000 pound load bearing capacity.

C. Internal Bracing

Shall be spaced at a maximum of 30" and constructed of a minimum of 1" thick high density polyethylene flat stock heat welded to the external shell with high density polyethylene weldingrods.

D. Internal Piping

Shall be constructed of Drisoplex 5300 Climate Guard High Density Polyethylene SDR 15.5 pipe having a cell classification of 345444 with a UV stabilizer of C. This internal pipe is constructed in an offset, over

and under, model for supply and return lines. All joints to be heat fused. The entire piping system shall be tested using 150 psi nitrogen. The main supply and return pipe to be shipped with cap butt welded to pipe. All pipe penetrating the vault walls shall be SDR9 and heat welded to external shell.

E. Fittings

P/T Plugs: Shall be constructed of solid brass and have a dual seal core of Nordel, good up to 350°F for water. Plugs shall be rated zero leakage from vacuum to 1000 psgi and are capable of receiving a pressure or temperature probe. Each HPS & R pipe to the well field shall have a P & T port.

Butterfly Valve: Shall be constructed of a cast iron body, 416 stainless steel stem with a lever shut off system.

90° Elbows: Shall be molded out of high density polyethylene resins in accordance with the requirements of ASTM 3261.

Branch and Service Saddles: Shall be molded out of high density polyethylene resins in accordance with the requirements of ASTM 3261.

Valving: Each row of 10 wells shall have HPS & R shut off valve and each return line shall have a bell & gossett circuit setter for balancing.

Drain: Provide a 4" floor drain in each vault.

F. Installation

The vault shall be lowered into a pit with a 6" bed of #57 gravel. Once the vault is in its place, concrete is poured as recommended by the manufacturer in and around the vault to balance buoyancy pressure and allow for anchoring. The manhole shall be flush with finished grade.

7. FLUSHING, PURGING, PRESSURE AND FLOW TESTING

- A. General
 - (1) Coordinate this section with the cleaning and flushing listed in Section 230200 HVAC Equipment.
 - (2) All fusion joints and loop lengths shall be checked to verify that no leaks have occurred due to fusion joining or shipping damage.
- B. Pressure Testing
 - (1) Vertical loops shall be pressure tested before installation. All horizontal components of the ground heat exchanger will be flushed, pressure and flow tested prior to backfilling. Pipes must contain fluid under pressure during backfilling.
 - (2) Heat exchangers shall be tested hydrostatically at 150% of the pipe design rating or 300% of the system operating pressure if this value is the smaller of the two. No leaks shall occur within a 48 hour period. Engineer shall be notified when system is to be placed under pressure test.
- C. Flushing and Purging
 - (1) Notify the Engineer a minimum of 2 weeks in advance of system flushing. The Engineer, Mechanical Contractor, Heat Pump Supplier, Test and Balance Contractor, and Well Field Installer shall all be present to observe system flushing and purging. Schedule the system flushing to occur the same day as

a regularly scheduled progress meeting. The Engineer MUST BE PRESENT. Failure to notify the Engineer in advance will result in the Contractor having to flush the system a second time.

- (2) Flow rates shall be compared to calculated values to assure that there is no blockage or kinking of any pipe. Submit this in writing to the Engineer. Balance Contractor to verify.
- (3) A minimum velocity of 3 ft/sec in each piping section must be maintained until all air is removed. Piping 8" and larger shall be purged at 4 ft/s minimum. The system shall also be forward and reverse flushed to remove all debris. The building shall be flushed in sections as required to maintain high velocities. Building mains shall be flushed separate from branches to maintain high velocity when flushing the mains.
- (4) Final purging of air from the entire building and loop field shall be performed by the Well Field Installer so that air in building piping will not be transferred to the well field.
- (5) The Balance Contractor must witness and confirm all pressure tests and flushing velocities along with confirm pressure drop for each geothermal well zone.
- (6) Contractor shall provide full size connection ports and valves as required to purge wellfield and building separately.
- (7) After the heat pump bypasses are flushed and the piping network is determined to be clean and free of air, the heat pumps themselves shall be flushed.
- (8) The system flushing device shall be equal to a Purge Pro Max distributed by Geothermal Supply Company. The flushing pump shall provide performance equal to or exceeding the following values: 550 GPM at 117 PSI, 500 GPM at 115 PSI, 300 GPM at 125 PSI, dead head pressure of 128 PSI. SUBMIT PUMP CURVE to Engineer for review and approval prior to system flush. The flushing device shall provide means to release entrained air to the atmosphere and shall filter the water. Filter shall be 50 micron. Water shall be circulated and filters shall be changed until debris is no longer visible on filter. Contractor shall provide filter media as required.

8. HORIZONTAL PIPING SYSTEMS

- A. Sharp bending of pipe around trench and bore hole corners must be prevented by using a shovel to round corners. Manufacturer's procedures must be followed.
- B. Backfilling procedure will include prevention of any sharp-edged rocks from coming into contact with the pipe by removal of the rocks before backfilling, backfilling through a coarse screen for a 6 inch cover, or use of a 6 inch cover of rock-free soil. Clods resulting from use of a backhoe must be broken up so as not to form air pockets around the pipe which will reduce heat conduction between the earth and the pipe. The flow of backfill soil must be controlled to prevent bridging and the formation of air pockets. Several slow passes with an angled backfill blade are required. Flooding is required to assure removal or air pockets. Backfill load bearing capacity shall meet the Architect's specification.
- C. Horizontal return bends must be backfilled by hand to properly support the pipes and prevent kinking.
- D. All horizontal piping shall be a minimum of 42 inches below finished grade.

9. BORE HOLE

A. The Contractor shall bore wells of a sufficient diameter to allow installation of the piping and U-bend, but shall be no less than 4-1/2".

- B. The entire bore shall be grouted as recommended by IGSHPA with a thermally enhanced grout mixture with a thermal conductivity of 1.00 Btu/hr-ft-°F. Grout shall be GeoPro Thermal Grout Lite 100 bentonite mixture or approved equal. Mixture shall be field mixed in strict accordance with manufacturer's recommendations. Grout mixture shall be mechanically pumped with a positive displacement pump into bore hole from bottom to top utilizing a tremie tube. Through the course of the project, three sample grout specimens shall be taken of the mixed grouting material by this contractor. An analysis shall be performed by the grout manufacturer to verify proper thermal performance and grout mixture. This contractor shall submit these reports to the Owner, Architect and Engineer to verify compliance with the installation specifications.
- C. If large water seams are encountered, bridging across water seams with #7 or #9 rock, or GeoPro Black Hills 3/8 inch Bentonite Plug, is acceptable. The maximum height of the rock or bentonite bridge shall not exceed 8 feet. The remainder of the vertical bore hole shall be grouted per the above specification. Bore holes with water seams shall be monitored for settling of grout. After a period of one week, all holes shall be topped off with grout as needed. The Contractor shall continue to monitor holes that experience grout settling and continue to top off with grout throughout the warranty period. Bore holes that are unable to hold grout shall be replaced with new bore holes at no cost.
- D. The Contractor shall accept the site as-is and is responsible for any and all required casings. If an area of voids is encountered, the Contractor shall either fill or re-drill wells in an approved area and extend piping to them.
- E. No night drilling will be allowed.

10. DUST CONTROL

- A. The Contractor is responsible for and shall provide dust control. Dust shall not be allowed to leave the construction site boundaries, and furthermore, shall not be allowed to enter the building or accumulate on the building exterior. When needed to meet these requirements, the Contractor shall provide and operate a mechanical dust collection system to control dust at the source. Mechanical dust collection system shall consist of collection hood at the source ducted to a dust collector which separates dust from the airstream. Dust shall be collected into sealed containers for disposal by the Contractor.
- B. Water spraying may be used but shall not be considered a substitute for mechanical dust collection at the source when required.

11. SURFACE WATER / MUD / SLURRY CONTROL

A. The Contractor is responsible for and shall provide control of all ground flowing fluids resulting from drilling operations. The Contractor shall erect silt fences or other structures as required to contain drill cuttings, mud, slurry, etc. within the construction site boundaries. In the event this requirement is not met, the Contractor shall provide all remediation measures as required by all authorities having jurisdiction over such events.

12. WARRANTY

A. The entire ground loop system and backfill from a point 5 feet inside the building shall be warranted for **five (5) years** from date of substantial completion against any leakage or failure. Warranty service for a pipe leak shall include recharging system with heat transfer fluid as originally specified, including glycol or ethyl alcohol if originally specified, as well as corrosion inhibitors.

13. BALANCE

The Contractor shall assist the Balance Contractor in balancing the geothermal well zones to obtain the specified flows.

14. SUBMITTALS

- A. Submit manufacturer's specification sheets and installation instruction for each component of the system, showing manufacturer, pipe or tube weight, pressure rating, fitting type and joint type for each piping system.
- B. Submit manufacturer's mechanical data for valves.
- C. Submit a drawing indicating the system layout and pipe sizes.
- D. Provide a copy of the technician's certification, and International Ground Source Heat Pump Association Certification.

15. TEST BORES

- A. One test bore has been drilled. The test bore location and corresponding geological data is show on the plans, Sheet UM 1.0.
- B. The Contractor may visit the site prior to bid and perform their own test boring if additional information is required. This shall be coordinated with the Owner.

SECTION 202100 - VALVES AND COCKS

1. GENERAL

- A. The Contractor's attention is directed to the General and Special Conditions, General Conditions-Mechanical and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified herein.
- B. The Contractor shall provide all valves required to control, maintain and direct flow of all fluid systems indicated or specified. This shall include, but may not be limited to all valves of all types including balancing cocks, air cocks, lubricated plug cocks, packed plug cocks, special valves for special systems, etc., for all Mechanical Systems.
- C. All valves shall be designed and rated for the service to which they are applied.
- D. The following type valves shall <u>not</u> be acceptable: Zinc, plastic, fiber or non-metallic.
- E. Ball valves with temperature and pressure ports are <u>not</u> an acceptable alternative to the balancing valves specified herein. Valves that do not comply with these specifications shall be removed and replaced by the Contractor with no increase in contract price.
- F. Each type of valve shall be of one manufacturer, i.e., gate valves, one manufacturer, globe valves, one manufacturer, silent check valves, one manufacturer, etc. The following valve manufacturers shall be acceptable: Lunkenheimer, Tour & Anderssen, Powell, Nibco, Crane, Jenkins, T & S Brass, Walworth, Milwaukee, DeZurik, Consolidated Valve Industries, Inc., Victaulic, Bell & Gossett, Flow Design, Watts.
- G. All valves shall comply with current Federal, State and Local Codes.
- H. All valves shall be new and of first quality.
- I. All valves shall be full line size. Valves and hydronic specialties shall not be reduced to coil or equipment connection size. Size reductions shall be made at the connection to the equipment.
- J. Angle stops for plumbing fixtures shall be quarter turn ball type.
- K. All valves for use in potable water systems shall comply with federal lead free requirements that the lead content of wetted surfaces cannot exceed 0.25% by weight.

2. LOCATION OF MAINTENANCE VALVES

Maintenance valves and unions, installed so as to isolate equipment from the system shall be installed at the following locations:

- A. At each plumbing fixture.
- B. At each Energy Recovery Unit and Heat Pump Unit.
- C. At each heating or cooling coil.
- D. At all other locations indicated on the drawings.

3. WORKMANSHIP AND DESIGN

A. Handwheels for valves shall be of a suitable diameter to allow tight closure by hand with the application of reasonable force without additional leverage and without damage to stem, seat and disc. Seating surfaces shall be machined and finished to insure tightness against leakage for service specified and shall seat freely. All screwed valves shall be so designed that when the screwed connection is properly made, no interference with, nor damage to the working parts of the valve shall occur. The same shall be true for sweat valves when solder or brazing is applied.

4. TYPES AND APPLICATION

A. GATE VALVES

Gate Valves shall not be allowed.

B. GLOBE VALVES

Globe Valves shall permit control of flow rate from full flow to complete shut-off and designed that when the valve is wide open it can be repacked under pressure, and have a deep stuffing box with gland and filled with high quality packing. Valves 1-1/2 inches and smaller shall be bronze with ends to suit piping union bonnet, and with stainless steel plug type disc and seat of not less than 500 Brinnell hardness. Valves 2 inches and larger shall be iron body bronze mounted with flanged ends, yoke bonnet, and disc guide. Working pressure for bronze valves shall be 150 pounds and iron valves 125 pounds when installed in piping with system pressures up to 100 pounds per square inch and 250 pounds for 100 pounds per square inch and over. 1-1/2" and under NIBCO T256AP, greater than 1-1/2" NIBCO F768B.

C. CHECK VALVES

Check Valves shall be horizontal swing type with two piece hinges, disc construction seats to be bronze and bronze discs or with composition face depending on service and provide silent operation. Valves 1-1/2 inches and smaller shall be bronze with ends to suit piping, have full area "Y" pattern body and integral seats. Valves 2 inches and larger shall be iron body brass mounted and with flanged ends. Working pressure for bronze valves shall be 150 psi and iron valves 125 psi when installed in piping with system pressures up to 100 psi and 250 psi for 100 psi and over. 3" and under NIBCO T433Y, greater than 3" NIBCO F918B (for less than 100 psi systems) greater than 3" NIBCO F968B (for 100 psi or greater systems).

D. BALL VALVES (NON-POTABLE)

Ball Valves shall have removable lever handle with vinyl grip, adjustable stem gland screw, reinforced Teflon stuffing box ring, blow out proof stem, bronze body, reinforced Teflon seats, chrome plated steel ball as manufactured by Consolidated Valve Industries, Inc., Lunkenheimer, Apollo, Jenkins, Nibco or equivalent. Provide a stem extension so that the base of the handle is 1/4" above the insulation similar to Nibseal. NIBCO T5800-70.

E. BALL VALVES (POTABLE WATER)

All valves for use in potable water systems 2" and smaller contain less than 0.25% lead by weight and comply with federal lead free potable water requirements. Ball valves shall have a removable lever handle with vinyl grip, adjustable stem gland screw, reinforced Teflon stuffing boxring, blowout proof stem, stainless steel or bronze body, reinforced Teflon seats, stainless steel or chrome plate steel ball as

manufactured by Appollo, Aslo, Nibco, Milwaukee, or equivalent. Provide a stem extension so that they bas of the handle is ¹/₄" above the insulation similar to Nibseal. NIBCO S-585-66-LF.

F. BUTTERFLY VALVES

Butterfly valves shall be line sized cast iron body, lug style, 200 PSI rating (bubble tight) EPT or Viton seat, cartridge type; high strength stem. Disc to have ground and polished seating surface. Operator shall be locking lever style. Quality equivalent to Crane Monarch series. 3" and under NIBCO LD3222-3, greater than 3" NIBCO LD322-5. Valves 6" and over shall have gear driven oprators.

G. BALANCING VALVES

Bell & Gossett, Model CB circuit setter balancing valve or approved equivalent. Calibrated balancing valve shall have flanged connections suitable for 125# working pressure at 250°F. 4" and up shall be rated at 175# at 250°F working pressure. Provide with brass readout valves fitted with an integral EPT insert and check valve. Each balance valve shall have a calibrated nameplate to assure specific valve settings and be constructed with internal seals to prevent leakage.

H. AIR COCKS

Straight nose; Lunkenheimer Fig. 476; bronze; tee handle; bent nose; Lunkenheimer Fig. 478, 125#; bronze; tee handle.

I. GAUGE COCKS

Straight, Lunkenheimer, Fig. 1178; 125#; bronze; tee handle. FIP.

J. LUBRICATED PLUG COCKS

2" and under; Homestead Fig. 601; 150#; semi-steel; screwed; 2-1/2" and over; Homestead Fig. 602; ±50#; semi-steel; flanged.

K. PACKED PLUG COCKS

2" and under; DeZurik Fig. 425-S; 175#; semi-steel; screwed. 2-1/2" and over; DeZurik Fig. 425-F; 175#; semi-steel; flanged.

SECTION 202110 - ACCESS TO VALVES, EQUIPMENT, FILTERS, ETC.

1. GENERAL

- A. The Contractor's attention is directed to the General and Special Conditions, General Requirements-Mechanical and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified herein.
- B. All mechanical equipment shall be installed in a manner which allows ready access to all components requiring service, adjustments, shutoff, etc.
- C. Filters shall be accessible, removable and replaceable without disconnecting mounting brackets, piping, wiring, etc.
- D. All oil cups, grease cups, grease fittings, etc. shall be accessible without disassembly of equipment, piping, ductwork, etc. (Extended oilers or grease fittings may be required).
- E. Provide access doors or panels for all equipment, valves, dampers, filters, fire dampers, etc. in concealed spaces not otherwise provided with suitable access. (Lay-in ceilings shall be considered acceptable access; splined or drywall ceilings shall not).
- F. All valves, unions, strainers, cleanouts, volume dampers, and test points shall be accessible.
- G. Access panels in lay-in ceilings shall be labeled with a lamacoid plate to indicate location of equipment, filters, valves, etc.
- H. Access panels in fire rated walls shall bear the same rating as the wall.
- I. Each fire damper shall be provided access through the duct to allow reset of the damper. This may be either a gasketed sheet metal panel over a suitable opening or a factory built access panel. The panel shall be at least one and one-half (12) inch larger than the opening all around and shall be held in place with sheet metal screws sufficiently to Ensure that it is air tight. Manually check the size and location of each of these openings to ensure that the fire damper may be manually reset by use of hand only.

2. ACCESS DOORS

Refer to Sheet Metal and Flexible Duct section of the specifications.

SECTION 202200 - INSULATION - MECHANICAL

1. GENERAL

- A. The Contractor's attention is directed to the General and Special Conditions, General Conditions-Mechanical and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified herein.
- B. Work under this section shall include all labor, equipment, accessories, materials and services required to furnish and install all insulation, fittings and finishes for all mechanical systems specified herein and/or as indicated.
- C. Application of insulation materials shall be done in accordance with manufacturer's written recommendations. Where thickness of insulation is not specified, use applicable thickness recommended by manufacturer for specific use. Insulation shall be applied by a company regularly engaged in the application of insulation and any work deemed unacceptable by the Engineers shall be removed and properly installed at the expense of the Contractor.

2. MANUFACTURERS

A. Insulation shall be as manufactured by Manville, Knauf, CertainTeed, Owens-Corning, Armacell or other approved equivalent. Insulation sundries, adhesives, and jackets/covers shall be as made by Benjamin Foster, Zeston, Speedline, Proto, Childers, Vimasco or approved equivalent.

3. FIRE RATINGS AND STANDARDS

- A. Insulations, jackets and facings shall have composite fire and smoke hazard ratings as tested by ASTM E-84, NFPA 255 and UL 723 procedures not exceeding Flame Spread 25, Smoke Developed 50.
- B. Adhesives, mastics, tapes and fitting materials shall have component ratings as listed above.
- C. All products and their packaging shall bear a label indicating above requirements are not exceeded.
- D. Duct linings shall meet the Erosion Test Method in compliance with UL Publication No. 181.

4. GENERAL APPLICATION REQUIREMENTS

- A. Insulation shall be applied on clean, dry surfaces in a neat and workmanlike manner reflecting the best current practices in the trade. Insulation shall not be applied to piping, ductwork or equipment until tested, inspected and released for insulation.
- B. All insulation shall be continuous through walls, ceiling openings and sleeves. However, insulation shall be broken through fire walls. All covered pipe and ductwork is to be located a sufficient distance from walls, other pipe, ductwork and other obstacles to permit the application of the full thickness of insulation specified. If necessary, extra fittings and pipe are to be used. No noticeable deformation of insulation or discontinuity of vaporseal, where required, will be accepted.
- C. "Concealed", where used herein, shall mean hidden from sight as in trenches, chases, furred spaces, pipe shafts, or above hung finished ceilings. "Exposed" shall mean that piping or equipment is not "concealed" as defined above. Piping and equipment in service tunnels, mechanical equipment rooms, storage areas, or unfinished rooms is to be considered as "exposed".
- D. Existing and/or new insulation removed and/or damaged during course of construction shall be repaired or replaced as directed by the Engineer.

- E. Vapor barrier jackets shall be applied with a continuous unbroken vapor seal. Do not use staples thru the jacket. NO EXCEPTIONS!
- F. All insulation shall be installed with joints butted firmly together.
- G. The Contractor shall insure that all insulation (piping, ductwork, equipment, etc.) is completely continuous along all conduits, equipment, connection routes, etc. carrying cold fluids (air, water, other) and that condensation can, in no way, collect in or on the insulation, equipment, conduits, etc. Any such occurrence of condensation collection and/or damage therefrom shall be repaired solely at the expense of the Contractor.

5. PIPING SYSTEMS

A. GENERAL

- (1) Bevel insulation and jacket at all points where insulation terminates at unions, flanges, valves and equipment. Note: Applies to hot water lines only; cold water lines require continuous insulation.
- (2) Geothermal piping systems, if required to be insulated, shall be insulated continuously like a chilled water system. This requirement extends to all components in the system (pump impeller housing, unions, flanges, valves, air separators, sidestream filters, hydronic specialties, etc.).
- (3) Pipe insulation shall extend around valve bodies to above drain pans in hydronic equipment over pumps, etc. to ensure no condensation drip or collection.
- (4) Factory molded fittings may be installed in lieu of built-up fittings. Jackets to be the same as adjoining insulation. Insulated fittings must have same or better K factors than adjoining straight run insulation.
- (5) Valves, flanges and unions shall only be insulated when installed on piping whose surface temperature will be at or below the dew point temperature of the ambient air.
- (6) Insulation shall not extend through fire and smoke walls. A UL-listed penetration system shall be used for each fire or smoke wall penetration in accordance with KBC. Materials used such as caulk, sleeves, etc. shall be manufactured by 3M, Hilti, or equal.

B. INSULATION SHIELDS

(1) Metal insulation shields are required at all pipe hangers where the piping is insulated. Metal shields shall be constructed of galvanized steel, formed to a 180 degree arc. Insulation shields shall be the following size:

PIPE SIZE	SHIELD GAUGE	SHIELD LENGTH
2" AND LESS	20	12"
2 1/2" TO 4"	18	12"
5" TO 10"	16	18"
12" AND GREATER	14	24"

C. INSULATION MATERIAL (FOR THE FOLLOWING SYSTEMS)

Insulation shall be Owens-Corning Model 25ASJ/SSL, or approved equivalent fiberglass pipe insulation with an all service jacket. The insulation shall be a heavy density, pipe insulation with a K factor .23 at 75°F mean temperature. The insulation shall be wrapped with a vapor barrier jacket approved manufacturers are listed in section 2. Manufacturers. The jacket shall have an inside foil surface with self sealing lap and a water vapor permeability of .02 perm/inch. All circumferential joints shall be vapor sealed with butt strips. All insulation shall be installed in strict accordance with the manufacturers' recommendations. The following pipes shall be insulated with the thickness of insulation as noted.

- (1) Domestic Cold Water
 - a. Piping 3" or less use 1/2" thick insulation.
 - b. Piping 4" or greater use 1" thick insulation.
- (2) Hydronic System Fill Lines From Domestic Cold Water 1/2" thick.
- (3) Domestic 110°F Hot Water and 110°F Recirculating Hot Water.
 - a. Piping $1 \frac{1}{2}$ " or less use $1 \frac{1}{2}$ " thick insulation.
 - b. Piping 2" or greater use 2" thick insulation.
- (4) Geothermal Heat Pump Piping
 - a. Piping $1 \frac{1}{2}$ " or less use $\frac{1}{2}$ " thick insulation.
 - b. Piping 2" and greater use 1" thick insulation.
- (5) Horizontal Roof Leaders.
 - a. Piping 3" or less use 1/2" thick insulation
 - b. Piping 4" or greater use 1" thick insulation
- (6) Condensate Drain Lines.
 - a. Piping $1\frac{1}{2}$ " or less use 1/2" thick insulation
 - b. Piping 2" or greater use 1" thick insulation

D. JACKETS

(1) Exposed (Mechanical Rooms, Service Platforms, Interior Finished Rooms and Storage Rooms)

All insulated piping installed in the above areas shall have a canvas or PVC jacket:

- a. 6 oz. canvas jacket with fire retardant lagging. Apply to the insulation specified for the piping.
- b. Plenum rated PVC jacket equal to LoSmoke PVC jacket with flame/smoke rating of 25/50, ASTM-E84 test method. Minimum thickness 0.04 inches. Jackets shall be applied over top of specified pipe insulation. Approved equal manufacturers are Zeston and Speedline. Approved equal manufacturers are Zeston and Speedline.
- c. Apply canvas on piping to a point 6'-0" AFF. Insulated pipe installed highter than 6'-0" AFF does not get canvas jacket.

(2) Exposed (Exterior)

In addition to the insulation specified for the exterior pipe, provide .016" aluminum jacket or PVC jacket 0.05" thick. The jackets shall be installed as recommended by the manufacturer to maintain water tight seal. All longitudinal and transverse seams to be sealed water tight. PVC jacket shall be Ceel-Co, Proto, or Zeston.

6. DUCTWORK SYSTEMS

A. GENERAL

- (1) Duct sizes indicated are the net free area inside clear dimensions; where ducts are internally lined, overall dimensions shall be increased accordingly.
- (2) Duct insulation shall extend completely to all registers, grilles, diffusers, and louver outlets, etc., to insure no condensation drip or collection. The backs of all supply diffusers, plenums, grilles, etc. shall be insulated only if indicated by details on the drawings.
- (3) All flexible duct connections on insulated ductwork shall be externally insulated.
- (4) All duct outside of building envelope, including rooftop duct, duct in unconditioned attic spaces above the insulation, etc. shall have two layers of specified insulation. This shall apply to supply air, exhaust air where air is run through energy recovery unit, outside air, return air, and combustion air intake ducts.

B. EXTERNAL INSULATION

- (1) Supply Air.
- (2) Outside Air.

Owens/Corning "Faced Duct Wrap - Type 100", or approved equal, 2" thick fiberglass duct wrap, **1.0 pcf** density factory laminated to a reinforced foil kraft vapor barrier facing (FRK) with a 2" stapling flange at one edge. Flame spread 24, smoke developed 50, vapor barrier performance 0.02 perms per inch. K factor shall not exceed .26 at 75°F. mean temperature. Minimum R-value of the 2" thick insulation shall be 7.4 out of package and 6.0 installed.

Special Notes:

- a. Refer to drawings as well as specification Section 231200, Sheet Metal and Flexible Duct for insulation requirements where ducts must be painted.
- b. Where supply, return, and outside air ductwork is routed through an unconditioned attic or any other space outside of the building thermal envelope, the ductwork shall be provided with a minimum of 2 layers of duct wrap for a minimum R value of 11.0. Additionally, this shall apply to exhaust ductwork on entering side of energy recovery type air handling units.

C. EXPOSED EXTERNALLY INSULATED DUCT

- (1) Round. 1 ¹/₂" semi-rigid fiberglass tank and pipe wrap with kraft aluminum foil all service jacket vapor barrier or PSK facing. K=.27 @ 75°F. Minimum R-value shall be OK. Provide 6 oz. canvas jacket with fire retardant lagging.
- (2) Rectangular. 1" rigid fiberglass industrial board with foil scrim kraft vapor barrier facing or PSK facing, 6.0 PCF density, K=.22 @ 75°F. Owens/Corning type 705. Provide 6 oz. canvas jacket with fire retardant lagging.

7. MECHANICAL EQUIPMENT

A. ROOF DRAIN SUMPS

(1) Owens-Corning Model 475-FR or approved equivalent rigid board insulation with exterior vapor barrier jacket formed to bottom of sump basin. Insulation shall have a K factor of .22 at 75°F. mean temperature. Insulation shall be 1" thick. Insulation shall be formed to roof drain sump. Vapor barrier shall remain continuous.
SECTION 202400 – IDENTIFICATIONS, TAGS, CHARTS, ETC.

1. GENERAL

A. The Contractor's attention is directed to the General and Special Conditions, General Conditions-Mechanical and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other Contract Documents which affect the work of this section and which are hereby made a part of the work specified herein.

2. VALVE TAGS AND CHARTS

A. Provide and install on each valve in the Mechanical Systems a 1-1/2" diameter circular brass tag fitted to each valve so that it cannot be removed. Each tag shall be embossed consecutively with letter and number identifiers as to system and purpose respectively. Letter identifiers shall be as follows:

Geothermal Supply
Combination Heating/Cooling
Domestic Cold Water
Domestic Hot Water
Recirculating Hot Water
Fire Protection
Natural Gas
Geothermal Return

Number identifiers shall be determined by the Contractor sequentially. For example, valve No. HC-1 may be maintenance stops for fan coil units. HC-2 maintenance stops for air heaters, etc.

- B. Provide three (3) copies of typewritten valve charts indicating each valve identifier, the valves purpose and its location. For example: "HC-1 Fan Coil Maintenance Stop-one valve at supply and return of each fan coil unit." One (1) copy of this chart shall be mounted in suitable wood frame(s) with clear plastic or glass covers in a conspicuous location in the Mechanical Room. Two other copies shall be turned over to the Engineers.
- C. Where more than one major Mechanical room is indicated for the project, install mounted valve schedule in each major Mechanical Room, and repeat only main valves which are to be operated in conjunction with operations of more than single Mechanical Room.

3. PIPING IDENTIFICATION

A. GENERAL

(1) Provide stenciled markers and arrows indicating direction of flow on all piping installed under this Contract. Markers and arrows shall be painted on the piping using machine cut stencils. All letters shall be sprayed using fast drying lacquer paint. All markers and arrows shall be properly oriented so that descriptive name may be easily read from the floor. At the Contractor's option, Setmark or equivalent manufactured marking system may be substituted for field marking. The following table describes the size of the color field and size of the identification letter which shall be used for pipes of different outside pipe diameters.

OUTSIDE DIAMETER OF		
PIPE	LENGTH OF COLOR FIELD	SIZE OF LETTERS
OR COVERING		

INCHES	INCHES	INCHES
3/4 TO 1-1/4	8	1/2
1-1/2 TO 2	8	3/4
2-1/2 TO 6	12	1-1/4
8 TO 10	24	2-1/2
OVER 10	32	3-1/2

(2) "Concealed", where used herein, shall mean hidden from sight as in trenches, chases, furred spaces, pipe shafts, or above hung finished ceilings. "Exposed" shall mean that piping or equipment is not "concealed" as defined above. Piping and equipment in service tunnels, mechanical equipment rooms, storage areas, or unfinished rooms is to be considered as "exposed".

B. PAINTING (REFER ALSO TO ARCHITECTURAL SECTION ON PAINTING)

- (1) Paint all equipment and metal surfaces which are not factory finished (and all damaged or rusted surfaces) in high grade rust proofing machinery enamel. Pay particular attention to flanges, valves, unions, etc., where condensation may collect.
- C. All piping shall be marked. Piping shall be marked not less than every 15 linear feet above a ceiling system, every 10 feet in a mechanical room, and at all points where the piping passes through wall or floors.

4. EQUIPMENT IDENTIFICATION

A. All equipment, except in finished rooms, shall be identified by stenciling the title of the equipment as taken from the plans in a position that is clearly visible from the floor. The letters shall be made with black paint and shall be not less than two inches high. The titles shall be short and concise and abbreviations may be used as long as the meaning is clear. Lamacoid plates are also acceptable. In finished rooms or outdoors, equipment shall be identified by engraved nameplates.

5. DUCTWORK IDENTIFICATION

A. All ductwork shall be identified as to the service of the duct and direction of flow. The letters shall be at least two inches high and the flow arrow shall be at least six inches long. The letters and flow arrow shall be made by precut stencils and black oil base paint with aerosol can. Concealed ducts need not be identified.

6. ACCESS THROUGH LAY-IN CEILINGS

A. Mark the ceiling T-bar nearest the ceiling panel access to equipment, valves, damper, filter, duct heaters, etc., with a small red lamacoid plate with name of item above ceiling.

SECTION 202500 - HANGERS, CLAMPS, ATTACHMENTS, ETC.

1. GENERAL

- A. The Contractor's attention is directed to the General and Special Conditions, General Provisions -Mechanical and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.
- B. Each Contractor's attention is also directed to Section 201300, Pipe, Pipe Fittings and Pipe Support.
- C. This section includes, but is not limited to, furnishing and installing dampers, supports, anchors, and accessories for piping, ductwork, equipment, etc. Furnishing and installing shall be by each trade for the completion of their work.
- D. Power driven anchors and expansion anchors shall be permitted only when permission is granted in writing by the Architect and Engineer.
- E. The contractor's attention is directed to notes on the mechanical, plumbing, and structural drawings for additional requirements related to the installation of anchors in precast planks.

2. MATERIALS AND EQUIPMENT

A. Hangers, Clamps, Attachments, Etc.:

	SIZE	SPECIFICATION
1. Pipe Rings	2" pipe and smaller	Adjustable swivel split ring or split pipe ring, Grinnell Figures 104 and 108, Elcen, Fee & Mason, or approved equivalent.
2. Pipe Clevis	2-1/2" pipe and larger	Adjustable wrought Clevis type, Grinnell Figure 260, Elcen, Fee & Mason, or approved equivalent.
3. Pipe Clevis	All	Steel Clevis for insulated pipe, Elcen Figure 12A, Grinnell, Fee & Mason or approved equivalent.
4. Rise Clamps	All	Extension pipe or riser clamp, Grinnell Figure 261, Elcen, Fee & Mason or approved equivalent.
5. Beam Clamps and Attachments	All	Grinnell Figure numbers listed or, Elcen, Fee & Mason, or approved equivalent. Malleable beam clamp with extension piece figure 229; I- beam clamp figure 131; C-clamp figures 83, 84, 85, 86, 87, and 88.
6. Brackets	All	Welded steel brackets medium weight, Grinnell Figure 195, Elcen, Fee & Mason or approved equivalent.

7. Concrete Inserts	All	Grinnell Figure numbers listed or, Elcen, Fee & Mason or approved equivalent. Wrought steel insert Figure 280 and wedge type insert Figure 281.	
8. Concrete Fasteners	All	Self-drilling concrete inserts, Phillips, Grinnell, Elcen or approved equivalent.	
9. Ceiling	All	Grinnel Figure numbers listed or Elcen, Fee & Mason, or approved equivalent. Pipe hanger flange Figure 153, adjustable swinging hanger flange Figure 155, ceiling flanges Figures 128 and 128R, and adjustable ceiling flange Figure 116.	
10. Rod Attachments	All	Grinnel Figure numbers listed or Elcen, Fee & Mason, or approved equivalent. Extension piece Figure 157, rod coupling Figure 136, and forged steel turnbuckle Figure 230.	
11. U-Bolts	All	Standard, U-bolt, Grinnell Figure 137, Elcen, Fee & Mason, or approved equivalent.	
12. Welded Pipe Saddles	All	Pipe covering protection saddle sized for thickness of insulation, Grinnell Figure 186, Elcen, Fee & Mason or approved equivalent.	
13. Pipe Roll	All	Adjustable swivel pipe roll, Grinnell Figure 174, Elcen, Fee & Mason, or approved equivalent.	
14. Protection Saddle	All	18 gauge sheet metal pipe protection saddle, Elcen Figure 219, Fee & Mason, Power Strut, or approved equivalent.	
15. Hanger Rods	All	Steel, diameter of the hanger threading, ASTM A-107.	
16. Miscellaneous Steel	All	Steel angles, rods, bars, channels, etc., used in framing for supports and fabricated brackets, anchors, etc., shall conform to ASTM-A-7.	
17. Concrete Channel Inserts	All	Continuous slot inserts, Unistrut, or approved equivalent. Heavy duty Series P-3200 or Light Duty Series P-3300 as required.	
18. Adjustable Spot Insert	All	Adjustable spot insert Unistrut, or approved equivalent, P-3245. Design load 1000 lbs.	

3. INSTALLATION

- A. Unless otherwise specifically indicated or hereinafter specified in the specifications, all supporting, hanging and anchoring of piping, ductwork, equipment, etc., shall be done by each trade as is necessary for completion of the work and shall be as directed in the following paragraphs:
 - (1) Supporting and hanging shall be done so that excessive load will not be placed on any one hangers so as to allow for proper pitch and expansion of piping. Hangers and supports shall be placed as near as possible to joints, turns and branches.
 - (2) For concrete construction, utilize adjustable concrete inserts for fasteners. Expansion anchors and power driven devices may be used when approved in writing by the Architect/Engineer. Utilize beam clamps for fastening to steel joists and beams and expansion anchors in masonry construction. When piping is run in joists, piping shall be top mounted on trapeze type hangers with each pipe individually clamped to trapeze hanger.
 - (3) Trapeze hangers shall be supported by steel rods of sufficient diameter to support piping from joists or concrete construction. Where desired or required, piping may be double mounted on trapeze hangers. Where conditions permit, trapeze hangers may be surface mounted on exposed joists by means of approved beam clamps, or to concrete construction by means of approved adjustable inserts or expansion anchors.
 - (4) Install all miscellaneous steel other than designed building structural members as required to provide means of securing hangers, supports, etc., where piping does not pass directly below or cross steel joists.
 - (5) Piping shall not be supported by the equipment to which it is connected. Support all piping so as to remove any load or stress from the equipment.
 - (6) Where piping, etc., is run vertically, approved riser clamps, brackets or other means shall be utilized at approximately 10'-0" center to center minimum and an approved adjustable base stand or fitting on concrete support base shall be utilized at the base of the vertical run.
 - (7) Where piping is run along walls, knee braced angle frames or pipe brackets with saddles, clamps, and rollers (where required) mounted on structural brackets fastened to walls or columns shall be used.
 - (8) Support all ceiling hung equipment, with approved vibration isolators.
 - (9) Where copper tubing is specified, hangers shall be of copper clad type when piping is uninsulated.
 - (10) Uninsulated piping hung from above shall be supported with ring and clevis type pipe hangers. Uninsulated piping mounted on trapeze and wall bracket type support shall be held in place with Ubolts. U-bolts shall allow for axial movement in the piping.
 - (11) All insulated piping shall be supported with clevis type and/or pipe roll hangers. Hangers shall be sized to allow the pipe insulation to pass through the hangers. Install insulation protection saddles at all hanger locations. Welded pipe saddles shall be installed at all hangers on piping 5" and larger. The pipe saddles shall be sized for the thickness of insulation used. Hangers shall fit snugly around outside of insulation saddles.
 - (12) Under no conditions will perforated band iron or steel wire driven hangers be permitted.
 - (13) In general, support piping at the following spacing:

- a. Steel and copper piping 5 feet intervals for piping 3/4" and smaller. 6 feet intervals for 1 ¼" and 1" pipe. 8 foot intervals for piping 1 ½" to 3". 10 foot intervals piping 3 ½" and larger.
- b. Polyethylene piping 4 foot intervals for piping 2" and smaller. 5 foot intervals for 3" pipe. 6 foot intervals for 4", 6", and 8" pipe. 7 foot intervals for 10" and larger pipe.
- c. PVC piping 4 foot intervals for piping 1 1/2" and smaller. 5 foot intervals for 2 and 2 ¹/₂" piping. 6 foot intervals for 3" pipe and larger.
- d. Where the manufacturer of the pipe has more strict guidelines, the manufacturer's recommendations shall be followed.

SECTION 203100 - TESTING, BALANCING, LUBRICATION AND ADJUSTMENTS

1. GENERAL

- A. The General Conditions, Instructions to Bidders, Section 200100, and other Contract Documents are a part of this specification and shall be binding on all Mechanical Contractors. It shall be each Contractor's responsibility to apprize himself of all information pertinent to his work prior to submitting his proposal. No adjustments will be made in this Contract which is a result of failure to comply with this requirement.
- B. The Engineer, or his authorized representative, shall be notified by the Contractor twenty-four (24) hours in advance of any tests called for in these specifications or required by others. Any leaks or imperfections found shall be corrected and new tests run to the satisfaction of the Engineer or his authorized representative. Upon completion of a test, a written approval of that part of the work will be given to the Contractor. Only after written approval, signed by the Engineer, shall the Contractor apply insulation or paint or allow his work to be furred-in. This written approval, however, does not relieve the Contractor of the responsibilities for any failure during the guarantee period. The expense of all tests shall be borne by the Contractor, along with all temporary equipment, materials, gauges, etc. required for tests.

2. PLUMBING

- A. Piping shall be tested before being insulated or concealed in any manner. Where leaks or defects develop, required corrections shall be made and tests repeated until systems are proven satisfactory.
- B. Water piping systems shall be subjected to a hydrostatic test of one hundred fifty pounds. The system shall be proven tight after a twenty-four (24) hour test.
- C. The house drain line, interior storm sewers, interior rain water conductors, and all soil, waste and vent piping shall be subjected to a hydrostatic test of not less than a 10-foot head or an air test of not less than 5 lbs. per sq. inch using a mercury column gauge and shall hold for 15 minutes.
- D. Exterior sewer lines to the termination point outside the building shall be subject to a ten-foot hydrostatic test or an approved smoke test. These lines shall be subjected to a second test after 2 feet of backfill has been properly installed.
- E. After fixtures have been installed, the entire plumbing system, exclusive of the house sewer, shall be subjected to a pressure test equivalent to one inch water column and proven tight. The Contractor responsible shall furnish and install all of the test tees required, including those for isolating any portion of the system for tests.
- F. Thermometers and gauges shall be checked for accuracy. If instruments prove defective, they shall be replaced.
- G. The Contractor shall perform all additional tests that may be required by the Kentucky Department of Health or other governing agency.
- H. Set temperature control on water heaters and adjust tempering valves as required.
- I. Water balance of domestic water systems is by Owner under separate contract.
- J. Any leaks or imperfections found shall be corrected and a new test run until satisfactory results are obtained. The cost of repair or restoration of surfaces damaged by leaks in any system shall be borne by the Contractor.

3. HEATING, VENTILATING AND AIR CONDITIONING

- A. Air and water balancing are provided under separate contract by the Owner's testing and balancing (TAB) agency. The Contractor shall coordinate with the Owner's TAB agency as specified herein
- B. Bidding TAB contractor to provide bid pricing for test and balance work separately to Matt Wade, CMTA, mwade@cmtaegrs.com prior to bid date and time for test and balance work specified herein. Do not turn in with bid or include in total submitted bid amount.
- C. The test and balance of this system shall be by a contractor who employs only the services of a certified AABC or independent NEBB firm whose sole business is to perform test and balance services. The test and balance contractor shall report all deficiencies to the engineer
- D. The Mechanical Contractor shall test all piping before being insulated or concealed in any manner. Where leaks or defects develop, required corrections shall be made and tests repeated until systems are proven satisfactory. Water piping systems shall be subjected to a hydrostatic test of not less than one hundred pounds and shall be proven tight after a twenty-four (24) hour test.
- E. All motors, bearings, etc. shall be checked and lubricated as required during start-up procedures. All automatic, pressure regulating and control valves shall be adjusted. Excessive noise or vibration shall be eliminated. Provide all start-up documents prior to commencing of test and balance by the Owner's contractor.
- F. All fan belts shall be adjusted for proper operation of fans.
- G. System balancing, where required, shall be performed only by persons skilled in this work. The system shall be balanced as often as necessary to obtain desired system operation and results.
- H. All deficiencies observed by the Test and Balance Contractor shall be reported immediately to the Engineer and Mechanical Contractor.
- I. For the purpose of placing the heating, ventilating and air conditioning system in operation according to design conditions and certifying same, final testing and balancing shall be performed in complete accordance with AABC Standards for Total System Balance, Volume Six (2002), for air and hydronic systems as published by the Associated Air Balance Council. The following systems shall be test and balance:
 - a. The supply, return and outside air duct systems associated with Energy Recovery Unit. Provide static pressure profiles thru each system. Static pressure profiles shall include all sections from the return duct inlet and supply duct outlet of the air handling unit. Show accurate representation of return, exhaust, and outdoor damper locations.
 - b. Balance all supply, return and exhaust air grille to within 10% of design air flow rate.
 - c. Balance domestic hot water return system including all balance valves and record settings and flows.
 - d. Balance all heat pumps both in the addition as well as in the attached existing building. Refer to drawings.
- J. The Test and Balance agency shall provide lifts, scaffolding, etc. as required to balance devices in areas with high ceilings such as gymnasiums, auditoriums, atriums, cupolas, etc. The Test and Balance agency may coordinate with the General Contractor or Mechanical Contractor to arrange for these items to be provided to access high devices, however, it is emphasized the Contractor is finally responsible for providing the means required to balance all devices.
- K. Instruments used for testing and balancing of air and hydronic systems shall have been calibrated within a period of six months prior to balancing. All final test analysis reports shall include a letter of certification

listing instrumentation used and last date of calibration.

- L. Test and Balance agency is to provide sizing of fan or motor sheaves required for proper balance. The Mechanical Contractor will purchase and install all sheaves and belts as required. This includes new and existing equipment.
- M. Four (4) copies of the complete test reports shall be submitted to the Consulting Engineer prior to final acceptance of the project. Preliminary test reports shall be submitted when requested.
- N. The Contractor shall provide and coordinate his work in the following manner:
 - a. Provide sufficient time before final completion date so that tests and balancing can be accomplished.
 - b. (2) Provide immediate labor and tools to make corrections when required without undue delay.
- O. The Contractor shall put all heating, ventilating and air conditioning systems and equipment and rangehood system into full operation and shall continue the operation of same during each working day of testing and balancing.
- P. The test and balance contractor shall be present during the Engineer's final inspection of the building, or a separate project review date. The Engineer may request confirmation of the air balance report by asking for new measurements to be taken at that time. Any information in the test and balance report may be asked to be reconfirmed.
- Q. Balance all water and air systems. Be sure to include:
 - a. Domestic Hot Water Recirculating System.
 - b. Geothermal Pump Balancing Verify calibrations of the differential pressure sensors for the geothermal pumping system. Set differential pressure control setpoint as low as possible to allow the system to control to the lowest possible setpoint. Coordinate pressure setpoint and verify flow is achieved at worst-case system outlet. Process may require several iterations to achieve a calibrated system pressure setpoint. Provide results of tests and record iterative values read in the process of optimization in the balance report submitted for review to the engineer.
 - c. Geothermal Balance
 - i. Confirm flushing velocities (forward and backward) in geothermal well field.
 - ii. Confirm pressure drop values for each well field zone.
 - iii. Set flow rate for each well field zone.
 - iv. Submit report confirming above geothermal information to the Engineer prior to submission of final balance report.
 - d. Automatic Flow Control Balance Valves
 - i. Verify that each installed automatic flow control device matches the GPM indicated on the drawings.
 - ii. Verify that the actual pressure at each automatic flow control device is within the pressure limits specified by the valve manufacturer.

4. FIRE PROTECTION SYSTEM

A. Test in accord with local Fire Marshal requirements and/or requirements or recommendations of NFPA Regulations.

5. PREPARATION AND COORDINATION REQUIREMENTS – GENERAL

- a. Shop drawings, submittal data, up-to-date revisions, change orders, and other data required for planning, preparation, and execution of the TAB work shall be provided to the TAB Agency no later than 30 days prior to the start of TAB work.
- b. System installation and equipment startup shall be complete prior to the TAB Agency's being notified to begin.
- c. The building control system shall be complete and operational. The Building Control system contractor shall install all necessary computers and computer programs, and make these operational. Assistance shall be provided as required for reprogramming, coordination, and problem resolution.
- d. All test points, balancing devices, identification tags, etc., shall be accessible and clear of insulation and other obstructions that would impede TAB procedures.
- e. Qualified installation or startup personnel shall be readily available for the operation and adjustment of the systems. Assistance shall be provided as required for coordination and problem resolution.

6. PREPARATION AND COORDINATION REQUIREMENTS - HVAC CONTROLS

- a. Written notice shall be submitted through the General Contractor to the Architect stating that the Control System is operating and controlling the HVAC System.
- b. The control subcontractor shall have entered all data needed for the TAB Agency to begin work.
- c. The control subcontractor shall be available to correct any problems that the TAB Agency might have with the systems.
- d. All costs for additional work by the TAB Agency due to the Contractor's failure to comply with the above shall be paid by the Contractor and any subcontractor(s) for HVAC controls.

7. PREPARATION AND COORDINATION REQUIREMENTS – MECHANICAL

- a. Written notice shall be submitted through the General Contractor to the Architect stating that the HVAC system is operational and ready for the TAB Agency.
- b. The mechanical subcontractor shall have proved all units operational and all air outlets in the full open position.
- c. The mechanical contractor shall be available to correct any problems that the TAB Agency might have with any equipment or systems.
- d. The mechanical contractor shall furnish and install any replacement sheaves, pulleys and drive belts required for flow adjustments, as determined by the TAB Agency. Adjustable sheaves shall be selected so that the final adjustment position is in the middle third of the total adjustment range.

e. All costs for additional work by the TAB Agency due to the Contractor's failure to comply with the above shall be paid by the Contractor and any subcontractor(s) for mechanical work.

SECTION 210100 - FIRE PROTECTION SYSTEM

1. GENERAL

- A. The General Conditions, Instructions to Bidders, Section 200100, 1. A, and other Contract Documents are a part of this specification and shall be binding on the Contractor. It shall be the Contractor's responsibility to apprise himself of all information pertinent to his work prior to submitting his proposal. No adjustments will be made in this Contract which is a result of failure to comply with this requirement.
- B. No Contractor, other than those regularly engaged in the installation of approved and franchised automatic sprinkler systems, will be considered or approved for the work under this section of the specifications. Bidders must have had not less than five (5) years experience in the fabrication and erection of such systems: wet, dry and rack storage types, and shall have completed installations similar and equivalent in scope to this system under approval by one or more of the recognized Underwriting Associations in the Insurance Field.
- C. Before submitting bid, examine all Mechanical, Architectural, and Structural Drawings, visit the site and become acquainted with all conditions that may, in any way whatsoever, affect the execution of this work. Also, the Contractor shall coordinate with the rating bureau and insuring agency to verify adequacy of water supply for the proposed sprinkler system extension.
- D. The Contractor shall take his own measurements and be responsible for exact size and location of all openings required for installation of this work. Figured dimensions where indicated are reasonably accurate and should govern in setting out work. Detailed method of installation is not indicated. Where variations exist between described work and approved practice, the Engineer shall be consulted for directive.
- E. It is the intent of the Plans and Specifications to provide a general layout only and locate major equipment, piping, etc. Variations in head locations, pipe routing, etc., may be anticipated by the Contractor and shall be coordinated with all other trades and indicated on the drawings and descriptive literature called for hereinafter. It shall be the express responsibility of the Contractor to provide all required materials and equipment and perform all work required to install a complete and approved installation.
- F. All materials and methods shall be in accordance with applicable codes, regulations and/or ordinances and meet approval of local inspection authority and the State Fire Marshal. Also, all work shall comply with the latest editions of the National Board of Fire Underwriters, National Fire Protection Association, OSHA Regulations, the National Building Code, the Life Safety Code, IMC Code and the Southern Building Code (Where applicable). The local insuring agency shall review plans prepared and submitted by the Contractor but shall have no authority to make changes once work has begun.
- G. All work performed under this section shall be accomplished in close harmony with all other trades. All work not so coordinated shall be removed and reinstalled at the expense of the Contractor.
- H. The Contractor shall submit a proposed layout to the Engineer prior to submittal to the Fire Marshal's Office.

2. SCOPE OF WORK

A. Furnish all material, labor, tools, equipment and supervision required for installation of a complete fire protection and stand pipe system as indicated on the project drawings. Include all necessary piping,

sprinkler heads, test connections, valves, drains, cabinets, siamese connections, fire hydrants, fire pump, etc.

- B. The Contractor shall provide flushing and sterilization of all water lines in accordance with current Kentucky Plumbing Codes, Rules and Regulations and shall make connection to domestic water mains in accord with current rules and regulations of the State Department of Sanitary Engineering and Division of Water.
- C. Provide stand pipes with fire hose cabinets or fire valves as indicated or as required to meet the requirements of NFPA and the local fire authority.
- D. Provide sprinklers in attics, overhangs, awnings, cooler/freezers, in accessible spaces and all other areas required by NFPA and the local fire authority.
- E. Provide dry pipe systems or freeze proof heads as required to provide continuous coverage without freezing.

3. WATER SUPPLIES AND SYSTEM LAYOUT CRITERIA

A. Where flow and pressure data are available, they are indicated on the project drawings. The Contractor shall independently verify all such information and notify the engineer of any discrepancies discovered prior to beginning the work. Where no flow information is indicted on the project drawings, the Contractor shall obtain it and indicate it on the shop drawing submittal. Piping systems shall be hydraulically sized based on the most conservative flow information obtained. No adjustments in the contract amount will be allowed for failure of the Contractor to obtain adequate flow information.

4. DRAWINGS AND DESCRIPTIVE LITERATURE

- A. The Contractor shall prepare and submit to the Engineers, seven (7) copies of detailed drawings indicating his proposed Automatic Sprinkler System. These drawings shall indicate minimally the following components when they are used in the system.
 - (1) Name and address of Owner, Architect and Engineers.
 - (2) Make and type of sprinkler heads (Catalog cuts).
 - (3) Make and type of fire department connection (Catalog cuts).
 - (4) Make and type of post indicator valve (Catalog cuts).
 - (5) Make and type of detector check valve (Catalog cuts).
 - (6) Make and type of electric alarm bell (Catalog cuts).
 - (7) Make and type of retard chamber (Catalog cuts).
 - (8) Make and type of dry pipe alarm valve (Catalog cuts).
 - (9) Make and type of flanged check valve (Catalog cuts).
 - (10) Make and type of flanged gate valve (Catalog cuts).
 - (11) Make and type of automatic drains (Catalog cuts).
 - (12) Make and type of pipe hangers (1 catalog cut of each make and/or type).
 - (13) Make, type and electrical characteristics of:
 - a. The pressure sensing switch*.
 - b. The post indicator supervisory switch*.
 - c. The main gate valve supervisory switch*.
 - d. The flow switch*.
 - e. Air compressor.

- (14) Make and type of fire pump (Catalog cuts).
- (15) Make and type of jockey pump (Catalog cuts).
- (16) Make and type of supervised O.S & Y valve.
- (17) Make and type of indicating butterfly valve.
- (18) Make and type of fire hose cabinets.
- (19) Make and type of reduced pressure backflow preventer.

<u>Note</u>: All layouts and drawings are to be closely coordinated with the work of <u>all</u> other trades. The Engineers will, upon request, provide a complete set of Architectural, Structural, Mechanical and Electrical Plans and Specifications to aid the Contractor in this work.

*<u>SPECIAL NOTE</u>: 1) The items (indicated by asterisk) must be clearly coordinated with the Fire Alarm System supplier. 2) Supervisory switches located in wet locations (i.e., fire protection vault) shall be provided with NEMA 6 enclosures.

- (20) On a set of drawings to the same scale as the drawings accompanying these specifications, indicate:
 - a. Each head location coordinated with lights, diffusers and other ceiling mounted device.
 - b. Location of all risers, mains, runout lines, etc.
 - c. Size of all risers, mains, runout lines, etc.
 - d. Location and type of pipe hangers.
 - e. All other information required by the Kentucky Department of Housing, Buildings and Construction.

The Contractor shall submit these drawings to the Engineer through the General Contractor and Architect where applicable. The Contractor shall submit reviewed drawings to the Kentucky Department of Housing, Buildings and Construction for their review and approval. No work shall be done until drawings are approved by the Kentucky Department of HBC.

5. SYSTEM DRAINAGE

- A. The entire Standpipe and Sprinkler System (except that part which is below grade and will not freeze) shall be installed so as to allow 100% drainage.
- B. All sprinkler branch piping shall be installed so as to drain back to the main riser.
- C. Approved 2" drawoff piping shall be provided on sprinkler risers with discharge piping running to nearest floor drain or open air.
- D. Where sprinkler piping is trapped, an approved auxiliary draw-off shall be provided and neatly installed.
- E. All draw-offs shall have a metal tag labeled "Sprinkler Drain."

6. INSPECTIONS AND TESTS

- A. Furnish all labor, equipment and conduct all required tests in the presence of the Owner and Engineer or designated representative.
- B. All piping and devices comprising the fire protection system shall be tested under hydrostatic pressure of not less than 200 PSI and maintained for not less than two (2) hours.

C. Upon completion of his work, the Contractor shall submit a written and signed certificate to the Engineers indicating that he performed the above prescribed tests and rectified all malfunctions arising there from.

7. **PERMITS**

A. The Contractor shall obtain and pay for all necessary state, municipal, county, city and other permits and fees and pay all State taxes which are applicable.

8. GUARANTEE

A. All workmanship, equipment and material shall be guaranteed in writing against defects from any cause, other than misuse, for a period of one year after date of final acceptance.

9. ACCEPTANCE CERTIFICATE

A. Upon completion, the Contractor shall submit to the Engineers, a properly filled out "Sprinkler Contractor's Certificate Covering Materials and Tests." (4 copies).

10. CLEANING

A. Upon completion of this work all debris, material, and equipment shall be removed from the building and premises; all piping shall be cleaned ready for finish painting. Note: Do not remove rust inhibitive primer specified hereinafter.

11. PAINTING

A. All fire protection piping, fittings, etc., shall have one factory or shop coat of rust inhibitive primer. The Contractor shall thoroughly clean all such items in areas where the piping will be exposed so as to readily receive the finish coat specified in the Architectural Division of Painting. Colors shall be as specified in Identification Section of these specifications.

12. PIPE LAYING

A. Bell holes shall be excavated accurately to size and barrel of pipe shall bear firmly on bottom of trench throughout its length. All foreign matter and dirt shall be removed from the inside of the pipe before it is lowered into its position in the trench, and it shall be kept clean by approved means during and after laying. At times when pipe laying is not in progress, the open ends of pipe shall be closed by approved means, and no trench water shall be permitted to enter the pipe. Cutting of pipe, where necessary, shall be done in a neat and workmanlike manner, without damage to pipe. Refer also to Excavation.

13. EQUIPMENT AND MATERIALS

A. Signs

Appropriate code approved and required signs shall be installed on all control valves, drains, inspector's test, etc., indicating the function, installation, etc. Signs shall be neatly affixed with rust inhibitive screws, rivets or where hung from piping; with stainless steel No. 14 AWG wire.

B. Finish

All exposed materials such as valves, fire department connections, sprinkler heads, fire pump test headers, etc., shall be brass or chrome-plated brass.

- C. Check Valves
 - (1) 2-1/2" and over; listed and approved by UL and FM; marked SV-FM; 175# working pressure; 1 BBM; flanged; equivalent to Mueller, Scott or Lunkenheimer.
 - (2) 2" and under; 150# working pressure; bronze; screwed; equivalent to Jenkins, Scott or Lunkenheimer.
- D. Pipe & Fittings
 - (1) Nipples and fittings shall be of same material, composition, and weight classification as pipe in which installed.
 - (2) Up to 2" (Interior) Schedule 40 ASTM A-53 black steel; 125# cast iron screwed fittings or Schedule 10, ASTM A-135 black steel with victaulic or similar type approved fittings.
 - (3) 2-1/2" and larger (Interior) Schedule 40 black steel with flanged, welded or victaulic (or similar) type approved fittings or Schedule 10, ASTM A-135 black steel with victaulic or similar type approved fittings.
 - (4) Blazemaster or approved equivalent CPVC SDR 13.5 pipe UL listed for fire protection use. CPVC is not allowed for dry pipe systems and is only allowed in light hazard occupancies. Piping must be installed in accordance with the manufacturer's recommendation and all governing bodies having jurisdiction.
 - (5) Exterior: Class 200 PVC piping for exterior fire protection piping. Piping shall meet AWWA C900 requirements, be UL listed, Factory Mutual approved and NSF approved. Joints shall have spigot pipe ends with a flexible elastomeric ring seated in a groove to provide water tight seal. Minimum burst pressure to be 900 psi when tested in accordance with ASTM D1599. No. 8 copper wire (tracer wire) shall parallel all exterior PVC pipe.
 - (6) Dry Pipe System Piping: Same as standard system except Schedule 10 piping is not acceptable.
- E. Clamps and Anchors
 - (1) Furnish and install approved clamps, as required, at all (45 degree) 1/8 bends, (90 degree) 1/4 bends and flange and spigot pieces to the straight pipe to insure permanent anchorage of all fire lines. Clamps, clamp rods, nuts, washers, and glands shall be coated with a quick drying coal tar bituminous paint after installation.
- F. Hangers
 - (1) All piping shall be adequately and permanently supported in an approved manner on approved hangers (Submit with drawings).
- G. Sleeves and Escutcheon Plates
 - (1) Furnish and install sleeves for pipes where piping penetrates masonry walls; exterior wall sleeves to be watertight. Fire and smoke stop all penetrations through fire and smoke walls and coordinate with General Contractor for locations.

- (2) Furnish and install cast brass chrome plated split ring type escutcheons where piping penetrates walls, ceilings and floors, whether in finished areas or not.
- H. Electric Wiring
 - (1) All electric wiring for the system which may be required shall be installed in accordance with the National Board of Fire Underwriters, and National Electric Code. The cost of this electric wiring shall be included under this Contract. All electrical wiring and conduit installed in fire protection pits shall be sealed watertight.
- I. Inspection Test Connections & Pressure Gauges
 - (1) A 1" inspection test connection as required by the Kentucky Building Code. Discharge shall run to open air.
 - (2) Control valve for test connection shall be installed not over 7' above the floor.
 - (3) A pressure gauge at the inspection. Test connection at each location indicated on the Plans. Pressure gauges shall be 2-1/2" diameter and readable from the floor.
- J. Gate Valves
 - 2-1/2" and over; listed and approved by UL and FM; marked SV-FM; 175# working pressure; 1 BBM; OS&Y; flanged; cast iron discs; bronze seat rings; four point wedging mechanism; equivalent to Mueller, Scott or Lunkenheimer.
 - (2) 2" and under; 150# working pressure; bronze; rising stem; screwed; bronze discs; bronze seat rings; two point wedging mechanism; equivalent to Jenkins, Scott or Lunkenheimer.
- K. Sprinkler Head Cabinet
 - (1) Furnish and install a cabinet, clearly labeled, with four (4) sprinklers of each type complete with required wrenches. Locate as directed by Engineer. Label "Sprinkler Heads."
- L. Fire Department Connection
 - (1) Furnish and install a fire department connection with threads as approved by the local fire department; cast brass polished and chromium plated; with connection sizes and lettering as directed by the local authority having jurisdiction.
- M. Fire Valve Cabinets
 - (1) Manufacturer. The products specified hereunder shall be Crocker or equivalent by Larsen's Mfg. Co., J.L. Industries, Kidde, or other nationally recognized manufacturer of cabinets conforming closely to specification requirements.
 - (2) Valve cabinets for recessed installation at all locations where shown shall be similar to Crocker Model No. 2700 with flat trim and clear glazed full glass door. Provide 18 gauge steel tub, 20 gauge steel door, 16 gauge steel frame, and white enamel finish interior with all exposed exterior portions painted with color selected by Architect.

- (3) Each cabinet shall be equipped with one 2-1/2" (or as required by the local authority) Fire Department valve with cap and chain. All connections and threads shall be as required by the local authority.
- N. Fire Hose Valve

(1) Manufacturer. The products specified hereunder shall be Crocker or equivalent by Elkhart, Central Sprinkler, Kidde, or other nationally recognized manufacturer of hose valves conforming closely to specification requirements. Valve shall be with cap and chain. All connections shall be $2\frac{1}{2}$ " or as required by the local authority.

- O. Siamese Hose Connection
 - (1) Furnish and install on the fire protection pit where required by the local authority a siamese hose connections with threads as approved by the local Fire Department. Unit shall be similar to Larsen's No. 15 sidewalk siamese, size: 2-1/2" x 2-1/2" x 6". Coordinate threads type with local Fire Department.
- P. Post Indicator Valve
 - (1) Furnish and install a post indicator valve as required by the local authority. It shall be listed and approved by Underwriters Laboratories and Associated Factory Mutual Laboratories; Marked SV-FM; vertical; non-adjustable; with electric supervisory switch, handle, view window, brass padlock with (2) keys; gate valve to meet gate valve specifications, except to have non-rising stem and mechanical joint ends; equivalent to Mueller, Scott or Lunkenheimer.
- Q. Detector Check Valve
 - (1) Furnish and install detector check valve as required by the local authority. It shall be listed and approved by Underwriter Laboratories and Associated Factory Mutual Laboratories; 175# working pressure; IBBM; flanged; with tapped bosses each side for by-pass meter trimming; equivalent to Viking, Badger or Grinnell.
 - (2) The Contractor shall contact the servicing water company and ascertain their policy pertaining to the by-pass water meter; if not furnished by water company. The Contractor shall furnish and install the by-pass meter and trimming as detailed on the drawings.
- R. Sprinkler Heads

Gem, Grinnell, Star, Viking, Reliable, Central or approved equivalent as follows:

- (1) Where piping is exposed: "Standard up right."
- (2) Where piping is concealed above finished ceilings, provide two pieces, semi recessed, white plated sprinkler heads with removable escutcheon.
- (3) Install sprinkler head guards where heads are subject to physical abuse. Heads located below seven (7) feet above floor, etc.
- (4) Sprinkler head degree ratings shall be determined by the area serviced in accord with current Codes and Standard Practices. Indicate degree ratings on submitted Shop Drawings.

- (5) The Contractor shall submit to the Engineer for inspection, one (1) sample of each type of sprinkler head, proposed to be used on the project.
- (6) Where heads are installed in a tile ceiling, they shall be installed in the middle of the tiles, at half or quarter points along the length of the tiles. Install sprinkler heads at quarter points of center scoured 2' X 4' ceiling tiles.
- (7) Provide high temperature heads around range hoods, kitchen equipment, kilns, boilers, water heaters and other heat producing equipment.
- S. Water Motor Gong
 - (1) Furnish and install a water motor gong.

Grinnell, Viking, Mueller or equivalent.

- T. Retard Chamber
 - (1) Same as water motor gong.
- U. Flow Indicator Switches
 - (1) Furnish and install flow indicator switches as required by NFPA 13. All flow indicator switches shall be UL approved. Coordinate with Fire Alarm System supplier/installer. Provide a set of dry contacts on each flow switch for interface to the Control System if this control point is specified in the Controls Section.
- V. Tamper Switches for Water Shut-Off Valves
 - (1) Furnish and install tamper switches where required by NFPA 13. All tamper switches shall be UL approved. Coordinate with fire alarm system supplier/installer. All tamper switches located in fire protection pits shall be waterproof, capable of operating beneath water similar to Potter PTS Series and be NFPA approved.
- W. Fire Hydrant
 - (1) Furnish and install fire hydrants as approved by local Fire Department.

14. GUARANTEE

A. All workmanship, equipment and material shall be guaranteed in writing against defects from any cause, other than misuse, or vandalism, for a period of one year after date of final acceptance.

SECTION 220100 - PLUMBING SPECIALTIES

1. GENERAL

- A. The Contractor's attention is directed to the General and Special Conditions, General Conditions-Mechanical and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work specified in this section.
- B. The Contractor shall provide all equipment and specialties complete with trim required and connect in a manner conforming to the Kentucky Building Code.
- C. The Contractor shall obtain exact centerline rough-in dimensions between partitions, walls, etc. as required for lay-out of his rough-in work. All work shall be roughed-in so that all exposed piping will be straight and true without bends or offsets.
- D. Prior to final inspection, test by operation at least twice, all equipment.
- E. Prior to final inspection, remove all stick-on labels, dirt, grease, other removable stampings, lettering, etc. from equipment and specialties and thoroughly clean same.
- F. All equipment and specialties shall be installed as recommended by the manufacturer in a neat and workmanlike manner. Unacceptable workmanship shall be removed and replaced at the installing Contractor's cost.
- G. All pipes, valves, fittings, fixtures, etc. for use in potable water systems 2" and below shall comply with federal lead free requirements that the lead content of wetted surfaces cannot exceed 0.25% by weight.

2. DRAINAGE SPECIALTIES

A. GENERAL

- (1) Provide all drainage specialties indicated, specified and/or required to provide complete and acceptable removal of all storm, sanitary, waste, laboratory waste, etc. from the building and into approved receptors.
- (2) Drainage specialties shall be on non-electrolytic conduction to the material to which they are connected.
- (3) Drainage specialties shall be installed in a manner so as to ensure no leakage of toxic or odorous gases or liquids and shall have traps and/or backflow preventers where required. Nor shall they allow backflow into other or existing systems.

B. CLEANOUTS - INTERIOR (CO)

- (1) In addition to cleanouts indicated, provide cleanouts in soil and waste piping and storm drainage at the following minimum locations:
 - a. At base of each stack.
 - b. At fifty (50) foot maximum intervals in horizontal lines.
 - c. At each change of direction of a horizontal line.
 - d. As required by current KBC.
 - e. As required to permit rodding of entire system. (If in doubt, contact Engineers.)

- (2) Water closets, slop sinks and other fixtures with fixed traps shall not be accepted as cleanouts.
- (3) Cleanouts and/or test tees concealed in inaccessible pipe spaces, walls and other locations shall have an eight (8) inch by eight (8) inch (minimum) access panel or cover plates shall be set flush with finished floors and walls and shall be key or screw driver operable.
- (4) Access panels for cleanouts shall be of the Zurn, 1460 series or equivalent by Josam or Watts. Where they are not to receive paint, they shall be polished bronze unless otherwise indicated where they are to receive paint or other finishes. They may, at the Contractor's option, be Perma-Coated steel, prepared to receive finish.
- (5) Cleanouts and access panels shall be sized so as to permit the entry of a full sized rodding head capable of one hundred percent circumferential coverage of the line served.
- (6) Provide a non-hardening mixture of graphite and grease on threads of all screwed cleanouts during installation.
- (7) Do not install cleanouts against walls, partitions, etc. where rodding will be difficult or impossible. Extend past the obstruction.
- (8) In finished walls, floors, etc., insure that cleanouts are installed flush with finished surfaces and, where required, grout or otherwise finish in a neat and workmanlike manner.
- (9) Cleanouts shall be as manufactured by Zurn, Josam, Jay R. Smith, Watts, MIFAB, Ancon or equivalent, similar to the following:
 - a. Zurn, Z-1440 cleanouts or Z-1445 cleanout tee at base of exposed stack and at change in direction of exposed lines.
 - b. Zurn, Z-1440 cleanout or Z-1445-1 cleanout tee where stacks are concealed in finished walls
 - c. Zurn, ZN-1400-T cleanout with square scoriated top in finished concrete and masonry tile floors.
 - d. Zurn, ZN-1400-Tx cleanout with square recessed top for tile in vinyl and linoleum finished floors.
 - e. Zurn, ZN-1400-Z cleanout with round recessed top for terrazzo floors.
 - f. Zurn, Z-1400-HD cleanout with tractor cover for exterior locations. Provide concrete supporting pad crowned to shed water. Refer to drawings for pad size.
 - g. Mueller, No. D-731 or D-714, Nibco, Flage or equivalent for cleanouts in copper waste with cover plates and/or access panels listed for other cleanouts.
 - h. Threaded hex head type cleanouts of same materials as pipe for piping 2" and smaller.
 - i. Zurn, cleanout with round top with adjustable retainer for carpet area. Install flush with carpet.

C. FLOOR DRAINS

- (1) Provide floor drains at locations indicated and/or as required by Kentucky Building Code. Install in a neat and workmanlike manner. Coordinate locations with appropriate persons or party to insure floor pitch to drain where required.
- (2) Install floor drains in strict accordance with manufacturer's recommendations and the KBC unless otherwise indicated.
- (3) Each floor drain located on floors above the lowest floor shall be provided complete with a three (3) foot by three (3) foot, four (4) pound sheet lead flashing and clamping collar or chlorinated polyethylene shower pan liner of 30 mil. Lead pans shall be given a heavy coat of asphaltum on bottom and sides before installation and a heavy coat on exposed surfaces (if any). After installation, provide one ply of fifteen (15) pound roofing felt beneath each pan.
- (4) Insure by coordination with the appropriate persons or party that spaces served by a floor drain(s) has a water seal extending at least three (3) inches from the floor of the space served on all floors above the lowest level.
- (5) The floor drains shall be Zurn, Josam, Watts, Jay R. Smith, MIFAB, Sioux Chief or equivalent. Refer to drawings for specification.

D. TRAP PRIMERS

Provide trap primers for all floor drains and open receptacle. Acceptable Trap Primer Manufacturers included Zurn, Precision Plumbing Products and Sioux Chief. Trap Primer selection shall be as follows:

(1) Trap Primer Type-1 (TP-1)

Precisions Plumbing Products Prime-Time or equal electronic trap priming manifold, with atmospheric vacuum breaker, pre-set 24 hour clock, manual override switch, 120 volt solenoid valve with 120v/3wire connection. Provide in 12" x 12" x 4" surface mounted metal cabinet. Provide with 10 opening manifold, un-used manifold opening shall be capped. Install united as required by manufacturer. Provide $\frac{1}{2}$ " tubing from primer unit to all floor drains with primer connections in the area.

(2) Trap Primer Type-2 (TP-2)

Precision plumbing products Prime-Rite or equal trap primer shall be installed on a cold water line, with distribution unit(s) to serve 1 to 8 drains. Install per manufacturer's recommendations.

(3) Trap Primer Type-3 (TP-3)

Zurn Z-1022 or equal trap primer shall be installed in cold water supply line of nearest plumbing fixture. One trap primer per floor drain, one trap primer per fixture. Pipe to waste inlet per manufacturer's recommendations.

E. CLEANOUTS (EXTERIOR) (ECO)

Provide exterior cleanouts at each location indicated and in the manner indicated. Permanently set all exterior cleanouts centered in a 30" X 30" X 6" deep concrete pad. The top of the concrete pad shall be flush with finished grade. The top of the cleanout box shall be flush with the top of the pad and shall be stamped "CO."

F. ROOF DRAINS

(1) Each drain shall be provided complete with a three (3) foot by three (3) foot, four (4) pound sheet lead flashing and clamping collar. Roof drains shall be installed in strict accordance with the drain manufacturers and roofing manufacturer's instructions. Provide all accessories required for a complete installation. Refer to drawings for specification of roof drain.

G. VARMINT GUARDS

Provide at each live discharge and/or culvert discharge (where culvert exceeds 30 linear feet in length) and where the line has a surface opening greater than one-half (2) square feet, a three (3) inch mesh steel varmint guard made up with frame and 3/8 inch minimum steel rods welded together and affixed tightly into the end of the open pipe.

3. WATER SUPPLY SPECIALTIES

A. GENERAL

- Provide all water supply specialties indicated, specified and/or required for the complete installation. Install in a neat and workmanlike manner in accordance with the manufacturer's recommendations and the KBC.
- (2) Where required by the KBC, install code approved vacuum breakers in each water supply specialty.

B. FREEZEPROOF WALL HYDRANTS (FPWH)

- (1) Provide code approved wall hydrants at each location indicated in a neat and workmanlike manner. Affix tight to walls and insure that the feed piping is on the <u>heated</u> side of the building insulation blanket.
- (2) Where hydrants are of handwheel type, remove handwheels and turn over to owners in an envelope labeled "Wall Hydrants" exterior upon completion of the project.
- (3) Where hydrants have key operators, turn over at least two (2) keys in an envelope labeled "Wall Hydrants" to owners upon completion of the project.
- (4) Where hydrants have lockable boxes, turn over at least two (2) keys in an envelope labeled "Wall Hydrants, Exterior" to owners upon completion of project.
- (5) Mount all wall hydrants at least twenty (20) inches above finished exterior grade. Where this is not possible or practical, contact Engineers.
- (6) Wall hydrants shall be as follows or equivalent:
 - a. Zurn 1300 or equivalent, 3/4", encased, flush, non-freeze wall hydrant with key lock and combination backflow preventer/vacuum breaker.
- C. HOSE BIBBS (HB)
 - (1) Provide code approved hose bibbs with vacuum breakers and male threaded spouts at each location indicated and as follows:

- (2) Do <u>not</u> install hose bibbs spaces which do not have existing planned or installed floor drains even if sill cocks are indicated for these areas.
- (3) Hose bibbs shall be mounted at eighteen (18) inches above finished floor served.
- (4) The hose bibb shall be Zurn or equivalent similar to the following:
 - a. Zurn Z1350-VB Model. Encased moderate climate wall hydrant for narrow wall installation. Complete with bronze body, all bronze interior parts, replaceable seat washer, screwdriver operated stop valve in supply, key operated control valve, and ³/₄ [19] IP female inlet and ³/₄[19] male hose connection standard. Adjustable stainless steel box furnished with hinged cover, cylinder lock and "WATER" stamped on cover. Provide with 3/4 adapter vacuum breaker.

D. BOILER DRAINS (BD)

Install 3/4 inch bronze body boiler drains, similar and equivalent to Nibco, No. 72 or 73, as indicated and at the following locations:

- (1) At the low point of the plumbing system.
- (2) In each hot water heater and/or storage tank.
- (3) At the low point of each hydronic system.
- (4) On each water storage tank.
- (5) At each pump suction.
- (6) At the low point of each isolatable section of any system carrying water.

NOTE: Install a code approved vacuum breaker where installation on to domestic water system.

E. WATER HAMMER ARRESTORS (WHA): Provide water hammer arrestors at each location indicated and/or as required to eliminate hydrostatic on the domestic water system. Provide at least one water hammer arrestor at all quick acting valve locations including:

Automatic Clothes Washers – Type "A" Commercial Dishwashers – Type "B" Mop Basins (downstream of check valve) – Type "A" Flush valve fixtures - Type "B" (Each toilet room with 1-3 flush valve fixtures shall have its own Type "B" water hammer arrestor.)

- (1) Multiple Fixtures Branch Line Less Than 20' Long: The preferred location for a Zurn Shoktrol is at the end of the branch line between the last two fixtures when the branch lines do not exceed 20' in length, from the start of the horizontal branch line to the last fixture supply on this line.
- (2) Multiple Fixtures Branch Line More Than 20' Long: On branch lines over 20' in length, use two Shoktrols whose capacities total the requirement of the branch. Locate one unit between the last and next to last fixture and the other unit approximately midway between the fixtures.

- (3) Water hammer arrestors shall be Zurn, Z-1700, Shoktrol, Smith, Josam, Wade, or equivalent. Water hammer arrestors shall be stainless steel, bellows type. Field fabricated capped cylinders shall<u>not</u> be acceptable.
- (4) Note: Provide insulation unions where arrestors are of dissimilar material from the piping served (unless piping is non-conducting, such as ABS or PVC).

MARK	MANUFACTURER & MODEL	SIZE	P.D.I. SIZE
TYPE "A"	ZURN, Z-1700 # 100	1-11	А
TYPE "B"	ZURN, Z-1700 # 200	12-32	В
ТҮРЕ "С"	ZURN, Z-1700 # 300	33-60	С
TYPE "D"	ZURN, Z-1700 # 400	61-113	D

F. PRESSURE REDUCING VALVES (PRV)

Install at each location indicated and/or as required to reduce domestic building water service to a maximum of eighty (80) PSIG code approved pressure reducing stations with by-pass. Install in a manner indicated or as required. Provide unions and stops for removal of station. PRV shall be adjustable from thirty (30) percent above or below <u>reduced</u> pressure. Where this cannot be attained with single stage, provide multiphased reduction.

G. REDUCED PRESSURE BACKFLOW PREVENTERS (RPBP)

Watts #909 or equivalent reduced pressure backflow preventer. Provide with gate valves for isolation, FDA food grade strainer and air gap fitting. RPBP shall be UL listed.

H. DOUBLE CHECK VALVE ASSEMBLY

Watts #709, Watts #757, or equivalent double check valve assembly. Provide with FDA approved food grade strainer and gate valves for isolation. Assembly shall be UL listed.

4. GENERAL SPECIALTIES

A. VACUUM BREAKERS AND BACK FLOW PREVENTERS

Where required by the KBC, whether indicated or not, provide approved vacuum breakers or backflow preventers at the following locations.

- (1) Where domestic water system connects to fire protection system.
- (2) Where domestic water system connects to hydronic system.
- (3) At any hose (threaded) tap on the domestic water system.
- B. ROOF FLASHINGS

All plumbing vents or other plumbing passing thru the roof shall be flashed as approved by the KBC and as recommended by the roofing manufacturer and/or Contractor.

C. GAS PRESSURE REGULATORS

Provide gas pressure regulators for all gas fired equipment that requires a lower pressure than what is delivered to the appliance. Regulators shall be installed in accordance with the requirements of NFPA 54 and/or International Fuel Gas Code, whichever is more stringent.

SECTION 220200 - PLUMBING FIXTURES, FITTINGS AND TRIM

1. GENERAL

- A. The Contractor's attention is directed to the General and Special Conditions, General Conditions-Mechanical and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.
- B. The Contractor shall provide all fixtures complete with trim required and connect in a manner conforming to the State Plumbing Code.
- C. The Contractor shall obtain exact centerline rough-in dimensions between partitions, walls, etc. as required for lay-out of his rough-in work. All work shall be roughed-in so that all exposed piping will be straight and true without bends or offsets.
- D. All exposed piping or in casework below sinks, stops, traps, tailpieces, etc., shall be code approved chrome plated brass unless otherwise indicated or specified. Water supplies shall connect through walls with stops and chrome plated escutcheons with set screws.
- E. All fittings, fixtures and trim shall be new unless otherwise indicated or specified. They shall also be of equivalent quality, dimensions, material, etc. as those specified. All faucets, shower heads, drains, levers, trim, etc. shall be constructed of metal and not plastic.
- F. Handicapped fixtures shall be mounted as recommended by the KBC and ADA.
- G. All fixtures shall be mounted as recommended by the manufacturer. Fixtures shall be rigidly mounted to walls and floors. Pay particular attention to flush valves and bracket concealed portion to building structure during rough-in. Loose, shaky flush valves, lavatories, etc. shall not be acceptable.
- H. Prior to final inspection open all faucets and allow to run for fifteen (15) minutes, then remove all faucet aerators and thoroughly clean until smooth flow is obtained.
- I. Prior to final inspection, test by operation at least twice:
 - (1) (Where applicable) adequate flow of hot and/or cold water at;
 - a. Shower Heads
 - b. All Faucets
 - c. Flush Valves and Tanks
 - d. Hose Bibbs
 - e. Sill Cocks
 - f. All Other Valved Hot and/or Cold Water Openings In the Plumbing System
 - (2) All toilet seats
 - (3) All flush tank overflows
- J. Prior to final inspection, remove all stick-on labels, dirt, grease, other removable stampings, lettering, etc. from plumbing fixtures and thoroughly clean same.

- K. All sink and lavatory traps shall have screw in plugs in the bottom for ease of cleaning and have mechanical fittings for ease of removal.
- L. All fixtures shall be set level and true and shall be grouted into finished walls, floors, etc. in a neat and workmanlike manner with an approved waterproof non-yellowing grout for such service.
- M. <u>Special Note for Handicap Grab Rails</u>: Coordinate top of shower valves, flush valves, flush tank, etc., with location of grab rails as shown on the architectural plans. The Contractor shall install all items to allow for installation, removal and service without removal of the grab bar.
- N. All exposed drain pipes and domestic water piping under handicap accessible sinks and lavatories shall be insulated in accordance with ADA requirements and shall have a vinyl plastic covering over all insulation.
- O. The Contractor shall obtain a copy of the casework shop drawings and confirm sinks, faucets, gas turrets, etc., will fit in the space provided. Additionally, in ADA applications with handicap sink base cabinets, the Contractor shall limit the total distance from the bottom of the sink to the bottom of the P-trap and coordinate waste pipe rough-in height to ensure the proper installation of the handicap sink base cabinet front closure panel. The Contractor shall not order sinks until he confirms no conflicts occur and shall adjust sink sizes if required. If the Contractor orders sinks, faucets, etc., that do not fit in the casework supplied, he shall replace them at no additional cost.
- P. All lavatories, sinks, etc. shall be supplied with center rear drain outlets where necessary to avoid conflict with casework, handicapped kneeboards, etc. If the Contractor orders sinks that do not fit in the casework supplied, he shall replace them at no additional cost.
- Q. All single supply faucets shall be provided with mechanical mixing valves unless otherwise noted. Mechanical mixing valves shall have hot and cold water inlet connections, common outlet, in-line check valves, and adjustable temperature setting. Mixing valves shall be Moen model 104424 or equal. Provide one mixing valve per single supply faucet unless otherwise noted. Contractor shall provide all required connections and set mixing valve to required temperature.
- R. All gooseneck faucets shall have rigid spouts, unless swing spouts are specified. If swing spouts are specified, the spout shall have a maximum swing of 140 degrees from side to side.
- S. All plumbing fixtures shall comply with federal lead free requirements that the lead content of wetted surfaces cannot exceed 0.25% by weight.
- T. All water closet handles on ADA water closets shall be located on the approach side of the fixture.

2. FIXTURES AND TRIM

Available Manufacturers: Subject to compliance with requirements of manufacturers offering plumbing fixtures and trim. Plumbing fixtures and trim, which may be incorporated in the work include, but are not limited to, the following:

A. Plumbing Fixtures - Water Closet, Lavatory, Urinal, Bathtubs, Clinical Sink and Scrub Sink

American Standard, U.S. Plumbing Products Eljer Plumbingware Div., Wallace-Murray Corp. Kohler Co. Crane Plumbing Universal-Rundle Toto Zurn Co. Sloan Fixtures

B. Plumbing Trim

American Standard, U.S. Plumbing Products Chicago Faucet Co. Kohler Co. Delta Co. T&S Brass & Bronze Work Co. (Commercial) Zurn Co. Just Co. Speakman Co. Moen Commercial

C. Flush Valves

Delany Co. Sloan Valve Co. Zurn Co. American Standard

D. Fixture Seats

Bemis Mfg. Co. Church Seat Co. Olsonite Corp., Olsonite Seats

E. Water Coolers

Elkay Mfg. Co. Halsey Taylor Div., King-Sealey Thermos Co. Haws Drinking Faucet Co. Western Drinking Fountains, Div. of Sunroc Corp. Oasis Co. Acorn AQUA

* Acceptable wall hung water coolers shall be equal to Oasis P8AM, Elkay EZS8 or Halsey Taylor HAC8FS. All other wall hung water coolers shall be subject to review of the Engineer.

F. Service Sinks and Mop Basins

American Standard, U.S. Plumbing Products Eljer Plumbingware Div., Wallace-Murray Corp. Fiat Products Kohler Co. Stern-Williams Co., Inc. Florestone

G. Stainless Steel Sink

Elkay Mfg. Co. Just Mfg. Co. Moen, Div. of Stanadyne/Western Sterling Co.

H. Fixture Carriers

Josam Mfg. Co. Jay R. Smith Tyler Pipe Zurn Industries Watts

I. Shower

Bradley Co. Zurn Co. Symmons Industries, Inc. Chicago Faucets Speakman Company Powers Acorn Co. Moen Commercial

J. Shower Stalls

Clarion Universal-Rundle Aqua Bath Aquarius Aqua Glass Acryline Lasco Bathware

K. Canwash

Zurn Industries Murdock Woodford Watts

L. Washer/Dryer Connection Box

Guy Gray Co. Wolverine Brass, Inc.

M. Wash Fountain

Bradley Co. Acorn Co. Intersan Willoughby N. Emergency Fixtures - Eyewash, Showers

Bradley Co. Speakman Co. Guardian Co.

O. P-Trap Insulation Kit (Trap Wrap)

Truebro Brocar Plumberex

Note: Kitchen, Lab, Science Room Fixtures, Special Equipment, Etc.

Contractor to provide final plumbing connections to all of the equipment furnished by Owner including, but not limited to: chrome supplies, stops, continuous drains, drain tailpiece, Kentucky Code "P" traps and escutcheons.

3. FIXTURE SELECTION

A. Refer to drawings for fixture schedule.

SECTION 230100 - PUMPS

1. GENERAL

- A. The Contractor's attention is directed to the General and Special Conditions, General Provisions -Mechanical and to all other contract Documents as they apply to this branch of the work. Attention is also directed to other sections of the specifications which affect the work of this section and which are hereby made a part of the work specified herein.
- B. All required motor starters shall be furnished with the respective pump.
- C. Electric motors shall be furnished with the pumps and shall be of the size and type scheduled or otherwise specified. All motors shall be UL labeled and shall comply with applicable NEMA standard.
- D. Shop drawings shall be submitted as required by Section 200300 and shall include complete pump specifications, installation and start-up instructions, current and accurate pump performance curves with the selection points clearly indicated, maintenance data and spare parts lists.
- E. Pumps shall be factory tested, cleaned and painted prior to shipment. Size, type, capacity and electrical characteristics are listed in the pump schedule.
- F. Insofar as possible, all pumps shall be by the same manufacturer.
- G. Pump shall have data plate indicating horsepower, voltage, phase, ampacity, pressure head, and flow rate.
- H. Special notes for pumps controlled by variable frequency drives:
 - (1) Supplier shall provide the <u>largest non-overloading</u> impeller size for the specified pump motor horsepower, regardless of the specified pump head given on the pump schedule(s).
 - (2) Pumps less than 100 HP in size shall be furnished with shaft grounding kit, Aegis SGR Bearing Protection Ring or equal. One shaft grounding ring and related hardware shall be provided on drive end or non-drive end of motor per manufacturer's instructions. These shall be factory mounted and installed on the exterior of the motor to allow for visual inspection. Ground motor frame per manufacturer's instructions. Install kit in strict accordance with manufacturer's instructions.

2. MATERIAL

A. BASE MOUNTED PUMPS

- (1) Type: Horizontal, base mounted, end suction, single stage, flexible coupled, 175 PSI working pressure.
- (2) Pump Body: Cast iron, flanged gauge and drain tappings, bronze fitted.
- (3) Shaft: Stainless steel. Refer to special notes for pumps controlled by VFD's above for shaft grounding kit specification.
- (4) Bearing: Re-lubricatable ball bearing. Provide insulated bearing journals for pumps greater than 100 HP.
- (5) Seal: Mechanical, carbon ring with ceramic seal.

- (6) Motor: open, drip proof, re-lubricatable ball bearing. Minimum efficiency per NEMA Premium Induction Motor Efficiency.
- (7) Impeller: Enclosed, balanced.
- (8) Base: Structural steel.
- (9) Coupling: Flexible with coupling guard.
- (10) Manufacturers: Subject to compliance with the specified and scheduled requirements. Pumps by the following manufacturers will be considered:

Amtrol/Thrush Armstrong/Aurora Bell and Gossett Federal Pump Patterson Sigmund Worthington Pump Weinman Taco FloFab

(11) SELECTIONS:

Refer to the schedule on the plans for base-mounted pump selections.

SECTION 230200 - HVAC EQUIPMENT AND HYDRONIC SPECIALTIES

1. GENERAL

- A. The Contractor's attention is directed to the General and Special Conditions, General Conditions-Mechanical and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified herein.
- B. The Contractor shall provide in complete working order the following heating, ventilation and air conditioning equipment located as indicated and installed, connected and placed in operation in strict accordance with the manufacturer's recommendations. All equipment shall be factory painted and, where applicable, factory insulated and shall, where such standards exist, bear the label of the Underwriters Laboratory.
- C. Each subcontractor shall be responsible for their own completion of System Verification Checklists/Manufacturer's Checklist.
- D. Factory startup is required for all HVAC equipment. In general, as part of the verification process, equipment suppliers shall perform start-up by their factory authorized technicians and shall complete and submit start-up reports/checklists. This shall include heat pumps, rooftop units, outside air units, VFDs, etc.
- E. All HVAC equipment shall comply with the latest provisions of ASHRAE Standard 90 and/or International Energy Conservation Code 2012, whichever is more stringent.
- F. Installation of all heating, ventilating and air conditioning systems shall be performed by a master HVAC contractor licensed in the state the work will be performed.
- G. Note to Suppliers and Manufacturers Representative furnishing proposals for equipment for the project:
 - (1) Review the Controls Section of these Specifications (if applicable) to determine controls to be furnished by the equipment manufacturer, if any. The Contractor shall provide all controls with equipment unless specifically listed otherwise.
 - (2) Review the section of these specifications entitle: SHOP DRAWINGS, DESCRIPTIVE LITERATURE, MAINTENANCE MANUALS, PARTS LISTS, SPECIAL KEYS, TOOLS, ETC., and provide all documents called for therein.
 - (3) Insure that the equipment which you propose to furnish may be installed, connected, placed in operation and easily maintained at the location and in the space allocated for it.
 - (4) Determine from the Bid Documents the date of completion of this project and insure that equipment delivery schedules can be met so as to allow this completion date to be met.
 - (5) Where manufacturers' temperature controls are specified, they shall be in full compliance with International Mechanical Code Section 606 including automatic smoke shut down provisions.
 - (6) Provide factory start-up on site by a factory representative (not a third party contractor) for all HVAC equipment, including pumps, VFDS, outside air units, heat pumps, rooftop units, etc. Submit factory start-up reports to the Engineer.

- (7) Provide training to the Owner by a factory representative for each type of equipment. Training shall be a minimum of eight (8) hours on site and the Engineer shall be notified one (1) week in advance of the training. Training shall only occur when the systems are complete and 100% functional. All training shall be video taped.
- (8) Review the Section on Motor Starters and Electrical Requirements for Mechanical Equipment.
- (9) Requirements for motors controlled by variable frequency drives:
 - a. All motors shall be inverter duty rated.
 - b. Motors less than 100 HP in size shall be furnished with shaft grounding kit, Aegis SGR Bearing Protection Ring or equal. One shaft grounding ring and related hardware shall be provided on drive end or non-drive end of motor per manufacturer's instructions. These shall be factory mounted and installed on the exterior of the motor to allow for visual inspection. Ground motor frame per manufacturer's instructions. Install kit in strict accordance with manufacturer's instructions.
- (10) Equipment incorporating energy recovery wheels shall be provided with an aluminum wheel with molecular sieve desiccant, 4 angstrom maximum sieve size. Wheels shall be certified in accordance with ASHRAE 84 or ARI 1060 standards.
- (11) All condensate producing equipment shall be provided with a condensate trap as recommended by the equipment manufacturer and a condensate overflow switch.
- (12) Provide low ambient and all required controls and accessories on all HVAC equipment to ensure they can provide cooling during the winter season.
- (13) Provide a complete air tight enclosure with opening door that seals air tight for all filters on air moving equipment.
- (14) All equipment shall be furnished for a single point electrical connection unless specifically excluded as a requirement.

2. EQUIPMENT

A. HOSE KITS

(1) HOSE KIT SIZES SHALL BE AS SCHEDULED ON THE DRAWINGS.

- a. Provide a factory-assembled, one piece hose kit/piping package for supply and return connections for each heat pump.
- b. Contractor shall provide and install Hays Hose Kit Piping Packages or Nexus Hose Kit Piping packages with integral automatic balance valve. Each kit shall be sized for 2.0 to 7.0 feet per second. Valves may be mounted in any altitude and do not require straight sections of pipe either upstream or down stream for proper operation. Griswold is not an acceptable manufacturer.
- c. Each return side hose kit/piping package shall include the following:
 - 1) Single piece Y valve body for sizes $\frac{1}{2}$ " 1-1/2", shall be constructed of hot forged brass with threaded inlets and outlets. 2" 3" shall be constructed of bronze. 4" and larger shall be

constructed of carbon steel with flanged inlets and outlets. All valve bodies are suitable for a minimum of 400 PSIG working pressure.

- 2) Automatic flow control valves shall be factory set to rated flow and shall automatically control the flow to within 10% of the rated value subject to the operating parameters of; 2 to 80 PSID, fluid freezing to 225° F, 2.0 to 7.0 FPS.
- 3) Valve internal control mechanism shall be of a quiet, clog resistant design with reverse flow capabilities and consist of precision orifice that is field changeable within the listed flow rate.
- 4) Single pressure/temperature test ports for verifying the pressure differential and system temperature, full flow design ball valve with blow out proof stems for shut off.
- 5) Manufacturer shall provide certified independent laboratory tests verifying accuracy of performance.
- 6) All valves shall be labeled with controlled flow direction, flow rate, PSID control range, manufacturer and model number, unit tagging.
- d. Each supply side hose kit/piping package shall include the following:
 - 1) Single piece Y valve body for sizes $\frac{1}{2}$ " 1-1/2", shall be constructed of hot forged brass with threaded inlets and outlets. 2-3" shall be constructed of bronze. 4" and larger shall be constructed of carbon steel with flanged inlets and outlets. All valve bodies are suitable for a minimum of 400 PSIG working pressure.
 - 2) Single pressure/temperature test ports for verifying the pressure differential and system temperature, full flow design ball valve with blow out stems for shut off.
 - 3) Strainer shall be Y-type configuration furnished with hose connector blow down valve. Strainer screen shall be stainless steel mesh and easily accessible for cleaning without disconnecting hoses.
 - 4) All valves shall be labeled with flow direction, manufacturer and model number, unit tagging.
- e. Stainless Steel Braided Supply and Return Hoses: All hoses shall be equipped with end connections at terminal unit. All end connections shall be either permanently crimped swivel ends or butt welded to carbon steel end fittings to meet stated pressure ratings. Operational temperature shall be rated from fluid freezing to 200 degrees F. Minimum burst pressure shall be four times the working pressure. Furnish with field flushing connection fitting. ¹/₂" to 1-1/4" shall be reinforced, fire retardant EPDM rubber, bonded to the inside wall of braiding. 1 ¹/₂" and larger shall be a corrugated type 321 stainless steel tube.
- f. Flushing Bypass: Provide with means at each heat pump to flush system completely while allowing no fluid flow through heat pump. Also see "Start-up and Flushing" instructions in this section.
- g. Condensate Hose Kits: Contractors Option: Manufactured ³/₄" tubing x 54" long clear flexible plastic hose, with molded P-trap, fittings, couplings and clamps. All condensate drains larger than ³/₄" shall be field fabricated by contractor to allow for flexible movement. All sizes shall match sizes indicated on drawings.
h. Warrantee: Automatic Flow Control Valves containing orifice and diaphragm shall be warranted for the life of the HVAC system in which it was originally installed. Manufacturer shall warrant all other components, for no less than five (5) years from date of purchase. Manufacturer shall warrant steel braided hose for no less than three (3) years from date of substantial completion.

B. COMBINATION VARIABLE FREQUENCY DRIVE / DISCONNECT (VFD) FOR MOTORS 50 HP AND LESS

(1) Manufacturers

a. Danfoss Graham VLT 6000 Series, Reliance, Yaskawa, Emerson, ABB, or approved equal.

(2) General

- a. Furnish complete variable frequency VFDs as specified herein for the fans and pumps designated on the drawing schedules to be variable speed. All standard and optional features shall be included within the VFD enclosure, unless otherwise specified. VFD shall be housed in a metal NEMA enclosure of type according to the installation and operating conditions at the job site. The VFD's UL listing shall allow mounting in plenum or other air handling compartments. If a NEMA 12 enclosure is required for the plenum rating, the manufacturer must supply a NEMA 12 rated VFD.
- b. The VFD shall have integral disconnecting means to disconnect power to device in accordance with NEC.
- c. The VFD shall convert incoming fixed frequency three-phase AC power into a variable frequency and voltage for controlling the speed of three-phase AC motors. The motor current shall closely approximate a sine wave. Motor voltage shall be varied with frequency to maintain desired motor magnetization current suitable for centrifugal pump and fan control and to eliminate the need for motor derating.
- d. With the motor's rated voltage applied to the VFD input, the VFD shall allow the motor to produce full rated power at rated amps, RMS fundamental volts, and speed without using the motor's service factor. VFDs utilizing sine weighted/coded modulation (with or without 3rd harmonic injection) must provide data verifying that the motors will not draw more than full load current during full load and full speed operation.
- e. The VFD shall include an input full-wave bridge rectifier and maintain a fundamental power factor near unity regardless of speed or load.
- f. The VFD and options shall be tested to ANSI/UL Standard 508. The complete VFD, including all specified options, shall be assembled by the manufacturer, which shall be UL-508 certified for the building and assembly of option panels. Assembly of the option panels by a third-party panel shop is not acceptable. The appropriate UL stickers shall be applied to both the VFD and option panel, in the case where these are not contained in one panel. When these VFDs are to be located in Canada, CSA or C-UL certifications shall apply. Both VFD and option panel shall be manufactured in ISO 9001 certified facilities.
- g. The VFD shall have a dual 5% DC link reactor on the positive and negative rails of the DC bus to minimize power line harmonics and protect the drive from power line transients. The reactor shall be non-saturating (linear) to provide full harmonic filtering throughout the entire load range.

VFDs with saturating (non-linear) DC link reactors shall require an additional3% AC line reactor to provide acceptable harmonic performance at full load, where harmonic performance is most critical.

- h. The VFD's full load amp rating shall meet or exceed NEC Table 430-150. The VFD shall be able to provide full rated output current continuously, 110% of rated current for 60 seconds and 160% of rated current for up to 0.5 second while starting.
- i. The VFD shall be able to provide full torque at any selected frequency from 29 Hz to base speed to allow driving direct drive fans without derating.
- j. An automatic energy optimization selection feature shall be provided standard in the VFD. This feature shall automatically and continually monitor the motor's speed and load and adjust the applied voltage to maximize energy savings and provide up to an additional 3% to 10% energy savings.
- k. Input and output power circuit switching shall be able to be accomplished without interlocks or damage to the VFD. Switching rate may be up to 1 time per minute on the input and unlimited on the output.
- 1. An automatic motor adaptation test algorithm shall measure motor stator resistance and reactance to optimize performance and efficiency. It shall not be necessary to run the motor or de-couple the motor from the load to run the test.
- m. Galvanic and/or optical isolation shall be provided between the VFD's power circuitry and control circuitry to ensure operator safety and to protect connected electronic control equipment from damage caused by voltage spikes, current surges, and ground loop currents. VFDs not including either galvanic or optical isolation on both analog I/O and discrete I/O shall include additional isolation modules.
- n. VFD shall minimize the audible motor noise through the used of an adjustable carrier frequency. The carrier frequency shall be automatically adjusted to optimize motor and VFD efficiencies while reducing motor noise.
- o. VFD supplier shall coordinate with motor supplier to ensure that all motors 20 horsepower and greater are provided with grounding bushings.
- (3) Protective Features
 - a. A minimum of Class 20 I t electronic motor overload protection for single motor applications and thermal-mechanical overloads for multiple motor applications shall be provided.
 - b. Protection against input transients, loss of AC line phase, output short circuit, output ground fault, overvoltage, undervoltage, VFD overtemperature and motor overtemperature. The VFD shall display all faults in plain English. Codes are not acceptable.
 - c. Protect VFD from sustained power or phase loss. The VFD shall provide full rated output with an input voltage as low as 90% of the nominal. The VFD will continue to operate with reduced output with an input voltage as low as 164 V AC for 208/230 volt units, 313 V AC for 460 volt units, and 394 volts for 600 volts units.

- d. The VFD shall incorporate a motor preheat circuit to keep the motor warm and prevent condensation build up in the stator.
- e. VFD package shall include semi-conductor rated input fuses to protect power components.
- f. To prevent breakdown of the motor winding insulation, the VFD shall be designed to comply with IEC Part 34-17. Otherwise the VFD manufacturer must ensure that inverter rated motors are supplied.
- g. VFD shall include a "signal loss detection" circuit to sense the loss of an analog input signal such as 4 to 20 mA or 2 to 10 V DC, and shall be programmable to react as desired in such an instance.
- h. VFD shall function normally when the keypad is removed while the VFD is running and continue to follow remote commands. No warnings or alarms shall be issued as a result of removing the keypad.
- i. VFD shall catch a rotating motor operating forward or reverse up to full speed.
- j. VFD shall be rated for 100,000 amp interrupting capacity (AIC).
- k. VFD shall include current sensors on all three output phases to detect and report phase loss to the motor. The VFD will identify which of the output phases is low or lost.
- 1. VFD shall continue to operate without faulting until input voltage reaches 300 V AC on 208/230 volt units, 539 V AC on 460 volt units, and 690 volts on 600 volt units.
- (4) Interface Features
 - a. Hand/Start, Off/Stop and Auto/Start selector switches shall be provided to start and stop the VFD and determine the speed reference.
 - b. The VFD shall be able to be programmed to provide a 24 V DC output signal to indicate that the VFD is in Auto/Remote mode.
 - c. The VFD shall provide digital manual speed control. Potentiometers are not acceptable.
 - d. Lockable, alphanumeric backlit display keypad can be remotely mounted up to 10 feet away using standard 9-pin cable.
 - e. The keypads for all sizes of VFDs shall be identical and interchangeable.
 - f. To set up multiple VFDs, it shall be possible to upload all setup parameters to the VFD's keypad, place that keypad on all other VFDs in turn and download the setup parameters to each VFD. To facilitate setting up VFDs of various sizes, it shall be possible to download from the keypad only size independent parameters.
 - g. Display shall be programmable to display in 9 languages including English, Spanish and French.
 - h. The display shall have four lines, with a minimum of 20 characters on three lines and a minimum of eight large characters on one line.
 - i. A red FAULT light, a yellow WARNING light and a green POWER-ON light shall be provided. These indications shall be visible both on the keypad and on the VFD when the keypad is removed.

- j. A quick setup menu with factory preset typical HVAC parameters shall be provided on the VFD eliminating the need for macros.
- k. As a minimum, the following points shall be controlled and/or accessible:
 - 1) VFD Start/Stop
 - 2) Speed reference
 - 3) Fault diagnostics
 - 4) Meter points
 - (a) Motor power in HP
 - (b) Motor power in kW
 - (c) Motor kW-hr
 - (d) Motor current
 - (e) Motor voltage
 - (f) Hours run
 - (g) Feedback signal #1
 - (h) Feedback signal #2
 - (i) DC link voltage
 - (j) Thermal load on motor
 - (k) Thermal load on VFD
 - (l) Heatsink temperature
- 1. Four additional Form C 230 volt programmable relays shall be available for factory or field installation within the VFD.
- m. Two set-point control interface (PID control) shall be standard in the unit. VFD shall be able to look at two feedback signals, compare with two set-points and make various process control decisions.
- n. Floating point control interface shall be provided to increase/decrease speed in response to contact closures.
- o. Four simultaneous displays shall be available. They shall include frequency or speed, run time, output amps and output power. VFDs unable to show these four displays simultaneously shall provide panel meters.
- p. Sleep mode shall be provided to automatically stop the VFD when its speed drops below set "sleep" level for a specified time. The VFD shall automatically restart when the speed command exceeds the set "wake" level.
- q. The sleep mode shall be functional in both follower mode and PID mode.
- r. Run permissive circuit shall be provided to accept a "system ready" signal to ensure that the VFD does not start until dampers or other auxiliary equipment are in the proper state for VFD operation. The run permissive circuit shall also be capable of sending an output signal as a start command to actuate external equipment before allowing the VFD to start.
- s. The following displays shall be accessible from the control panel in actual units: Reference Signal Value in actual units, Output Frequency in Hz or percent, Output Amps, Motor HP, Motor kW, kWhr, Output Voltage, DC Bus Voltage, VFD Temperature in degrees, and Motor Speed in engineering units per application (in GPM, CFM, etc.). VFD will read out the selected engineering unit either in a linear, square or cubed relationship to output frequency as appropriate to the unit chosen.

- t. The display shall be programmed to read in inches of water column (in-wg) for an air handler application, pressure per square inch (psi) for a pump application, and temperature (⁰F) for a cooling tower application.
- u. VFD shall be able to be programmed to sense the loss of load and signal a no load/broken belt warning or fault.
- v. If the temperature of the VFD's heat sink rises to 80°C, the VFD shall automatically reduce its carrier frequency to reduce the heat sink temperature. If the temperature of the heat sink continues to rise the VFD shall automatically reduce its output frequency to the motor. As the VFD's heat sink temperature returns to normal, the VFD shall automatically increase the output frequency to the motor and return the carrier frequency to its normal switching speed.
- w. The VFD shall have temperature controlled cooling fans for quiet operation and minimized losses.
- x. The VFD shall store in memory the last 10 faults and related operational data.
- y. Eight programmable digital inputs shall be provided for interfacing with the systems control and safety interlock circuitry.
- z. Two programmable relay outputs, one Form C 240 V AC, one Form A 30 V AC, shall be provided for remote indication of VFD status.
- aa. Three programmable analog inputs shall be provided and shall accept a direct-or-reverse acting signal. Analog reference inputs accepted shall include two voltage (0 to 10 V DC, 2 to 10 V DC) and one current (0 to 20 mA, 4 to 20 mA) input.
- bb. Two programmable 0 to 20 mA analog outputs shall be provided for indication of VFD status. These outputs shall be programmable for output speed, frequency, current and power. They shall also be programmable to provide a selected 24 V DC status indication.
- cc. Under fire mode conditions, the VFD shall be able to be programmed to automatically default to a preset speed.
- dd. On motors connected to variable frequency drives, 20hp or greater in size. Provide grounding bushings to prevent archiny.
- (5) Interface With Building Automation System/Direct Digital Control System
 - a. VFD manufacturer shall provide an interface to the BAS/DDC system. Manufacturer shall coordinate as required with the Controls Contractor. Provide Bacnet, Lonworks, FLN, Modbus, or any other interface required for a complete and operational system.
 - b. Provide mode of operation to BAS/DDC system (hand, off, auto, etc.). BAS/DDC graphic shall highlight or produce pop-up graphic when VFD is in hand or off. Also, provide all points to BAS/DDC identified in section (4).K of this Specification.
- (6) Adjustments
 - a. VFD shall have an adjustable carrier frequency in steps of not less than 0.1 kHz to allow tuning the VFD to the motor.
 - b. Sixteen preset speeds shall be provided.

- c. Four acceleration and four deceleration ramps shall be provided. Accel and decel time shall be adjustable over the range from 0 to 3,600 seconds to base speed. The shape of these curves shall be automatically contoured to ensure no-trip acceleration and deceleration.
- d. Four current limit settings shall be provided.
- e. If the VFD trips on one of the following conditions, the VFD shall be programmable for automatic or manual reset: undervoltage, overvoltage, current limit and inverter overload.
- f. The number of restart attempts shall be selectable from 0 through 20 or infinitely and the time between attempts shall be adjustable from 0 through 600 seconds.
- g. An automatic "on delay" may be selected from 0 to 120 seconds.
- (7) Service Conditions
 - a. Ambient temperature, -10 to 40°C (14 to 104°F), without derating.
 - b. 0 to 95% relative humidity, non-condensing.
 - c. Elevation to 3,300 feet without derating.
 - d. AC line voltage variation, -10 to +10% of nominal with full output.
 - e. No side clearance shall be required for cooling of any units. All power and control wiring shall be done from the bottom.
- (8) Quality Assurance
 - a. To ensure quality and minimize infantile failures at the jobsite, the complete VFD shall be tested by the manufacturer. The VFD shall operate a dynamometer at full load and speed and shall be cycled during the test.
 - b. All optional features shall be functionally tested at the factory for proper operation.
- (9) Submittals
 - a. Submit manufacturer's performance data including dimensional drawings, power circuit diagrams, installation and maintenance manuals, warranty description, VFD's FLA rating, certification agency file numbers and catalog information.

The specification lists the minimum VFD performance requirements for this project. Each supplier shall list any exceptions to the specification. If no departures from the specification are identified, the supplier shall be bound by the specification.

a. Harmonic filtering. The seller shall, with the aid of the buyer's electrical power single line diagram, providing the data required by IEEE-519, perform an analysis to initially demonstrate the supplied equipment will met the IEEE standards after installation. If, as a result of the analysis, it is determined that additional filter equipment is required to meet the IEEE recommendations, then the cost of such equipment shall be included in the bid. A harmonic analysis shall be submitted with the approval drawings to verify compliance with the latest version of IEEE-519 voltage and current distortion limits as shown in table 10.2 and 10.3 at the point of common coupling (PCC). The PCC shall be defined as the consumer–utility interface or primary side of the main distribution transformer.

(10) Start-Up Service

a. The manufacturer shall provide on-site start-up commissioning of the VFD and its optional circuits by a factory certified service technician who is experienced in start-up and repair services. Sales personnel and other agents who are not factory certified shall not be acceptable as commissioning agents. Start-up services shall include checking for verification of proper operation and installation for the VFD, its options and its interface wiring to the building automation system. Provide start-up report to Engineer.

(11) Warranty

a. The VFD shall be warranted by the manufacturer for a period of 36 months from date of shipment. The warranty shall include parts, labor, travel costs and living expenses incurred by the manufacturer to provide factory authorized on-site service. The warranty shall be provided by the VFD manufacturer.

(12) Examination

- a. Contractor to verify that job site conditions for installation meet factory recommended and coderequired conditions for VFD installation prior to start-up, including clearance spacing, temperature, contamination, dust, and moisture of the environment. Separate conduit installation of the motor wiring, power wiring, and control wiring, and installation per the manufacturer's recommendations shall be verified.
- b. The VFD is to be covered and protected from installation dust and contamination until the environment is cleaned and ready for operation. The VFD shall not be operated while the unit is covered.

C. HYDRONIC SPECIALTIES

(1) Manufacturers

Subject to compliance with the specified and scheduled requirements the following manufacturers will be considered, but not limited to:

- Hoffman Amtrol/Thrush Armstrong/Aurora Bell & Gossett Patterson Taco Victaulic Wheatley
- (2) Air Release Tank (AS-X)

The air release tank shall be of the in-the-pipe-line type with flanged tangential openings for inlet and outlet connections. The inside shall be specifically designed to create a low velocity vortex for the separation of free air from the water stream. The tank shell shall be rated at 125 PSI working pressure and shall be constructed with the ASME code for unfired pressure vessels and shall be so certified and stamped. The tank shall be equipped with a bottom drain connection and expansion tank/vent connection. Tank shall be line sized. Tank shall not have a strainer.

(3) Expansion Tank (ET-X)

The tank shall be constructed in accordance with the ASME Code for unfired pressure vessels and shall be suitable for 125 PSI water working pressure and 340°F maximum water temperature. The tank shall be a pre-charged, heavy duty butyl rubber diaphragm-type pressure vessel complete with standard tire charging valve. Refer to the plans for mounting orientation. Capacities shall be as scheduled on the drawings.

(4) Suction Diffusers

Provide at the inlet of each base mounted pump, a suction diffuser as manufactured by Bell and Gossett, Victaulic, Thrush, or approved equivalent. Each suction diffuser shall be equipped with a disposable fine mesh start-up strainer and an adjustable support foot to carry weight of inlet piping. Victaulic Series 731 G, W731G, Bell and Gossett Suction Diffuser, or equal.

(5) Flexible Connections

Provide at the inlet and discharge side of each base mounted pump, at each connection to major equipment requiring vibration isolation and where shown on plans, a flexible connector, Metraflex Metrasphere or Engineer approved equal. Flexible connectors shall be of the flexible neoprene and nylon or EPDM and suitable for 225 PSI working pressure and 230°F temperature. Couplings shall be installed per the manufacturer's recommendations, in close proximity to the source of the vibration.

Alternatively, in lieu of a flexible connector, three (3) Victaulic Style 77 flexible couplings may be used on suction side and discharge side of base mounted pumps (six Victaulic flexible couplings per pump).

(6) Pressure Reducing Valve

Provide at the point of connection of the domestic water line to the hydronic system and where shown on the plans, a pressure reducing valve by Thrush, Bell and Gossett, or Engineer approved equivalent. Such pressure reducing shall be provided with an inlet strainer and shall be set to maintain a pressure of 4 PSI in excess of that at the highest point in the hydronic system. Each pressure reducing valves shall be line sized.

(7) Vacuum Breaker

Provide, where shown on the plans, a vacuum breaker as manufactured by Huffman, Jackson or Engineer approved equivalent.

(8) Manual Air Vents

Provide, where shown on the plans, at each rise in piping and where required a manual air vent.

(9) Automatic Air Vents

Provide, where shown on the plans, automatic air vents.

(10) Expansion Loops

Expansion loops shall be Metaflex Metra loops or Engineer approved equivalent. Install with pipe guides and anchors as recommended by the manufacturer in all piping runs 75 feet long or greater and also where indicated on the plans.

Alternatively, in water piping systems, use adequate numbers of Victaulic Style 77 flexible couplings in header piping to accommodate thermal growth and contraction, and as required for the elimination of expansion loops. (In accordance with Victaulic recommendations and as approved by the Engineer). Where expansion loops are required in Victaulic piping systems, use Victaulic flexible couplings on the loop(s).

D. GEOTHERMAL WATER SOURCE HEAT PUMP UNITS (WHP-XX)

- 1.01 General:
 - A. Furnish and install Water Source Heat Pumps, as indicated on the plans. Equipment shall be completely assembled, piped and internally wired. Equipment must meet capacities, efficiencies, and characteristics as listed in the schedule and this specification.
- 1.02 Horizontal / Vertical Water Source Heat Pumps::
 - A. Heat pump performance shall be certified in accordance with AHRI/ISO Standard 13256-1 and shall have the correct AHRI/ISO and CUL labels affixed to the cabinet.
 - B. Heat pumps shall be listed by a nationally recognized safety-testing laboratory or agency, such as Underwriters Laboratory (UL), or Electrical Testing Laboratory (ETL).
 - C. Units shall be supplied completely factory built for an entering water temperature range from 20 to 110 deg F. All units shall be fully run tested at the factory under normal operating conditions and water flow rates.
- 1.03 Manufacturers Refer to drawings for acceptable manufacturers.
- 1.04 Unit Construction:
 - A. Vertical units shall have air flow arrangements as shown on the plans.
 - B. All units must have a minimum of four access panels for serviceability of the unit.
 - C. Casings and Cabinet Shall be corner post and panel construction with a 16-gauge galvanized steel base pan. Compressor compartment access panels shall be lined internally with acoustic type dual density fibrous glass foil faced insulation with edges sealed or tucked under flanges to prevent glass fibers from entering the supply air stream. Airside compartment access panels shall be lined internally with acoustic type dual density fibrous glass foil faced insulation with edges sealed or tucked under flanges to prevent glass fibers from entering the supply air stream. All construction shall meet the National Fire Protection Association Standard NFPA 90A. All internal sheet metal parts subject to water exposure shall be galvanized or non-ferrous and coated with a baked-on, thermosetting plastic coating. Compressor mounting shall incorporate "double isolation."
 - D. All Water Source Heat Pump units shall be suitable for continuous operation with a supply voltage variation, measured at the factory power connection point, of ± 10% of the nameplate voltage. A control box shall be located within the unit and shall contain controls for compressor, reversing valve, and fan motor operation and shall have a 50VA 24V control circuit transformer and a terminal block for low voltage field wiring connections. Unit shall be nameplated to accept time delay fuses or HACR circuit breaker for branch overcurrent protection of the power source.

- E. The air section of the unit shall be isolated from the compressor and control section with an insulated divider panel to minimize the transmission of compressor noise and to permit operational service testing with the compressor compartment cover removed.
- F. Supply and return, condenser water connections shall be FPT fittings, brazed copper water tubes and securely flush mounted to the cabinet corner post allowing for connection to a flexible hose without the use of a back-up wrench. Condensate drain connection shall not be less than ³/₄" FPT fitting securely flush mounted to the corner post. Supply, return, and condensate drain shall be connected to loop and drain piping as detail on mechanical drawings. Piping connections at the unit which require brazing or soldering by the installer (which may damage the unit) shall not be allowed.
- G. Stainless Steel Drain Pan Unit shall utilize corrosion resistant closed-cell insulated stainless steel drain pans. A stub out connection shall be provided. The drain pan shall be designed to ensure no pooling of condensate water per ASHRAE 62.2. The unit will be supplied with condensate overflow protection as standard.
- H. 2-position, 2-way water valve Unit shall have a factory mounted water valve, valve shall open at least 3 seconds before compressor operation and shall close when compressor is off.
- I. Disconnect switch Unit shall be provided with a factory mounted disconnect switch.
- J. Provide hose kits per hose kit section.
- 1.05 Fan and Motor Assembly
 - A. An ECM blower motor shall be provided on all units. Units shall have a direct drive centrifugal fan. Factory motor wiring shall be set for optimum fan performance. CFM settings shall be field adjustable by means of a fan speed selector switch located in the unit control box. The unit shall be shipped at one fixed setting. The ECM motor shall utilize a permanent magnet rotor, which is connected to the shaft through resilient rings to absorb high frequency torque ripple. The ECM motor shall deliver precise speed and economic performance regardless of system static pressure.
 - B. Single stage heat pumps acceptable with PSC motor. Heat pumps over 5 tons acceptable with belt-drive motor.
 - C. The blower housing shall have a removable orifice ring to facilitate blower wheel and motor removal for ease of service and without the need to disconnect ductwork. Units without a removable orifice ring are not acceptable.
- 1.06 Refrigerant Circuit
 - A. A sealed refrigerant circuit, consisting of a high efficiency 2-stage scroll compressor (sizes 2 to 6 tons), rotary compressor (sizes ½ to 1.5 tons) or 2 single stage high efficiency scroll compressors (8 tons and above) mounted on rubber vibration isolation grommets (spring isolators shall not be accepted), air-to-air refrigerant finned tube coil, refrigerant flow metering device, water-to-refrigerant coaxial tube type heat exchanger, high pressure safety cutout, and fusible pressure relief factory-installed on the refrigerant circuit. Heat pump conditioners shall additionally contain a pilot-operated refrigerant reversing valve. The reversing valve shall be energized for heating operation. High and low side refrigerant service valves shall be provided. The refrigerant flow-metering device shall be a thermostatic expansion valve. Refrigerant will be HFC R410A in all sizes.
 - B. High and low pressure switches and low temperature safety sensors shall be wired through a latching lockout circuit to disable the unit until it is reset electrically by interrupting the power supply to the unit. Automatic reset by wall sensor switching shall not be allowed. All safety switches shall be normally closed, opening upon fault detection. Control logic dependent upon the closing of a normally open switch shall not be allowed to preclude the possibility of simple, easily corrected faults being escalated into compressor or heat exchanger failure due to loss of integrity in control wiring. (heating

or cooling methods that do not require the refrigeration circuit, including hydronic heat, waterside economizer, and electric heat, shall be allowed to operate during lockout. This includes fan and pump operation)

- C. Manufacturer shall guarantee "extended range" heat pump units to start and operate continuously in an ambient of 40° F, with entering air and water at 40° F, with both air and water at the flow rates used in the ARI/ISO rating test. A geothermal extended range option shall be made up of a TXV metering device and wrapped condenser coil. Closed cell insulation shall be added to the internal water lines and on suction side refrigerant tubing including refrigerant to water heat exchanger.
- 1.07 Unit Controller:
 - A. Provide unit with internal controller and terminal strip to accommodate field-mounted controller. Refer to schedule/controls drawings.
 - B. The unit control board shall be the main component of the system and shall contain the required inputs/outputs to operate the water source heat pump. Controller shall have the following features:
 - 1. Anti-short cycle timer
 - 2. Random start on power up mode
 - 3. Low voltage protection
 - 4. High voltage protection
 - 5. Unit shutdown on high or low refrigerant pressure
 - 6. Unit shudown on low water temperature
 - 7. Condensate overflow protection
 - 8. 3 LED status lights viewable from outside the unit
 - 9. Intelligent Reset: (Low pressure and Low temperature in heating only). The "Fault Retry" feature helps to minimize nuisance trips of automatic lockouts caused by low-pressure or low temperature faults. This feature automatically clears these faults the first two times they occur within a 24-hour period and triggers an automatic lockout on the 3rd fault. The retry count is reset to zero every 24 hours. The fault retry feature does not apply to a high pressure fault which causes an immediate lockout and requires a manual reset, or condensate overflow or brownout faults which are self-clearing.
 - 10. Auxiliary Relay Output: A 24VAC signal which is turned on when the unit is in alarm mode.
- 1.08 Warranty:
 - A. Manufacturer shall warranty equipment for a period of 12 months from substantial completion. Manufacturer Rep shall provide labor warranty for a period of 12 months from substantial completion.
 - B. Manufacturer to provide a parts warranty on the compressor for a period of 5 years from substantial completion.

E. ENERGY RECOVERY UNIT (ERV-1)

1. GENERAL

- A. SECTION INCLUDES
 - (1) Energy Recovery Unit
- B. REFERENCES
 - (1) AFBMA 9 Load Ratings and Fatigue Life for Ball Bearings.
 - (2) AMCA 99 Standards Handbook.
 - (3) AMCA 210 Laboratory Methods of Testing Fans for Rating Purposes.

- (4) AMCA 300 Test Code for Sound Rating Air Moving Devices.
- (5) AMCA 500 Test Methods for Louver, Dampers, and Shutters.
- (6) AHRI 410 Forced-Circulation Air-Cooling and Air-Heating Coils.
- (7) AHRI 430 Central-Station Air-Handling Units.
- (8) AHRI 435 Application of Central-Station Air-Handling Units.
- (9) ASTMB117 Standard Practice for Operating Salt Spray Apparatus.
- (10) NEMA MG1 Motors and Generators.
- (11) NFPA 70 National Electrical Code.
- (12) SMACNA HVAC Duct Construction Standards Metal and Flexible.
- (13) UL 723 Test for Surface Burning Characteristics of Building Materials.
- (14) UL 900 Test Performance of Air Filter Units.
- (15) UL 1995 Standard for Heating and Cooling Equipment.
- (16) UL 94 Test for Flammability of Plastic Materials for Parts in Devices and Appliances.
- (17) IBC 2000, 2003 International Building Code.
- (18) NFPA 90A Standard for the Installation of Air Conditioning and Ventilating Systems.
- (19) NFPA 5000 Building Construction and Safety Code.
- (20) ASHRAE 90.1 Energy Code.
- (21) AHRI Standard 1060 Rating Air-to-Air Heat Exchangers for Energy Recovery Ventilation Equipment.
- (22) GSA 2003 Facilities Standard 5.9 HVAC Systems and Components.
- C. SUBMITTALS
 - (1) Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, and electrical characteristics and connection requirements. Computer generated fan curves for each air handling unit shall be submitted with specific design operating point noted. A computer generated psychometric chart shall be submitted for each cooling coil with design points and final operating point clearly noted. Sound data for discharge, radiated and return positions shall be submitted by octave band for each unit. Calculations for required baserail heights to satisfy condensate trapping requirements of cooling coil shall be included.
 - (2) Product Data:
 - a. Provide literature that indicates dimensions, weights, capacities, ratings, fan performance, finishes of materials, electrical characteristics, and connection requirements.
 - b. Provide data of filter media, filter performance data, filter assembly, and filter frames.
 - c. Provide manufacturer's installation instructions.
- D. QUALIFICATIONS
 - Manufacturer: Company specializing in manufacturing Air Handler products specified in this section must show a minimum five years documented experience and complete catalog data on total product.
- E. SAFETY AGENCY LISTED & CERTIFICATION
 - Air Handling units shall be cETLus safety listed to conform with UL Standard 1995 and CAN/CSA Standard C22.2 No. 236. Units shall be accepted for use in New York City by the Department of Building, MEA 342-99-E.

- (2) Air handling unit water heating & cooling coils shall be certified in accordance with the forced circulation air cooling and air heating coils certification program, which is based on AHRI Standard 410.
- F. DELIVERY, STORAGE, AND HANDLING
 - (1) Deliver, store, protect and handle products to site.
 - (2) Accept products on site on factory-furnished shipping skids. Inspect for damage.
 - (3) Store in clean dry place and protect from construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.

2. PRODUCTS

- A. ACCEPTABLE MANUFACTURERS
 - (1) Manufacturers as listed on drawings.
- B. GENERAL DESCRIPTION
 - (1) Unit shall be arranged with side by side air tunnels. Stacked air tunnels are not acceptable.
 - (2) Configuration: Fabricate as detailed on drawings.
 - (3) Performance: Conform to AHRI 430. See schedules on prints.
 - (4) Acoustics: Sound power levels (dB) for the unit shall not exceed the specified levels shown on the unit schedule. The manufacturer shall provide the necessary sound treatment to meet these levels if required.

C. UNIT CONSTRUCTION

- (1) Fabricate unit with heavy gauge channel posts and panels secured with mechanical fasteners. All panels, access doors, and ship sections shall be sealed with permanently applied bulb-type gasket. Shipped loose gasketing is not allowed.
- (2) Panels and access doors shall be constructed as a 2-inch nominal thick; thermal broke double wall assembly, injected with foam insulation with an R-value of not less than R-13.
 - a. The inner liner shall be constructed of G90 galvanized steel.
 - b. The outer panel shall be constructed of G90 galvanized steel.
 - c. The floor plate shall be furnished with .125 inch thick aluminum tread plate in sections as indicated on project schedule.
 - d. Unit will be furnished with solid inner liners.
- (3) Panel deflection shall not exceed L/240 ratio at 125% of design static pressure, maximum 5 inches of positive or 6 inches of negative static pressure. Deflection shall be measured at the panel midpoint.
- (4) The casing leakage rate shall not exceed .5 cfm per square foot of cabinet area at 5 inches of positive static pressure or 6 inches of negative static pressure (.0025 m3/s per square meter of cabinet area at 1.24 kPa static pressure).
- (5) Module to module field assembly shall be accomplished with an overlapping, full perimeter internal splice joint that is sealed with bulb type gasketing on both mating modules to minimize on-site labor and meet indoor air quality standards.
- (6) Access doors shall be flush mounted to cabinetry, with minimum of two six inch long stainless steel piano-type hinges, latch and full size handle assembly. Access doors shall swing outward for unit sections under negative pressure. Access doors on positive pressure sections, shall have a secondary latch to relieve pressure and prevent injury upon access.

- (7) A 8-inch formed G60 galvanized steel base rail shall be provided by the unit manufacturer for structural rigidity and condensate trapping..
- (8) Construct drain pans from stainless steel with cross break and double sloping pitch to drain connection. Provide drain pans under cooling coil section. Drain connection centerline shall be a minimum of 3'' above the base rail to aid in proper condensate trapping. Drain connections that protrude from the base rail are not acceptable. There must be a full 2'' thickness of insulation under drain pan.
- D. FAN ASSEMBLIES
 - (1) Acceptable fan assembly shall be a single width, single inlet, class II, direct-drive type plenum fan dynamically balanced as an assembly, as shown in schedule. Maximum fan RPM shall be below first critical fan speed. Fan assemblies shall be dynamically balanced by the manufacturer on all three planes. Provide access to motor and fan assembly through hinged access door.
 - (2) Fan and motor shall be mounted internally on a steel base. Factory mount motor on slide base that can be slid out the side of the unit if removal is required. Provide access to motor, drive, and bearings through hinged access door. Fan and motor assembly shall be mounted on 2" deflection spring vibration type isolators inside cabinetry.
- E. BEARINGS, SHAFTS, AND DRIVES
 - (1) Bearings: Basic load rating computed in accordance with AFBMA ANSI Standards. The bearings shall be provided on the motor with the fan wheel mounted directly on the motor shaft, AMCA arrangement 4.
 - (2) Shafts shall be solid, hot rolled steel, ground and polished, keyed to shaft, and protectively coated with lubricating oil. Hollow shafts are not acceptable.
 - (3) The fan wheel shall be direct coupled to the motor shaft. The wheel width shall be determined by motor speed and fan performance characteristics.
- F. ELECTRICAL
 - (1) Fan motors shall be manufacturer provided and installed, Open Drip Proof, premium efficiency (meets or exceeds EPAct requirements), 1750 RPM, single speed, 460V / 60HZ / 3P. Complete electrical characteristics for each fan motor shall be as shown in schedule.
 - (2) The air handler(s) shall be ETL and ETL-Canada listed by Intertek Testing Services, Inc. Units shall conform to bi-national standard ANSI/UL Standard 1995/CSA Standard C22.2 No. 236.
 - (3) Wiring Termination: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclosed terminal lugs in terminal box sized to NFPA 70.
 - (4) Manufacturer shall provide ASHRAE 90.1 Energy Efficiency equation details for individual equipment to assist Building Engineer for calculating system compliance.
 - (5) Installing contractor shall provide GFI receptacle within 25 feet of unit to satisfy National Electrical Code requirements.
 - (6) Air handler manufacturer shall provide, mount and wire ABB variable speed drive with electrical characteristics such as indicated on project schedule and shown on manufacturer's data sheets.
- G. FILTERS
 - (1) Furnish flat filter in mixing box section with 2-inch filter. Provide side loading and removal of filters.
 - (2) Filter media shall be UL 900 listed, Class I or Class II.
 - (3) Filter Magnehelic gauge(s) shall be furnished and mounted by others.

H. ADDITIONAL SECTIONS

- (1) Access section shall be provided for access between components.
- (2) Face and bypass section shall be provided to modulate airflow through and around heat transfer coils. Dampers shall be an integral part of the unit assembly. Internal face and top bypass shall be contained in the standard cabinet height. Blank-off and division sheets, internal linkage, access [panel] [doors] installed by unit manufacturer. Face and bypass dampers shall be of low leak design, opposed blade, with vinyl bulb edging and stainless steel edge seals, galvanized steel frame and axles in self-lubricating nylon bearings.
- (3) Outside air plenum section shall be provided with end outside air damper opening, Exhaust air plenum section shall be provided with top exhaust air damper opening. Dampers shall be parallel low leak airfoil damper blades. Dampers shall be hollow core galvanized steel airfoil blades, fully gasketed and have continuous vinyl seals between damper blades in a galvanized steel frame. Dampers shall have stainless steel jamb seals along end of dampers. Connecting linkage and ABS plastic end caps shall be provided when return and outside air dampers are each sized for full airflow. Return and outside air dampers of different sizes must be driven separately. Damper Leakage: Leakage rate shall be less than two tenths of one percent leakage at 2 inches static pressure differential. Leakage rate tested in accordance with AMCA Standard 500.
- (4) Energy Recovery Wheel: Rotor

Rotor shall be constructed of alternate layers of corrugated and flat aluminum sheet material. Both sides of the rotor shall be completely smooth which provides an optimum sealing surface for brush seals. The rotor shall have smooth air channels to ensure laminar airflow for low-pressure drop. Dry particles up to approximately 900 microns shall pass freely through the rotor without clogging the media. Rotor media shall be capable of being cleaned with air or with water or low pressure steam without degrading unit performance.

The rotor media shall be made of pure aluminume. For long term rigidity, the rotor shall be stabilized with interior spokes threaded at an aluminum hub and welded at an aluminum rotor periphery plate. No adhesive shall be used to bond the layers of aluminum. Energy recovery wheel shall be mounted in a vertical configuration. The maximum operating temperature is 160 °F.] Energy Recovery Wheel: Case

Adjustable brush seals shall be provided for installation in the case on the face shroud along the periphery of the rotor and along the central beam between the supply and exhaust airstreams to minimize leakage. Leakage shall be less than 3.0% at 0.0" w.g. differential pressure between airflows. Rotor and case shall be reinforced to prevent deflection from static pressures of up to 1.15 inches w.g.

The rotor hub shall require no maintenance and shall be equipped with permanently-lubricated ball or roller bearings, mounted and installed in a protected position within the hub. Bearings shall be serviceable or replaceable without complete removal of the rotor from the case. Purge Sector: The energy

recovery wheel shall be provided with an adjustable purge sector (0,2.5,5,7.5,10 degrees) designed to limit cross contamination at an appropriate design conditions to less than 0.04 % of the exhaust air stream concentration (EATR).

3. EXECUTION

- A. INSTALLATION
 - (1) Install in accordance with manufacturer's Installation & Maintenance instructions.

B. ENVIRONMENTAL REQUIREMENTS

(1) Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

C. EXTRA MATERIALS

(1) Provide one extra set fan belts, filters for unit as shown on project schedule.

1. FACTORY START-UP REPORTS

- A. Provide factory start-up on site by a factory representative (not a third party contractor) for all HVAC equipment, including pumps, VFD's, heat pumps, rooftop units, etc. Submit factory start-up reports to the Engineer. The Mechanical Contractor and the Controls Contractor shall have a representative on site to correct all deficiencies noted by the factory representative. For each deficiency noted, documentation of corrective action taken shall be submitted to Engineer.
- B. At a minimum, the report submitted to the Engineer shall include the following data:
 - (1) Water Source Heat Pumps
 - a. High voltage power supply is correct and accordance with the unit nameplate.
 - b. The phasing of the unit is correct per the compressor rotation.
 - c. The field wiring and circuit protection is the correct size.
 - d. The low voltage control circuit wiring is correct per the unit wiring diagram.
 - e. The piping system is clean and complete.
 - f. Verify water flow is established and circulating through all units.
 - g. The condensate line is properly sized, run, trapped and pitched.
 - h. The indoor blower turns freely without rubbing.

Start-up checklist and log: Upon unit start-up, the following items shall be checked and logged for each water source heat pump. Note, the items listed below must be verified/checked before the system is put into full operation:

- i. Entering fluid temperature (heat and cool mode)
- j. Leaving fluid temperature (heat and cool mode)
- k. Temperature differential (heat and cool mode)
- 1. Return air temperature (heat and cool mode)
- m. Supply air temperature (heat and cool mode)
- n. Water coil heat exchanger (water pressure "in" psig) (heat and cool mode)
- o. Water coil heat exchanger (water pressure "out" psig) (heat and cool mode)
- p. Pressure differential (psig) (heat and cool mode)
- q. Compressor amps
- r. Compressor volts
- s. Compressor discharge line temperature (after 10 minutes)
- t. Refrigerant charge (oz.)
- u. Test drain pan operation
- v. Check and note strainer condition.
- w. Check and note filter condition.

(2) Outside Air Units/Energy Recovery Units

a. Fan rotation

- b. Recovery wheel rotation
- c. Confirm all wiring connections are correct
- d. Confirm all field wiring is correct
- e. Adjust belt tensions and alignments
- f. Confirm pipe connections are correct
- g. Confirm sequence of operation is correct
- h. Confirm damper operation
- (3) Water-to-Water Heat Pumps
 - a. High voltage power supply is correct and accordance with the unit nameplate.
 - b. The phasing of the unit is correct per the compressor rotation.
 - c. The field wiring and circuit protection is the correct size.
 - d. The low voltage control circuit wiring is correct per the unit wiring diagram.
 - e. The piping system is clean and complete.
 - f. Verify water flow is established and circulating through all units.

Start-up checklist and log: Upon unit start-up, the following items shall be checked and logged for each water source heat pump. Note: The items listed below must be verified/checked before the system is put into full operation.

- g. Source entering fluid temperature (heat and cool mode)
- h. Source leaving fluid temperature (heat and cool mode)
- i. Load entering fluid temperature (heat and cool mode)
- j. Load leaving fluid temperature (heat and cool mode)
- k. Temperature differential (heat and cool mode)
- 1. Water coil heat exchanger (water pressure "in" –psig) (heat and cool mode)
- m. Water coil heat exchanger (water pressure "out" psig) (heat and cool mode)
- n. Pressure differential (psig) (heat and cool mode)
- o. Compressor amps
- p. Compressor volts
- q. Compressor discharge line temperature (after 10 minutes)
- r. Refrigerant charge (oz.)
- s. Check and note strainer condition.
- (4) Base-Mounted Pumps
 - a. With power off, note the following:
 - 1) pump properly secured, level, and grouted
 - 2) pipe installed so as not to transmit stress to pump
 - 3) coupler between pump and water shaft aligned
 - 4) pump and motor lubricated
 - b. With power on, note the following:
 - 1) impeller rotation
 - 2) Actual amps/volts vs. nameplate amps/volts.
 - 3) Inlet and outlet pressure
- (5) Rooftop Units
 - a. Verify economizer operation

- b. Verify operating per sequence of control
- c. Discharge air temperature sensor calibration
- d. Discharge static pressure
- e. Dirty filter differential pressure switch function
- f. Outside air temperature sensors calibration
- g. Return air temperature sensor calibration
- h. Airflow monitoring station calibration
- i. VFD response to pressure sensors or other DDC input
- j. Smoke detection shut down
- k. Freeze protection sequence
- l. Fan bearings lubrication
- m. Fan not vibrating
- n. Fan motor volts / amps
- o. Check drive belt tension
- p. Check sheave alignment
- q. Coils clean
- r. Dampers operating properly
- s. Filters clean
- t. Fan rotation direction

2. WATER TREATMENT

A. SCOPE

Provide a one-year water treatment program for the HCS and HPS water loop systems. The one-year period shall start from the date of substantial completion. The program shall minimize corrosion, scaling, and prevent biological fouling of the piping system.

B. QUALIFICATIONS

Chemicals, service, and equipment shall be supplied by a single water treatment company for undivided responsibility. The water treatment chemical and service supplier shall be a recognized specialist, active in the field of commercial/industrial water treatment for at least 5 years, whose major business is in the field of industrial water treatment. The water treatment company shall have regional water analysis laboratories, service department, and full time representatives located within the trading area of the job site or facility.

Water treatment company shall be Bluegrass Kesco, Nalco, American Water Treatment, or approved equal.

C. SERVICE

Provide quarterly field service and Owner consultation. System water or fluid shall be tested for proper chemical parameters, clarity, and biological activity. If needed, provide chemical addition. Provide any laboratory and technical assistance required to achieve a successful program.

D. CHEMICALS

Provide one year's supply of the recommended chemical for scale and corrosion protection of the closed loop recirculating system. If needed, provide separate chemical to control microbiological growth in the system. Formulations shall not contain any ingredients which are harmful to system materials of construction.

E. PHASED PROJECTS

Provide multiple trips, testing, treatment, chemicals, etc. as required to accommodate phased projects. Systems that will be constructed and brought on-line in phases shall be treated at the completion of each phase. Under no circumstance shall any portion of the system operate with untreated heat transfer fluid.

F. EQUIPMENT

(1) Bypass Feeder

Provide one 5 gallon bypass chemical feeder for each system. Neptune DBF-5HP or approved equivalent.

(2) HPS Loop Filter LF-1

Harmsco HIF or WB series fluid filter. Refer to schedule on the drawings for selection. Provide with a total of three sets of filter cartridges.

G. REPORTS

A summary of water or fluid quality and treatment shall be provided in writing to the Owner and Engineer after each quarterly site visit. Results of quarterly biological activity tests shall also be provided to the Owner and Engineer.

3. HEATING/COOLING SYSTEM CLEANING

A. GENERAL

The heating/cooling system for this contract is a hydronic heat pump system and there are several precautions which must be observed during its installation. The Contractor is advised to read all of the manufacturer's instructions prior to commencing the installation.

B. SYSTEM START-UP

The Contractor shall include as a part of his work a factory system fill and start-up by an authorized Factory Representative of the unit manufacturer.

C. CLEANING AND FLUSHING HYDRONIC HEAT PUMP PIPING SYSTEMS

- (1) During construction, extreme care shall be exercised to prevent all dirt and other foreign matter from entering the pipe or other parts of the system. Pipe stored on the project shall have the open ends capped and equipment shall have all openings fully protected. Before erection, each piece of pipe, fitting or valve shall be visually examined and all dirt removed.
- (2) After the system is complete it shall be thoroughly cleaned before placing in operation to rid the system of dirt, biological contamination, piping compound, loose mill scale, oil and any and all other material foreign to the water.
- (3) Before chemical cleaning and sterilization of the entire system, the loop field shall be flushed and purged until free of dirt, debris, and air. During the chemical cleaning and sterilization process the supply and return run-outs shall be temporarily connected together at each heat pump location.

- (4) After purging of the field loop the Contractor shall add an approved system cleaning solution at the recommended concentration to the entire system. Circulate the system with cleaner for the time recommended by the chemical manufacturer. After prescribed circulation time, flush the system until cleaner is removed.
- (5) After chemical cleaning, the entire system shall be sterilized. Introduce a solution of sodium hypochlorite to achieve a chlorine residual of 25 to 50 ppm. Maintain this chlorine level for 12 to 24 hours. Flush out system until chlorine residual in system equals that of the makeup water.
- (6) After the system has been completely cleaned and sterilized as specified herein, the individual heat pumps shall be connected permanently to the supply and return runouts and the system filled for operation under normal closed loop conditions. Within 48 hours of the completion of the sterilization implement a water treatment program to passivate all metal surfaces.

4. HVAC SYSTEM START-UP PROCEDURE

- A. GENERAL
 - (1) The goal of this procedure is for a few units to run as much as possible with the coils as cold as possible to "wring out" the water and allow it to drain away in the condensate drain pans. Allowing all units to cycle on and off, running for short periods of time, does not dehumidify the air in the building. Starting the system without following the steps outlined will raise the relative humidity in the building and most likely cause condensation on some of the building surfaces and HVAC system that the Contractor will be responsible to correct.
 - (2) The high humidity and condensation occurs in school buildings at start up primarily because the building is only partly occupied (or not occupied) when the HVAC system is started. Most people believe that the answer to this problem is to turn the thermostats down very low. The assumption is that cold air will not hold moisture. That is not true. What happens is that the thermostats are quickly satisfied thermally because there is very little cooling load on the building and the cooling equipment. The terminal units then only have to run for a very short period of time to keep the thermostats satisfied and the relative humidity of the air is in fact raising. The goal is to cause the moist air to pass over coils which are cooling it and drying it without allowing more moist air to be introduced into the building.
 - (3) To reduce the always present high humidity start-up problem, we have devised this start-up procedure that will minimize the adverse effects of the start-up. As the building sits at start-up, all of the walls, floor, and ceilings are saturated with moisture from the air and also moisture is being released from the drying paint and curing concrete and mortar.
 - (4) The following procedure will slowly bring down the temperature and humidity in the lightly loaded building. It will also allow the HVAC equipment to more closely match the actual building load without students and equipment in use.

To reach these goals we require the following:

- (1) Set 1/3 of the units (approximately every third unit) on 74°F (no lower). Set the other thermostats for a cooling setpoint of 90°F so the units will not cool. Override the controls so that the fans in all units will circulate air.
- (2) Leave all of the interior doors open to allow the air to mix throughout the building.
- (3) Close all exterior windows and doors.

- (4) Turn off all exhaust fans and outside air units. Outside air unit exhaust and outside air dampers shall be closed.
- (5) Leave all of the lights on in the building to provide a cooling load.
- (6) Provide portable electric heaters or dehumidifiers in any room that shows signs of condensation.

Here is a list of things you should not do:

- (1) Do not prop the exterior doors open during construction or while moving in furnishings.
- (2) Do not start all of the units until students are starting school. When students start school the normal setpoints, schedules, and fan cycling shall begin.

SECTION 230300 - CONDENSATE DRAINAGE SYSTEM (FOR COOLING EQUIPMENT)

1. GENERAL

- A. The Contractor's attention is directed to the General and Special Conditions, General Conditions-Mechanical and to all other Contract Documents as they apply to this section of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.
- B. The Contractor shall provide a complete condensate drainage system to carry all condensate discharge from all cooling equipment from the building. Condensate system shall be installed in accordance with IMC. Provide condensate overflow switch for all condensate producing equipment.
- C. Pipe installation and fabrication shall be in accordance with the section of these specifications entitled PIPE, PIPE FITTINGS AND PIPE SUPPORT and as hereinafter specified.
- D. All piping shall be installed concealed, unless specifically noted otherwise and shall be installed under slabs or underground only when specifically indicated.
- E. Lines installed in ceiling spaces shall be held at the maximum possible elevation and shall be coordinated with all other trades to avoid conflicts.
- F. Condensate drain lines shall be pitched 1/4 inch per foot and installed with cleanout plugs at each change in direction and/or at thirty (30) foot intervals. Where this minimum pitch cannot be attained, contact Engineers.
- G. Horizontal runs of condensate drain lines shall be supported at six (6) foot intervals maximum, or more frequently where required to prevent sags and low spots.
- H. Lengths of horizontal lines shall be held at a minimum due to potential lint collection.
- I. Provide condensate traps in accordance with the manufacturer's recommendations.

2. MATERIAL

A. Refer to Section of these Specifications entitled: PIPE, PIPE FITTINGS AND SUPPORT.

3. INSULATION

A. Refer to Section of these Specifications entitled: INSULATION - MECHANICAL.

SECTION 231100 - REGISTERS, GRILLES, DIFFUSERS & LOUVERS

1. REGISTERS, GRILLES AND DIFFUSERS

A. GENERAL

Alternate R, G & D selections, other than manufacturers and models listed below, will be accepted, provided quality, function and characteristics are equivalent. Acceptable alternates are Price, Titus, Metalaire, Carnes, Anemostat, Kruegar, and Tuttle & Bailey. Shop drawings shall identify and list all characteristics of each device exactly as scheduled herein. Finishes shall be selected by the Architect. If Architect elects not to select color, all colors shall be off-white. Factory color samples shall be submitted with shop drawings.

B. SELECTION

Refer to the Selections Scheduled on the Drawings.

2. LOUVERS

A. GENERAL

Alternate louver selections, other than manufacturer and model listed below, will be accepted, provided quality, function and characteristics are equivalent. Acceptable alternates are Ruskin, Air Balance, Airline, Airstream, Louvers and Dampers and Penn. Shop drawings shall identify and list all characteristics of each device exactly as scheduled herein. Finishes shall be selected by the Architect unless scheduled otherwise.

B. LINTELS

Provide lintels above all louvers as required. Refer to the lintel schedule in Specification Section 201100.

C. SELECTION

Refer to the Selections Scheduled on the Drawings.

SECTION 231200 - SHEET METAL AND FLEXIBLE DUCT

1. GENERAL

- A. The Contractor's attention is directed to the General and Special Conditions, General Requirements-Mechanical and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified herein.
- B. This branch of the work includes all materials, labor and accessories for the fabrication and installation of all sheet metal work as shown on the drawings and/or as specified herein. Where construction methods for various items are not indicated on the drawings or specified herein, all such work shall be fabricated and installed in accordance with the recommended methods outlined in the latest edition of SMACNA's HVAC Duct Construction Standards, Metal and Flexible, and its subsequent addenda. HVAC duct systems shall be fabricated and installed in accordance with the SMACNA duct construction standards (SMACNA-HVAC and SMACNA-Seismic) including Appendix B of the Seismic Restraint Manual Guidelines for Mechanical Systems. These references and plate numbers shall be used by the Engineer for required sheet metal thicknesses and final acceptance of methods of fabrication, hanging, accessories, etc. All equipment furnished by manufacturers shall be installed in strict accord with their recommended methods.
- C. Ductwork shall be constructed and installed per the latest edition of the International Mechanical Code.
- D. Ductwork shall be kept clean at all times. Ductwork stored on the job site shall be placed a minimum of 4" above the floor and shall be completely covered in plastic. Installed ductwork shall be protected with plastic to prohibit dust and dirt from entering the installed ductwork, air handling unit, terminal devices, etc. Provide temporary filters on <u>all</u> return grilles and duct openings if the units are running prior to the building being satisfactorily cleaned. Do not install the ductwork if the building is not "dried-in". If this is required, the open ends of duct shall be covered in plastic to protect. The Owner/Engineer shall periodically inspect that these procedures are followed. If deemed unacceptable, the Contractor shall be required to clean the duct system utilizing a NADCA certified Contractor.

Prior to purchase and fabrication of ductwork (shop fabricated or manufactured), the Contractor shall coordinate installations with new and existing conditions. Notify the Engineer if there are any discrepancies for resolution.

- E. Provide a SMACNA duct cleanliness level "C" per the latest SMACNA standards. [Refer to LEED / Healthcare Requirements]
- F. If separate filter grilles are specified for an HVAC unit the Contractors shall remove any unit mounted filters and blank off the unused filter access opening with sheet metal and seal air tight.
- G. Wall Penetrations: Where ducts penetrate interior or exterior walls, the walls shall be sealed air tight. Refer to the sleeving, cutting, patching, and repairing section of the specifications for additional requirements.
- H. Duct dimensions indicated are required <u>inside clear</u> dimensions. Plan duct layouts for adequate insulation and fitting clearance.
- I. Prior to purchase/shipment of the ductwork, manufacturer shall provide as part of the submittal process scaled, field coordinated Autocad drawings of the complete system to be furnished. Drawings will indicate all system components including fittings, ductwork and manifolds. Drawings shall be available in an electronic format.

2. LOW PRESSURE DUCTWORK

A. General (Low Pressure)

- (1) Double turning vanes shall be installed in all square turns and in any other locations indicated.
- (2) Provide a "high efficiency" type take-off with round damper (Flexmaster STOD-B03 or approved equal) for all round duct branches from a rectangular main to a GRD. Refer to the detail on the drawings for all installation requirements.
- (3) Cross-break all ducts where any duct section dimension or length is 18" or larger.
- (4) Air volume dampers shall be installed in each duct branch takeoffs and/or where indicated, whichever is more stringent. All such dampers shall be accessible without damage to finishes or insulation and shall be provided where required for proper system balance.
- (5) Splitter dampers shall be provided in all rectangular supply air duct tees. Damper blade operator shall extend a minimum two inches thru the insulation.
- (6) Unless otherwise dimensioned on the drawings, all diffusers, registers and grilles shall be located aesthetically and symmetrically with respect to lighting, ceiling patterns, doors, masonry bond, etc. Locate all supply, return and exhaust diffusers and grilles in the locations shown on the architectural reflected ceiling plan.
- (7) Ducts shall be hung by angles, rods, 18 ga. minimum straps, trapezes, etc., in accordance with SMACNA's recommended practices. Duct supports shall not exceed 12 ft intervals. There shall be no less than one set of hangers for each section of ductwork. Where ductwork contains filter sections, coils, fans or other equipment or items, such equipment or items shall be hung independently of ductwork with rods or angles. Do <u>not</u> suspend ducts from perlins or other weak structural members where no additional weight may be applied. If in doubt, consult the structural engineer.
- (8) Provide approved flexible connectors at inlet and outlet of each item of heating and cooling equipment whether indicated or not. Install so as to facilitate removal of equipment as well as for vibration and noise control.
- (9) All ductwork connections, fittings, joints, etc., including longitudinal and transverse joints, seams and connections shall be sealed. Seal with medium pressure, smooth-textured, water based duct sealant. Sealant shall be UL 181B-M listed, UL 723 classified, NFPA 90A & 90B compliant, permanently flexible, nonflammable, and rated to 15"wg. Apply per manufacturer's recommendations. Contractors shall insure no exposed sharp edges or burrs on ductwork.
- (10) All angular turns shall be made with the radius of the center line of the duct equivalent to 1.5 times the width of the duct.
- (11) Miscellaneous accessories such as test openings with covers, latches, hardware, locking devices, etc., shall be installed as recommended by SMACNA and/or as indicated. Test openings shall be placed at the inlet and discharge of all centrifugal fans, coils, VAV boxes, fan sections of air handling units, at the end and middle of all main trunk ducts and where indicated. All such openings shall be readily accessible without damage to finishes.
- (12) Whether indicated or not, provide code approved, full sized fire dampers at all locations where ductwork penetrates fire rated walls. Fire stop rating shall meet or exceed the rating of the wall. Provide an approved access panel at each fire damper located and sized so as to allow hand reset of

each fire dampers. All such fire dampers and access panels shall be readily accessible without damage to finishes. Refer to Architectural Plans for locations of fire rated walls. All access doors shall be 16"x16" or as high as ductwork permits and 16" in length.

- (13) The Contractor who installs the sheet metal shall furnish to the Air Balancing Contractor, a qualified person to assist in testing and balancing the system.
- (14) All fans and other vibrating equipment shall be suspended by independent vibration isolators.
- (15) The interior surface of the ductwork connecting to return/exhaust air grilles shall be painted flat black. The ductwork shall be painted a minimum of 24" starting from the grille.
- B. Materials (Low Pressure Single Wall)
 - (1) Ductwork, plenums and other appurtenances shall be constructed of the following:
 - a. Steel sheets, zinc coated, Federal Specification 00-S-775, Type I, Class E & ASTM A93-59T with G-90 zinc coating or aluminum alloy sheets 3003, Federal Specification AA-A-359, Temper H-14. Utilize Aluminum in MRI Scan Rooms or NMR Room applications.
 - (2) Ductwork, plenums and other appurtenances shall be constructed of the materials of the minimum weights or gauges as required by the latest SMACNA 2" W.G. Standard or the below table, whichever is more stringent. When gauge thickness differs, the heavier gauge shall be selected. The below table shall serve as a minimum:

	ROUND DUCT	RECTANGULAR DUCT	
DIA., INCHES	GAUGE	WIDTH, INCHES	GAUGE
3 TO 12	26	UP TO 12	26
12 TO 18	24	13 TO 30	24
19 TO 28	22	31 TO 54	22
29 TO 36	20	55 TO 84	20
37 TO 52	18	85 AND ABOVE	18

- C. Materials (Low Pressure Double Wall Ductwork)
 - (1) Install Double Wall Ductwork in the following areas:
 - a. Gymnasium (HS Gym, Auxiliary Gym) Contractor to prep duct for painting.
 - b. Anywhere supply ductwork is installed exposed to view in spaces (other than mechanical rooms) except where noted to be canvas wrapped. Refer to drawings.
 - c. Agriculture Lab-155
 - d. Art Room 121, contractor to prep duct for painting.

- (2) Furnish and install where indicated double wall duct. The double wall duct shall be Eastern Sheet Metal, United McGill, Semco or approved equivalent. The duct shall have an inner shell, a 1-inch layer of fiberglass insulation and an outer pressure shell.
- (3) Ductwork outer shell shall be spiral, lock-seam construction fabricated from galvanized steel meeting ASTM-527 standard. Any ductwork exposed to view shall be constructed of G90 galvanized steel, 20 gauge, and shall be supported as required with aircraft cables and self-tightening locks. Ductwork shall be constructed as specified in LOW PRESSURE DUCTWORK.
- (4) Inner shell for spiral pipe shall be a perforated inner liner. The inner liner shall have 3/32" perforation with an overall open area of 23%.
- (5) The fiberglass liner shall have a maximum thermal conductivity (k) factor of 0.27 btu per hour per square foot per degree Fahrenheit per inch thickness at 75 degree F ambient temperature.
- (6) All double wall ductwork will be furnished with factory installed flanges equal to Eastern Sheet Metal Flange which shall consist of a 1.5 outer flange and an inner secondary flange which shall keep the inner flange concentric and eliminate inner wall connections. Flanges requiring inner couplings will not be allowed, no insulation shall be exposed to the airstream at the connections.
- (7) All grille and register taps shall be factory manifolded. Field installed taps will not be allowed. Manifolded taps may be tack welded and caulked for appearance. Only taps for grilles and registers may be provided this way. All other fittings shall be full body welded.
- D. Miscellaneous (Low Pressure)
 - (1) Un-insulated Flexible ductwork (Use Only Where Indicated)
 - a. Un-insulated flexible ductwork shall be corrugated aluminum. No sections shall be greater than five feet in length. Ductwork shall be UL rated and in accordance with IMC.
 - b. Flexible ductwork installed in a return or exhaust or other negative static pressure application shall be rated for installation in negative pressure systems.
 - (2) Insulated Flexible Duct (Use Only Where Indicated)
 - a. Owens/Corning or equivalent, 1 ¹/₂^{''} inch thick fiberglass insulation; flexible liner; with aluminum pigment vinyl vapor barrier facing. Insulated flexible duct shall meet Fire Hazards Standards of NFPA 90A and IMC, flame spread not to exceed 25, smoke develop and fuel contributed not to exceed 50 when tested in accordance with ASTM-E84. Minimum R-value of 6.0, tested in accordance with ASTM C177.71. Flexible duct may be used only for runouts and no sections shall be more than five feet in length.
 - b. When flexible duct is located in areas where it will be visible because the ceiling allows views to the ductwork above, the flexible duct shall be black. The black color shall be factory coloring and not field applied.
 - c. Flexible duct shall not be used in areas where there is no ceiling.
 - d. Flexible ductwork installed in a return or exhaust or other negative static pressure application shall be rated for installation in negative pressure systems
 - (3) Flexible Connectors: Duro-Dyne, Ventfabrics, Inc., U.S. Rubber or equivalent; conforming to NFPA Pamphlet No. 90-A; neoprene coated glass fabric; 20 oz. for low pressure ducts secured with snap lock.

- (4) Turning Vanes: Duro-Dyne or equivalent fabricated as recommended by SMACNA: noiseless when in place without mounting projections in ducts. All turning vanes shall be double blade type.
- (5) Splitter Damper: Splitter damper shall be constructed of 16 gauge galvanized steel. Provide with operating hardware by Ventfabrics, Inc. to include damper blade bracket, ball joint bracket and operator shaft. Operator shall extend two inches from duct to allow for external insulation, where required. Regulator shall seal operator shaft air tight. Install hardware as recommended by manufacturer.
- (6) Access Doors; In Ductwork: Flexmaster TBSM, Air Balance, Vent Products or equal. Access doors for rectangular ducts shall be 16"x16" where possible. Otherwise install as large an access door as height permits by 16" in length. Door shall be 1" thick double-wall insulated with continuous hinge and cam lock. Provide in ducts where indicated or where required for servicing equipment whether indicated or not. Provide a hinged access door in duct adjacent to all fire, smoke and control dampers for the purpose of determining position. Access doors shall also be provided on each side of duct coils (water, electric, steam, etc.) and downstream side of VAV boxes and CAV boxes.
- (7) Architectural Access Doors In Ceilings or Walls: Provide where required to access equipment, dampers, valves, filters, etc. Provide Kees D Panel, Cesco, Milcor or equal. Panels shall be 24"x24" in size and constructed with 16 gauge galvannealed steel for door and frame. In finished areas, provide with primed steel with 1" border to accept architectural specified finish. In Mechanical, Electrical, or service spaces, provide brushed satin finish with 1" border. Door shall include three (3) screwdriver operated cam latches and concealed continuous pivoting rod hinge. Door shall open 175 degrees. For masonry construction, furnish frames with adjustable metal masonry anchors. For fire rated units, provide manufacturer's standard insulated flush panel/doors with continuous piano hinge and self-closing mechanism. The Contractor shall include all required access doors in the bid and shall coordinate with the General Contractor prior to the bid to insure a complete project.
- (8) Security Architectural Access Doors in Walls: Provide where required to access equipment, dampers, valves, filters, etc.Provide Kees SSAP Panel, Cesco, Milcor or equal. Panels shall be 24"x24" in size and constructed with 12 gauge steel for door and frame. In finished areas, provide with primed steel with 1" border to accept architectural specified finish. In Mechanical, Electrical, or service spaces, provide brushed satin finish with 1" border. Door shall include key-operated cylinder dead bolt lock (coordinate cylinders and keys with Owner to match facility standards) and concealed continuous pivoting rod hinge. Door shall open 175 degrees. For masonry construction, furnish frames with adjustable metal masonry anchors and straps. For fire rated units, provide manufacturer's standard insulated flush panel/doors with continuous piano hinge and self-closing mechanism. The Contractor shall include all required access doors in the bid and shall coordinate with the General Contractor prior to the bid to insure a complete project.
- (9) Volume Dampers (Rectangular): Ruskin, Model MD35 or Empco, Air Balance; Louvers and Dampers, Titus, Carnes, Cesco/Advanced Air, Creative Metals, United Air, Pottorf rectangular volume dampers. Frames shall be 4" x 1 "x 16 gauge galvanized steel. Blades shall be opposed blade 16 gauge galvanized steel with triple crimped blades on 6" centers.Linkage shall be concealed in jamb. Bearings shall be ½" nylon. Maximum single section size shall be 48" wide and 72" high. Provide with Ventfabrics 2" high elevated dial regulator to avoid damper handle from conflicting with duct insulation. Provide permanent mark on dial regulator to mark air balance point.
- (10) Volume Dampers (Round): Ruskin, Model MDRS25 or, Empco, Air Balance; Louvers and Dampers, Titus, Carnes, Cesco/Advanced Air, Creative Metals, United Air, Pottorff round volume dampers.

Dampers shall be butterfly type consisting of circular blade mounted to axle. Frames shall be 20 gauge steel, 6" long. Damper blades shall be 20 gauge galvanized steel. Axle shall be 3/8"x6" squre plated steel. Bearing shall be 3/8" nylon. Provide with Ventfabrics 2" high elevated dial regulator to avoid damper handle from conflicting with duct insulation. Provide permanent mark on dial regulator to mark air balance point.

(11) Fire Dampers: Fire dampers shall comply with IMC and shall be constructed and tested in accordance with UL Safety Standard 555. Each fire damper shall have a 1-1/2 or 3 hour fire protection rating as required by fire wall. Damper shall have a 165°F fusible link, and shall include a UL label in accordance with established UL labeling procedures. Fire damper shall be equipped for vertical or horizontal installation as required by the location shown. Fire dampers shall be installed in wall and floor openings utilizing 16 gauge minimum steel sleeves, angles, other materials, practices required to provide an installation equipment to that utilized by the manufacturer when dampers were tested at UL. Installation shall be in accordance with the damper manufacturer's instructions. All fire dampers shall be dynamic. Static fire dampers are not allowed. Provide velocity level and pressure level as required for application (if in doubt, contact Engineer). Fire dampers shall be Ruskin Type DIBD for 1-1/2 hour rating or Ruskin Type DIBD 23 for a 3 hour rating. Other acceptable manufacturers are Air Balance, Prefco, Greenheck, Nailor, or Safe Air. Provide an access door for fire damper reset at all fire damper locations.

3. MEDIUM PRESSURE DUCTWORK

- A. General (Medium Pressure)
 - All ductwork connections, fittings, joints, etc., shall be sealed. Seal with high velocity, smooth-textured, water based duct sealant. Sealant shall be UL 181B-M listed, UL 723 classified, NFPA 90A & 90B compliant, permanently flexible, non-flammable, and rated to 15"wg. Apply per manufacturer's recommendations.
 - (2) Ductwork shall be installed per SMACNA Medium or High Pressure Manual, whichever is applicable. (Latest Edition shall apply.)
 - (3) All hanger straps shall be 18 ga. minimum with reinforcement angles installed in strict accordance with SMACNA. Flat oval ducts shall be installed with 2"x2"x1/4" angles on top and bottom ducts 18" wide and larger. Use 1"x1"x3/16" angles on ducts under 18" wide.
 - (4) Miscellaneous accessories such as test openings with covers, latches, hardware, locking devices, etc., shall be installed as recommended by SMACNA or the duct manufacturer, and/or as indicated. Test openings shall be placed at the discharge of all air handling units and at the end and middle of all main trunk ducts and where indicated. All such openings shall be readily accessible without damage to finishes.
 - (5) Whether indicated or not, provide code approved, full sized fire dampers at all locations where ductwork penetrates fire rated walls. Fire stop rating shall meet or exceed the rating of the wall. Provide an approved access panels at each fire damper located and sized so as to allow hand reset of each fire damper. All such fire dampers and access panels shall be readily accessible without damage to finishes. Refer to Architectural Plans for locations of fire rated walls. Where access doors are installed in insulated ductwork, the access door shall be the insulated type.
- B. Materials (Medium Pressure Single Wall)

- (1) All round, rectangular, and oval medium pressure ductwork for systems above 1.5" W.G. shall be Eastern Sheet Metal, United McGill or Semco or equal with construction as required by the latest SMACNA Standard (Refer to required pressure rating of the duct system as outlined in the Duct Schedule of this spec section).
- (2) Any ductwork exposed to view shall be double wall and constructed of galvanized steel. Galvanized metal shall be prepped and clean prior to painting. Coordinate with General Contractor.

Ductwork shall be spiral, lock-seam construction fabricated from galvanized steel meeting ASTM-527 standard. Ductwork shall be constructed of materials of the minimum weights or gauges as required by the latest SMACNA Standard (Refer to required pressure rating of the duct system as outlined in the Duct Schedule of this spec section) or the below table. When gauge thickness differs, the heavier gauge shall be selected. The below table shall serve as a minimum:

	ROUND DUCT (or Equivalent Round Diameter for Oval Ducts)	RECTANGULAR DUCT	
DIA., INCHES	GAUGE	WIDTH, INCHES	GAUGE
3 TO 14	26	UP TO 12	26
15 TO 26	24	13 TO 30	24
27 TO 36	22	31 TO 54	22
37 TO 50	20	55 TO 84	20
52 TO 60	18	85 AND ABOVE	18

(3) All medium pressure duct fittings shall be fabricated by the same manufacturer as the spiral pipe. Contractor or field fabricated fittings shall not be accepted. Duct fittings shall be constructed per the latest SMACNA standard (Refer to required pressure rating of the duct system as outlined in the Duct Schedule of this spec section) with continuous welds. Take-off fittings shall be combination type tees (Eastern Sheet Metal Model "CB" or equal). Straight or angle tees are not acceptable. Fittings shall be constructed of the following minimum gauges:

	ROUND DUCT (or Equivalent Round Diameter for Oval Ducts)	RECTANGULAR DUCT	
DIA., INCHES	GAUGE	WIDTH, INCHES	GAUGE
3 TO 50	20	UP TO 36	20
51 TO 60	18	37 TO 60	18
61 TO 84	16	61 AND ABOVE	16

- (4) All single wall ductwork will be furnished with factory installed flanges equal to Eastern Sheet Metal Flange on all ductwork greater than 24 inches in size.
- C. Materials (Medium pressure Double Wall)
 - (1) Furnish and install where indicated by drawings or specifications medium pressure double wall duct. The double wall duct shall be United McGill Acoustic K27, SEMCO, Dixie or approved equivalent. The duct shall have a **perforated inner liner. The inner liner shall have 3/32" perforation with an overall open area of 23%.** an intermediate layer of fiberglass insulation minimum 1" thick and an outer pressure shell. Duct shall be of spiral lockseam construction fabricated from galvanized steel meeting ASTM-A527 standard. The duct insulation shall have minimum R-value of 6.0. Medium pressure double wall fittings shall have the same construction features as the double wall duct. Duct shall be constructed of G90 Galvanized steel. Outer shell of ductwork shall be constructed of the minimum gauges specified above for single wall medium pressure ductwork.
 - (2) All double wall ductwork will be furnished with factory installed flanges equal to Eastern Sheet Metal Flange which shall consist of a 1.5 outer flange and an inner secondary flange which shall keep the inner flange concentric and eliminate inner wall connections. Flanges requiring inner couplings will not be allowed, no insulation shall be exposed to the airstream at the connections.
- D. Miscellaneous (Medium pressure)
 - (1) Flexible Connectors: Duro-Dyne, Ventfabrics, U.S. Rubber or equivalent; conforming to NFPA Pamphlet No. 90-A or IMC, whichever is more stringent; neoprene coated glass fabric; 30 oz. for medium pressure ducts secured with bolted angles. Provide flexible connectors at inlet and outlet of air handling equipment to accommodate a minimum of three times the operating pressure of the system.
 - (2) Architectural Access Doors In Ceilings or Walls: Provide where required to access equipment, dampers, valves, filters, etc. Provide Kees D Panel, Cesco, Milcor or equal. Panels shall be 24"x24" in size and constructed with 16 gauge galvannealed steel for door and frame. In finished areas, provide with primed steel with 1" border to accept architectural specified finish. In Mechanical, Electrical, or service spaces, provide brushed satin finish with 1" border. Door shall include three (3) screwdriver operated cam latches and concealed continuous pivoting rod hinge. Door shall open 175 degrees. For masonry construction, furnish frames with adjustable metal masonry anchors. For fire rated units, provide manufacturer's standard insulated flush panel/doors with continuous piano hinge and self-closing mechanism. The Contractor shall include all required access doors in the bid and shall coordinate with the General Contractor prior to the bid to insure a complete project.
 - (3) Security Architectural Access Doors in Walls: Provide where required to access equipment, dampers, valves, filters, etc.Provide Kees SSAP Panel, Cesco, Milcor or equal. Panels shall be 24"x24" in size and constructed with 12 gauge steel for door and frame. In finished areas, provide with primed steel with 1" border to accept architectural specified finish. In Mechanical, Electrical, or service spaces, provide brushed satin finish with 1" border. Door shall include key-operated cylinder dead bolt lock (coordinate cylinders and keys with Owner to match facility standards) and concealed continuous pivoting rod hinge. Door shall open 175 degrees. For masonry construction, furnish frames with adjustable metal masonry anchors and straps. For fire rated units, provide manufacturer's standard insulated flush panel/doors with continuous piano hinge and self-closing mechanism. The Contractor shall include all required access doors in the bid and shall coordinate with the General Contractor prior to the bid to insure a complete project.

- (4) Fire Dampers: Fire dampers shall comply with IMC and shall be constructed and tested in accordance with UL Safety Standard 555. Each fire damper shall have a 1-1/2 or 3 hour fire protection rating as required by fire wall. Damper shall have a 165°F fusible link, and shall include a UL label in accordance with established UL labeling procedures. Fire damper shall be equipped for vertical or horizontal installation as required by the location shown. Fire dampers shall be installed in wall and floor openings utilizing 16 gauge minimum steel sleeves, angles, other materials, practices required to provide an installation equipment to that utilized by the manufacturer when dampers were tested at UL. Installation shall be in accordance with the damper manufacturer's instructions. All fire dampers shall be dynamic. Static fire dampers are not allowed. Provide velocity level and pressure level as required for application (if in doubt, contact Engineer). Fire dampers shall be Ruskin Type DIBD for 1-1/2 hour rating or Ruskin Type DIBD 23 for a 3 hour rating. Other acceptable manufacturers are Air Balance, Prefco, Greenheck, Nailor, or Safe Air. Provide an access door for fire damper reset at all fire damper locations.
- (5) Motor Driven control Dampers Provide Ruskin Model CD60 air foil damper as shown on the plans.. Frame shall be a minimum of 16 gauge galvanized steel formed into a structural hat channel shaper with tabbed corners for reinforcement. The blade shall be airfoil shaped, constructed of a dual skinned galvanized steel, 14 gauge equivalent thickness, 6 inches wide. Bearings shall be stainless steel sleeve turning in an extruded hole in the frame. Jamb seal shall be stainless steel flexible metal compression type. Blade seals shall be equal to Ruskinprene. Leakage Rating shall be Pressure/Class 1.
- (6) Access Doors; In Rectangular Medium Pressure Ductwork: Flexmaster TBSM, Air Balance, Vent Products or equal. Access doors for rectangular ducts shall be 16"x16" where possible. Otherwise install as large an access door as height permits by 16" in length. Door shall be 1" thick double-wall insulated with continuous hinge and cam lock. Provide in ducts where indicated or where required for servicing equipment whether indicated or not. Provide a hinged access door in duct adjacent to all fire, smoke and control dampers for the purpose of determining position.
- (7) Access Doors; In Round or Oval Medium Pressure Ductwork: All access doors in round or oval medium pressure ductwork shall be screw and gasketed type. Screws shall be maximum 4 inches on centers. Access door sizes shall be as follows:

DUCT DIAMETER	OPENING SIZE
3-4 inches	4" x 10"
5-6 inches	6" x 10"
7-24 inches	10" x 16"
26-36 inches	16" x 16"
Over 36 inches	16" x 22"

(8) Pressure Relief Doors: Provide a pressure relief vent in the supply air ductwork at each air handling unit. It shall be located between the fan outlet and the first manual or automatic (i.e., fire, fire smoke, or any motorized) damper or closure device. It shall be sized to relieve the duct air pressure below the rated pressure construction of the ductwork and above the working pressure of the fan. The supply air relief door shall be Ruskin PRD18 or equal. Provide a vacuum relief vent in the return and/or outside air ductwork at each air handling unit. It shall be located between the air handling unit casing and the first manual or automatic damper or closure device. It shall be sized to relieve the duct vacuum below the rated construction of the ductwork and above the working negative pressure of the fan. The return air relief door shall be Ruskin NRD18 or equal. Automatic fan shutdown upon damper closure shall not be an acceptable protection for either overpressure or vacuum conditions. All duct pressure relief doors shall be of the automatic resetting type unless otherwise noted.

4. DRYER VENT

- A. All dryer ducting shall be a minimum of 4" in diameter. Refer to the drawings for exact duct sizing.
- B. Dryer vent ductwork shall be rigid metal 20-gauge aluminum duct. Duct joints shall be installed so that the male end of the duct points in the direction of the airflow. Joints shall be secured with metal tape (not duct tape). Do not use rivets or screws in the joints or anywhere else in the duct as these will incur lint collection
- C. Length of concealed rigid metal ducting shall not exceed the allowable length of 35 feet. Deduct 5 feet from the allowable length for every 4" 90 degree elbow and 4" 2.5 feet for every 45 degree fitting. lengths may vary per local codes and dryer manufacturer's recommendations. Install per 2012 IMC Section 504 Clothes Dryer Exhaust. Provide a complete, working in-line booster fan system, including power, if the maximum allowable duct length is exceeded.
- D. Flexible transition hose connection at the dryer shall be the aluminum flexible duct type. Do not use the plastic or vinyl.
- E. Termination of dryer venting shall be to the exterior with a proper hood or roof jack equipped with a backdraft damper. Hood/jack shall be painted with suitable exterior grade paint and color per the Owner's direction. Small orifice metal screening shall not be part of the hood or roof jack as this will trap lint and block the opening. The hood opening shall point down and maintain a minimum of 12 inches of clearance between the bottom of the hood and the ground or other obstruction.

5. WATER HEATER FLUE STACKS

- A. Location
 - (1) All flues shall be offset to provide, whether indicated or not, a minimum of 10' horizontal separation to any air intake. This distance shall be a 25' minimum on healthcare facilities.
- B. Natural Draft, Gas-Fired Water Heaters and Boilers (Maximum Flue Temperature 300°F., Maximum Size 8 Inches Diameter)
 - (1) Metal Fab Type M, or approved equivalent Type "B" gas vent system. Gas Vent shall be double wall construction, with inner wall constructed of aluminum and outer wall constructed of galvanized steel. Gas vent system shall be UL listed and installed in strict accordance with the manufacturers recommendations. Provide with factory fittings such as elbows, tees, increasers, draft hood connections, tall cone flashing, storm collar, wall thimble, metal cap, etc., as required for a complete project. Minimum UL listed clearance to combustibles shall be one inch.
- C. Natural Draft, Gas-Fired Water Heaters and Boilers (Maximum Flue Temperature 400°F; 10 Inch Diameter and Greater In Size)
 - (1) Metal Fab Type M, or approved equivalent Type "B" gas vent system. Gas vent shall be double wall construction. Inner wall shall be aluminum and outer wall galvanized steel. One-half inch insulating air space shall be provided between the walls. Gas vent system shall be UL listed and installed in strict accordance with the manufacturer's recommendations. Provide with factory fittings such as elbows, tees, tee cap, cap, tall cone flashing, support plate increaser etc., as required for a complete project. Shop drawings shall be submitted for Engineer's review. Minimum UL listed clearance to combustibles shall be one inch.

- D. Category II and Category IV Appliances (Positive and Negative Pressure Condensing Appliances)
 - (1) Metal-Fab Corr/Guard, Heat-Fab Saf-T Vent or other approved equal meeting the specification below:

The vent shall be of the double wall, factory-built type for use on condensing appliances or pressurized venting systems serving Category II, III, or IV appliances or as specified by the equipment manufacturer.

Maximum temperature shall not exceed 550°F.

Vent shall be listed for an internal static pressure of 6" w.g. and tested to 15" w.g.

Vent shall be constructed on an inner and outer wall with a 1" annular insulating air space.

The inner wall (vent) shall be constructed of AL29-4C superferrite stainless steel, .015 thickness for 6"-12" diameters and .024 thickness for 14"-24" diameters.

The outer wall (casing) shall be constructed of type 304 stainless steel. .018 thickness for 6"-12" diameters and .024 thickness for 14"-24" diameters.

Inner and outer walls shall be connected by means of spacer clips that maintain the concentricity of the annular space and allow unobstructed differential thermal expansion of the inner and outer walls.

Product shall carry the appropriate UL listing mark or label.

6" to 12" diameter vent shall have 1" clearance to combustibles at 550°F. 14" to 24" diameter vent shall have 5" clearance to combustibles at 550°F.

6. FLUE CAPS

A. Provide a flue cap on all flues. It shall be similar to the Breident positive downdraft eliminator style.

7. DUCT SCHEDULE

- A. Supply Ducts:
 - (1) Ducts Connected to Heat Pumps,:
 - a. Pressure Class: Positive 2-inch wg Refer to Low Pressure requirements as outlined in section 2 of this spec.
 - b. Minimum SMACNA Seal Class: C.
 - c. SMACNA Leakage Class for Rectangular: 24.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.
 - (2) Ducts Connected to Air-Handling Units (RTU-1 and RTU-2 and relocated 75 ton Trane RTU)
 - a. Pressure Class: Positive 2-inch wg Refer to low pressure requirements as outlined in section 2 of this spec.
 - b. Minimum SMACNA Seal Class: C.
 - c. SMACNA Leakage Class for Rectangular: 24.
 - d. SMACNA Leakage Class for Round and Flat Oval: 2.

- B. Return Ducts:
 - (1) Ducts Connected to Heat Pumps,:
 - a. Pressure Class: Negative 2-inch wg Refer to Low Pressure requirements as outlined in section 2 of this spec.
 - b. Minimum SMACNA Seal Class: C.
 - c. SMACNA Leakage Class for Rectangular: 24.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.
 - (2) Ducts Connected to Air-Handling Units **RTU-1**, **RTU-2** and relocated 75 ton Trane RTU
 - a. Pressure Class: Negative 2-inch wg Refer to Low Pressure requirements as outlined in section 2 of this spec.
 - b. Minimum SMACNA Seal Class: C.
 - c. SMACNA Leakage Class for Rectangular: 24.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12
- C. Exhaust/Relief Ducts:
 - (1) Ducts Connected to Exhaust Fans (other than welding exhaust)
 - a. Pressure Class: Negative 2-inch wg. Refer to Low Pressure requirements as outlined in section 2 of this spec.
 - b. Minimum SMACNA Seal Class: C.
 - c. SMACNA Leakage Class for Rectangular: 24.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12
 - (2) Ducts Connected to Energy Recovery Units (ERU-1):
 - a. Pressure Class: Positive or Negative 2-inch wg. Refer to Low Pressure requirements as outlined in section 2 of this spec.
 - b. Minimum SMACNA Seal Class: C.
 - c. SMACNA Leakage Class for Rectangular: 24.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.
 - (3) Ducts connected to Welding Exhaust Fan:
 - a. Pressure Class: Negative 6-inch wg. Refer to Medium Pressure requirements as outlined in Section 3 of this spec.
 - b. Minimum SMACNA Seal Class: A
 - c. SMACNA Leakage Class for Round and Flat Oval: **3.**
- D. Outdoor Air Ducts:
 - (1) Ducts Connected downstream of Terminal Units (VAV/CAV Boxes):
 - a. Pressure Class: Positive 2-inch wg Refer to Low Pressure requirements as outlined in section 2 of this spec.
 - b. Minimum SMACNA Seal Class: C.
 - c. SMACNA Leakage Class for Rectangular: 24.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.
 - (2) Ducts Connected to Energy Recovery Unit (ERU-1) upstream of VAV/CAV terminal units:

- a. Pressure Class: Positive or Negative 4-inch wg. Refer to Medium Pressure requirements as outlined in section 3 of this spec.
- b. Minimum SMACNA Seal Class: A.
- c. SMACNA Leakage Class for Rectangular: 6.
- d. SMACNA Leakage Class for Round and Flat Oval: **3.**
- (3) All outside air duct system between ERU supply air discharge and terminal unit inlets.
SECTION 250100 - MOTOR STARTERS AND OTHER ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT

1. MOTOR STARTERS-GENERAL

- A. Where motor starters are required for mechanical equipment they are to be the responsibility of the Contractor furnishing the equipment as outlined herein.
- B. Motor starters shall be furnished by the Equipment Supplier with his equipment. Coordinate all requirements for starters with equipment suppliers and other trades.
- C. Motor starters shall be NEMA style. I.E.C.-style starters are not to be provided. Their sizing and installation shall be coordinated with the equipment manufacturer's requirements and in accordance with the National Electrical Code.
- D. Unless otherwise noted, provide combination starter/disconnects for all equipment requiring a starter.

2. ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT

- A. All mechanical equipment shall be provided for single point electrical connection unless specifically noted to the contrary. Refer to schedules and other sections of these specifications for further requirements. It is the responsibility of the Contractor to coordinate the electrical characteristics of all equipment with the electrical provisions indicated on the Contract Documents. The Contractor shall notify the Engineer in writing ten calendar days prior to bid of any discrepancy so a written clarification by Addendum may be made. If such notice is not given, the Contractor shall be responsible for any and all costs or delays associated with any changes required. Specification of equipment characteristics made during review of shop drawings shall not relieve the Contractor of this responsibility.
- B. The equipment manufacturer shall provide internally mounted fuses with his equipment, as required, to comply with the U.L. listing on the equipment name plate. (i.e., hermetically sealed compressors or equipment with name plate data that recommends or requires fuse protection.) See also, National Electrical Code, Article 440, and other applicable sections of the N.E.C.
- C. It is the Contractor's responsibility to furnish and install fusible or non-fusible disconnect switches or circuit breakers for disconnecting means as required by the Code for <u>all</u> electrically powered equipment. All power wiring from source, thru disconnecting means and motor starters to motor terminals or equipment junction box is to be furnished and installed by the Contractor. Each separate contractor engaged for the project shall coordinate with all other trades to ensure all necessary equipment and labor is included for fully functioning mechanical systems, installed per code requirements. Unless otherwise notes, provide combination starter/disconnects for all equipment requiring a starter.
- D. Final electrical connection of equipment shall be verified for proper voltage requirements in conjunction with the motor nameplate patch and actual wiring configuration. Any costs associated with damage to appliances motors, equipment, etc., connected to incorrect supply voltage shall be borne by the Contractor.
- E. Refrigeration condensing units with internal compressors shall be furnished with integral starter. The Contractor is to furnish and install a fusible disconnecting mains with fuses sized to motor nameplate requirements. Coordinate wiring, mounting and style of disconnect switch at unit in field.
- F. All interlock or other control wiring, unless specifically noted otherwise, is the responsibility of the Contractor.

- G. All equipment shall be suitably enclosed. All enclosures for equipment shall be rated and approved for the environment in which it operates. (i.e., NEMA 1, NEMA 3R, NEMA 7, NEMA 12, etc.) Verify the requirement with the installation condition if not indicated on the plans.
- H. Observe the following standards for manufacturers of equipment and selection of components.
 - (1) Starters, control devices and assemblies: NEMA, U.L. (I.E.C. style not acceptable)
 - (2) Enclosures for electrical equipment: NEMA, U.L.
 - (3) Enclosed switches: NEMA, U.L.
 - (4) All electrical work, generally: National Electrical Code
 - (5) All electrical work in industrial occupancies: J.I.C. standards
 - (6) All electrical components and materials: U.L. listing required.
- I. Where required, the Contractor is to provide mounting rails or channels to install starters with code-required clearances. Framing shall be solidly anchored by welding expansion shields in masonry or other approved anchorage. Frames are to be constructed of steel angles or pre-manufactured channel systems such as Unistrut, Kindorf or B-Line Company. Framing material shall be pre-finished with corrosion-resistant material or painted with two coats corrosion-resistant oil-based enamel.

3. REQUIREMENTS FOR MECHANICAL EQUIPMENT, 1/2 H.P OR LESS

- A. This section describes requirements for small mechanical equipment such as (but not limited to) package terminal heating/cooling units, (water source heat pumps, etc.) VAV boxes, unit heaters, vertical and horizontal unit ventilators, exhaust fans, in-line fans, fan coil units, cabinet heaters and the like.
- B. Small equipment with motor(s) of 1/2 H.P., single phase or less are generally not required to be furnished with NEMA-style starter(s), unless otherwise noted.
- C. For such equipment, provide integral contactor or horsepower-rated relay where controlled by thermostat or other type of switch. Contactors or relays shall be as recommended by the manufacturer of the equipment, suitable for the service duty.
- D. Provide transformer within unit as required to derive low voltage A.C. for thermostat control or derive from temperature controls panel, if available.
- E. Provide internal fusing for unit motor and other loads in fuse block or in-line fuseholder. See also Article 2-B, this Section.
- F. Where externally-mounted disconnecting means is required and would be impractical, unsightly or inappropriate in the judgment of the Engineer, disconnects shall be located within the unit. These disconnects may be fusible H.P.-rated snap switches or manual starters with overload elements, as required. Locate this and other electrical equipment within enclosure where easily accessible behind access panel or door on unit, and as acceptable to the electrical inspector or local authority having jurisdiction. Refer to mechanical equipment schedules for further information.
- G. Where fractional horsepower duplex pumps such as water circulators, sump pumps, etc. are provided, they shall be provided with alternators, cordsets, etc., as required for a complete installation.

4. REQUIREMENTS FOR MECHANICAL EQUIPMENT, 3/4 H.P. OR LARGER

- A. This section describes requirements for mechanical equipment such as (but not limited to) exhaust fans, larger air handling units, cooling tower fans, water source heat pumps, chilled or hot water pumps, D.X. roof-top units, air compressors and the like.
- B. Provide premium efficiency motors.
- C. Equipment provided with motor(s) of 3/4 H.P. and larger, single or three-phase are required to be furnished with starters suitable for the load(s) specified. It is recommended that starters be furnished integrally with or mounted on equipment for field wiring by the Contractor. Where starters are furnished separate from equipment, furnish templates or rough-in diagrams to the appropriate contractor for his use in installation.
- D. All starters shall be size 0 minimum. They shall be constructed and tested in accord with latest edition of NEMA standards. All starters shall be across-the-line magnetic type, unless indicated otherwise. On motors of 20 H.P. or greater rating, the supplier shall provide starters capable of limiting inrush currents. These shall be of the wye-delta, reduced voltage open-transition type, or electronic controlled, as required. Do not utilize closed transition starters unless specifically indicated.
- E. Magnetic starters shall be furnished with the following characteristics and accessories as a minimum. See other sections of these specifications and mechanical schedules for further requirements.
 - Contacts shall be silver-alloy, double-break type. Contacts shall be replaceable without removal of wiring or removal of starter from enclosure. Number of contacts shall be as required for service indicated. Contacts shall be gravity dropout type, positive operation.
 - (2) Coil voltage shall be 120 volts, A.C., 60 HZ or less, as required to suit control systems available voltages. Coils shall be of molded construction, rated for continuous duty. Provide coil clearing contact as required.
 - (3) Provide control transformer of adequate K.V.A. as required on all starters with line-to-line voltages higher than 120 volts A.C. Provide fuse block and slow-blow fuse to protect control transformer per NEMA, N.E.C. and U.L.
 - (4) Provide hand-off-auto selector switch in face of starter, wired into hand and off switch positions. Auto position (if needed) to be field wired as indicated on plans or schedules for automatic control. Provide a green run pilot light.
 - (5) Provide NEMA Class 20 resettable overload relays, accurately sized to the motor nameplate rating of the motor served and the temperature differential between motor and controller. Overloads shall be easily replaceable, and resettable without opening enclosure, via a push button or similar means. Class 10 or Class 30 overloads may be used, depending on the type of anticipated service.
 - (6) Provide at least one N.O. and one N.C. auxiliary contact (field-convertible to opposite operation) with each starter. Refer to mechanical details or schedules for additional requirements, if any. All starters shall have space for two additional single-pole contacts.
 - (7) All starters shall be thru-wiring type.
 - (8) Provide phase failure sensing relay to open starter coil circuit (on loss of one or more phases) on all three-phase starters controlling motors of 15 H.P. or larger.

(9) Provide power factor correction capacitors on motors of 15 H.P. or larger where predicted power factor based on manufacturer's data will fall below 0.90%. Capacitors shall be of the unit-cell type, in single enclosure with discharge resistors and tank overpressure circuit interrupter for safety.

5. REQUIREMENTS FOR WIRING

- A. All wiring, including controls, interlock, miscellaneous power, sensors, thermostats, etc., shall be installed in metallic raceway systems that are in compliance with all Division 26 requirements of these Specifications, unless specifically noted otherwise. Open cabling systems will only be permitted where specifically permitted within the Division 26 Specifications and if less than 50 volts A.C. peak-to-peak or 50 volts maximum D.C.
- B. Where open cabling is permitted, it shall be installed with proper support as specified in the Division 26 Specifications.
- C. Where open cabling is permitted, and installed in environmental air plenum (return, relief, supply, etc.), the materials installed shall be in compliance with N.E.C. Articles 700, 725, 770 (for fiber optic), 780 and 800.
- D. Where open cabling is permitted, it shall only be installed open in accessible spaces. Where concealed in walls, it shall be routed through raceways to outlet boxe(s) for the terminal device.

6. INVERTER DUTY MOTORS

- A. Motors which are controlled by variable frequency drive shall be:
 - (1) NEMA MG-1 Part 31 rated for Inverter Duty.
 - (2) Furnished with shaft grounding kit for all motors:
 - a. Motors less than 100 HP in size shall be furnished with shaft grounding kit, Aegis SGR Bearing Protection Ring or equal. One shaft grounding ring and related hardware shall be provided on drive end or non-drive end of motor per manufacturer's instructions. These shall be factory mounted and installed on the exterior of the motor to allow for visual inspection. Ground motor frame per manufacturer's instructions. Install kit in strict accordance with manufacturer's instructions.

END OF SECTION 250100

SECTION 250200 - CONTROLS – DIRECT DIGITAL

1. GENERAL

- A. The Contractor shall furnish all labor, materials, equipment and services required to provide a complete temperature control system as specified and as shown on the plans.
- B. Prior to the installation of or payment for any work, the Contractor shall prepare submittals which shall be reviewed by the Architect and Engineer. These submittals shall include a complete control diagram and sequence of operation of the entire system, plus engineering data on all devices used.
- C. The Contractor shall be a licensed installer of HVAC temperature controls by a national temperature controls manufacturer. Acceptable manufacturers are Trane, Siemens, Johnson, Honeywell, Andover, TAC, Invensys, Alerton or Automated Logic. The installer shall have 5 years experience and installed a minimum of 8 systems of similar size. Their offices shall be within 150 miles of the project site.
- D. The system herein specified shall be free from defects in workmanship and material under normal use and service if, within twelve (12) months from the date of acceptance by the Engineer, any of the equipment herein described is proved to be defective in workmanship or material, it will be adjusted, repaired, or replaced free of charge by the Contractor.
- E. All equipment, unless specified to the contrary, shall be fully proportioning and adjustable. The Control System shall consist of all room thermostats, air stream thermostats, valves, damper operators, relays, freeze protection equipment, dampers, panels, and other accessory equipment not provided with the equipment to fill the intent of the specifications and drawings.
- F. Complete freeze protection equipment shall be provided at all required locations. Freeze protection thermostats shall have twenty-foot elements and be capable of de-energizing the circuit when any point along the element reaches the set point of the thermostat. Freezestat elements shall be placed on the leaving side of each heating coil, so that every square foot on the heating coil is protected. On heating coils larger than eighteen (18) square feet, provide multiple freezestats wired in series. The Contractor shall ensure that all freeze protection devices and equipment has been fully tested prior to the heating season and shall so certify in writing to the Engineers. The cost of replacement of equipment damaged by freeze-up caused by improper freeze protection or faulty control equipment shall be borne by the Contractor.
- G. All units, controls, equipment, heat pumps, etc., and controls shall reset automatically when power is restored after an outage.
- H. All control wiring concealed in walls and exposed in mechanical rooms, closets, etc., shall be in conduit. Provide plenum rated wiring where cable is concealed above ceilings. Do not paint wiring. The Contractor is responsible for protecting wiring from paint. Any painted cabling shall be replaced.
- I. All dampers shall be capable of operating properly with the system pressures encountered. This shall include modulating and shut-off functions.
- J. The Contractor shall also refer to the mechanical maintenance, HVAC equipment, and all other sections of the specifications for additional control requirements.
- K. Provide smoke detectors and shut down control for all air handling units and combined air systems as required by the KBC and IMC Section 606.

- L. All DDC controllers or control modules shall have covers to protect the circuit boards. All wiring shall be anchored securely within 6" of the controller.
- M. Provide all control dampers, etc. not supplied with the equipment or required to accomplish the sequences specified.
- N. The Contractor shall provide all refrigeration control and interlock wiring as recommended by the equipment manufacturer.
- O. Wiring and required conduit in connection with the control system(s), including power wiring of any voltage, shall be installed by the Contractor. The Contractor may, at his option, engage the Electrical Contractor to accomplish this work. It is emphasized however, that the Contractor is finally responsible for all such work.
- P. Electric power for the control panels, modules, unit controller, damper motors, etc., shall be derived from the building electric system. Power shall not be derived from the HVAC equipment power source or equipment low voltage transformers (internal or integral).
- Q. The electrical work required for the installation of the control system(s), shall be provided by the Contractor in accordance with all National and Local Electrical Codes. All wiring shall be concealed except in Mechanical Rooms. All electrical work specified under this division of the specifications shall also comply with Division 26 of these specifications.
- R. All exterior electrical work, equipment, etc. shall be waterproofed.
- S. Controls system and all related components shall comply with ASHRAE Standard 135 (BACnet protocol).

2. OWNER'S TRAINING

- A. The Contractor shall provide full instructions to designated personnel in the operation, maintenance, and programming of the system. The training shall be specifically oriented to the system and interfacing equipment installed. Four hours of Owner Training shall be provided at substantial completion, again after 6 months and again 1 year after substantial completion. The Owner Training shall include an overview of the entire HVAC system operation, temperature sensor setpoint manipulation, critical alarm training and graphics display overview. Subcontractors shall be present during Owner training sessions.
- B. The Contractor shall provide a Sign-in Sheet and Meeting Minutes of the training. The Contractor shall also video record the initial training sessions. Complete Operations and Maintenance Manuals shall be reviewed by the Contractor during training.

3. CONTROL SYSTEM CHECKOUT AND TESTING – BY CONTROLS CONTRACTOR PRIOR TO DEMONSTRATION AND ACCEPTANCE

- A. Startup Testing. Complete startup testing to verify operational control system before notifying Owner of system demonstration. Provide Owner with schedule for startup testing. Owner may have representative present during any of all startup testing.
 - (1) Calibrate and prepare for service each instrument, control, and accessory equipment furnished under Section 250200.
 - (2) Verify that control wiring is properly connected and free of shorts and ground faults.
 - (3) Enable control systems and verify each input device's calibration. Calibrate each device according to manufacturer's recommendations.

- (4) Verify that binary output devices such as relays, solenoid valves, two-position actuators and control valves, and magnetic starters, operate properly and that normal positions are correct.
- (5) Verify that analog output devices such as I/Ps and actuators are functional, that start and span are correct, and that direction and normal positions are correct. Check control valves and automatic dampers to ensure proper action and closure. Make necessary adjustments to valve stem and damper blade travel.
- (6) Prepare a log documenting startup testing of each input and output device, with technician's initials certifying each device has been tested and calibrated. Submit log to Engineer for review.
- (7) Verify that system operates according to sequences of operation. Simulate and observe each operational mode by overriding and varying inputs and schedules. Tune PID loops and each control routine that requires tuning.
- (8) Alarms and Interlocks.
 - a. Check each alarm with an appropriate signal at a value that will trip the alarm.
 - b. Trip interlocks using field contacts to check logic and to ensure that actuators fail in the proper direction.
 - c. Test interlock actions by simulating alarm conditions to check initiating value of variable and interlock action.

4. CONTROL SYSTEM DEMONSTRATION AND ACCEPTANCE

- A. Demonstration. Prior to acceptance, perform the following performance tests to demonstrate system operation and compliance with specification after and in addition to tests specified in Control System Checkout and Testing. Provide Engineer with log documenting completion of startup tests. Submission of log is required before Demonstration and Acceptance may begin.
 - (1) Engineer will be present to observe and review system demonstration. Schedule with Engineer at least 14 days before system demonstration begins. Systems balancing shall be complete prior to demonstration, coordinate scheduling with TAB agency accordingly.
 - (2) Demonstrate actual field operation of <u>each</u> sequence of operation as specified in these specifications. Provide at least two persons for two days each (32 man-hours) to demonstrate calibration and response of any input and output points requested by Engineer. Provide and operate test equipment required to prove proper system operation. Specified on site time does NOT include time necessary to correct deficiencies.
 - (3) Demonstrate complete operation of operator interface.
 - (4) Demonstrate all alarms, including external alarms to Owner selected pagers, phones, e-mail accounts, etc. Also demonstrate fire alarm system interface.
 - (5) Tests that fail to demonstrate proper system operation shall be repeated after Contractor makes necessary repairs or revisions to hardware or software to successfully complete each test.
 - (6) Provide all required tools to perform system demonstration and point calibration (drills, duct plugs, thermometers, hygrometers, hand-held carbon dioxide sensors, aerosol test smoke, 2-way radios, water probes, DP sensors for water and air, etc.)
- B. Acceptance
 - (1) After tests described in this specification are performed to the satisfaction of both Engineer and Owner, Engineer will accept control system. Engineer may exempt tests from completion requirements that cannot be performed due to circumstances beyond Contractor's control. Engineer will provide written statement of each exempted test. Exempted tests shall be performed as part of warranty.
 - (2) System shall not be accepted until completed demonstration forms and checklists are submitted and approved as required in these specifications. Warrantee will not start until acceptance by Owner and Engineer.

5. ONE YEAR OPTIMIZATION PERIOD

- A. The controls contractor shall provide assistance to the Engineer for a period of one year from date of system acceptance for the purposes of optimizing the systems for energy efficiency and occupant comfort. The assistance shall consist of the following:
 - (1) Assist the Engineer in accessing the controls system remotely.
 - (2) Input schedules and setpoints for all zones and equipment as requested by Engineer and Owner.
 - (3) Trend points as requested by Engineer.
 - (4) Modify controls sequences as requested by Engineer. No additional points will be added by the Engineer.
 - (5) Modify setpoints and schedules as requested by Engineer and Owner.

Additionally, during the optimization period, include 2 site visits (6 hours on-site each) for system modifications that cannot be accomplished remotely.

6. EQUIPMENT

1.3 DESCRIPTION

General: The Building Automation System shall be comprised of a network of interoperable, stand-alone Building Controllers based on the latest Niagara 4 software and communicating via BACnet/mstp to a series of DDC controllers. The system shall be an enterprise-level multiple building control system as indicated on the drawings and described in the specifications. Control functions within a building site shall be performed by localized direct digital controls linked through a network of Building Controllers to a workstation utilizing the latest version of Niagara 4 software with the ability to integrate multiple Building Controllers into a unified database. The system shall provide a web-based user interface and be designed to integrate multiple systems together, collect, store and display historical data and provide enterprise-wide or multiple building facilities management capabilities from a central storage and operational location.

An operator shall be able to logon to the system using a standard web browser, and without requiring system vendorproprietary software installed on the user's PC to allow access to all appropriate data and control functions.

- A. Direct Digital Control (DDC) technology shall be used to provide the functions necessary for control of systems defined for control on this project.
- B. The control system shall accommodate simultaneous multiple user operation. Access to the control system data should be limited by operator password. An operator shall be able to log onto any workstation of the control system and have access to all designated data.
- C. The control system shall be designed such that each mechanical system will operate under stand-alone control. As such, in the event of a network communication failure, or the loss of other controllers, the control system shall continue to independently operate the unaffected equipment.
- D. Communication between the control panels and all workstations shall be over a high-speed network. All nodes on this network shall be peers. A network communications card shall be provided for each building control panel provided as part of the system installation.
- E. To assure open operability and future servicing by competing qualified contractors the Tridium Niagar 4 product platform controllers (JACE) must contain OPEN NIC statements. LOCKED JACE products with closed NIC statements inhibit the owner's ability to have open source service opportunities for their installed products and will not be acceptable on this project.

- F. Software tools for programming, graphical generation, and system configuration must be provided to the owner upon completion of the project. Any required interface hardware needed to connect to the controllers must also be provided to the owner for future service needs on their control system.
 - a. APPROVED CONTROL SYSTEM CONTRACTORS AND MANUFACTURERS
 - i. Approved Control System Contractors and Manufacturers:

Manufacturer Name	Contractor Name
Trane	Harshaw Trane
ECT	ECT
JCI	Johnson Controls
Innerspace	Automated Logic

b. QUALITY ASSURANCE

- i. System Installer Qualifications
 - 1. The Installer shall have an established working relationship with the Control System Manufacturer of not less than five years.
 - 2. The Installer shall have successfully completed Control System Manufacturer's classes on the control system. The Installer shall present for review the certification of completed training, including the hours of instruction and course outlines upon request.
 - 3. The installer shall have an office within 120 miles of the project site and provide 24-hour response in the event of a customer call.

c. CODES AND STANDARDS

- i. Work, materials, and equipment shall comply with the rules and regulations of all codes and ordinances of local, state and federal authorities. As a minimum, the installation shall comply with the current editions in effect 30 days prior to receipt of bids of the following codes:
 - 1. National Electric Code (NEC)
 - 2. International Building Code (IBC)
 - 3. International Mechanical Code (IMC)
 - 4. Underwriters Laboratories: Products shall be UL-916-PAZX listed.
 - 5. ANSI/ASHRAE Standard 135-2004 (BACnet)

d. SYSTEM PERFORMANCE

- A. Data values displayed on web pages (that represent live data) shall automatically refresh at a minimum rate of every 10 seconds in the browser without refreshing the entire page.
- B. Data on web pages must be returned and updated on a given web page within 5 seconds on average after the web page is initially delivered, subject to network loading.
- C. Graphic Display. The system shall display a graphic with a minimum of 20 dynamic points with current data displayed within 20 seconds of the request.
- D. Graphic Refresh. The system shall update all dynamic points with current data within 30 seconds.
- E. Object Command. The maximum time between the command of a binary object by the operator and the reaction by the device shall be 10 seconds. Analog objects shall start to adjust within 10 seconds.

- F. Object Scan. All changes of state and change of analog values shall be transmitted over the high-speed network such that any data used or displayed at a controller or workstation will be current, within the prior 60 seconds.
- G. Alarm Response Time. The maximum time from when an object goes into alarm to when it is viewable on an operator workstation web page shall not exceed 45 seconds.
- H. Program Execution Frequency. Custom and standard applications shall be capable of running as often as once every 5 seconds. The Contractor shall be responsible for selecting execution times consistent with the mechanical process under control.
- I. Performance. Programmable Controllers shall be able to execute DDC PID control loops at a selectable frequency from at least once every 5 seconds. The controller shall scan and update the process value and output generated by this calculation at this same frequency.
- J. Multiple Alarm Annunciation. Any authorized operator shall be able to view alarms through a web page interface, with up to 40 concurrent users accessing the system alarm data.
- K. Reporting Accuracy. Table 1 lists minimum acceptable reporting accuracies for all values reported by the specified system.

Measured Variable	Reported Accuracy
Space Temperature	±0.5°C [±1°F]
Ducted Air	±1.0°C [±2°F]
Outside Air	±1.0°C [±2°F]
Water Temperature	±0.5°C [±1°F]
Delta-T	±0.15°C[±0.25°F]
Relative Humidity	±5% RH
Water Flow	$\pm 5\%$ of full scale
Air Flow (terminal)	$\pm 10\%$ of reading *Note 1
Air Flow (measuring stations)	$\pm 5\%$ of reading
Air Pressure (ducts)	±25 Pa [±0.1 "W.G.]
Air Pressure (space)	±3 Pa [±0.01 "W.G.]
Water Pressure	$\pm 2\%$ of full scale *Note 2
Electrical Power	\pm 5% of reading *Note 3
Carbon Monoxide (CO)	\pm 5% of reading
Carbon Dioxide (CO2)	± 50 PPM

Table 1Reporting Accuracy

Note 1: (10%-100% of scale) (cannot read accurately below 10%)

- Note 2: for both absolute and differential pressure
- Note 3: * not including utility supplied meters

1.10SUBMITTALS

A. Contractor shall provide shop drawings and manufacturers' standard specification data sheets on all hardware and software to be provided. No work may begin on any segment of this project until the Engineer and Owner have reviewed submittals for conformity with the plan and specifications. Six (6) copies are required. All shop drawings shall be provided to the Owner electronically as .dwg or .dxf file formats.

- B. Quantities of items submitted shall be reviewed by the Engineer and Owner. Such review shall not relieve the contractor from furnishing quantities required for completion.
- C. Provide the Engineer and Owner, any additional information or data which is deemed necessary to determine compliance with these specifications or which is deemed valuable in documenting the system to be installed.
- D. Submit the following within 60 days of contract award:
 - 1. A complete bill of materials of equipment to be used indicating quantity, manufacturer and model number.
 - 2. A schedule of all control valves including the valve size, model number (including pattern and connections), flow, CV, pressure rating, and location.
 - 3. A schedule of all control dampers. This shall include the damper size, pressure drop, manufacturer and model number.
 - 4. Provide manufacturers cut sheets for major system components. When manufacturer's cut sheets apply to a product series rather than a specific product, the data specifically applicable to the project shall be highlighted or clearly indicated by other means. Each submitted piece of literature and drawings shall clearly reference the specification and/or drawing that the submittal is being submitted to cover. Include:
 - a) Centralized server hardware and software
 - b) Building Controllers
 - c) Custom Application Controllers
 - d) Application Specific Controllers
 - e) Operator Interface Computer(s) as specified
 - f) Configuration and service software programs
 - g) Portable Operator Workstation(s) or Service software PCs as specified
 - h) Auxiliary Control Devices
 - i) Proposed control system riser diagram showing system configuration, device locations, addresses, and cabling
 - j) Detailed termination drawings showing all required field and factory terminations. Terminal numbers shall be clearly labeled
 - k) Points list showing all system objects, and the proposed English language object names
 - 1) Sequence of operations for each system under control. This sequence shall be specific for the use of the Control System being provided for this project
 - m) Color prints of proposed graphics with a list of points for display

E. Project Record Documents. Upon completion of installation submit three (3) copies of record (as-built) documents. The documents shall be submitted for approval prior to final completion and include:

- 1. Project Record Drawings. These shall be as-built versions of the submittal shop drawings. One set of electronic media including CAD .DWG or .DXF drawing files shall also be provided.
- 2. Testing and Commissioning Reports and Checklists.
- 3. Operating and Maintenance (O & M) Manual. These shall be as-built versions of the submittal product data. In addition to that required for the submittals, the O & M manual shall include:
 - a) Names, address and 24-hour telephone numbers of Contractors installing equipment, and the control systems and service representative of each.
 - b) Operators Manual with procedures of operating the control systems including logging on/off, alarm handling, producing point reports, trending data, overriding computer control, and changing set points and other variables.
 - c) Programming Manual with a description of the programming language including syntax, statement descriptions including algorithms and calculations used, point database creation and modification, program creation and modification, and use of the editor.

- d) Engineering, Installation and Maintenance Manual(s) that explains how to design and install new points, panels, and other hardware; preventative maintenance and calibration procedures; how to debug hardware problems; and how to repair or replace hardware.
- e) A listing and documentation of all custom software created using the programming language including the point database. One set of magnetic media containing files of the software and database shall also be provided.
- f) One set of electronic media containing files of all color-graphic screens created for the project.
- g) Complete original issue documentation, installation, and maintenance information for all third party hardware provided including computer equipment and sensors.
- h) Complete original issue media for all software provided including operating systems, programming language, operator workstation software, and graphics software.
- i) Licenses and warranty documents for all equipment and systems.
- j) Recommended preventive maintenance procedures for all system components including a schedule of tasks, time between tasks, and task descriptions.
- F. Training Materials: The Contractor shall provide a course outline and training material for all training classes at least six weeks prior to the first class. The Owner reserves the right to modify any or all of the training course outline and training materials. Review and approval by Owner and Engineer shall be completed at least 3 weeks prior to first class.

1.11WARRANTY

- A. Warrant all work as follows:
 - Labor & materials for control system specified shall be warranted free from defects for a period of twelve (12) months after final completion acceptance by the Owner. Control System failures during the warranty period shall be adjusted, repaired, or replaced at no charge or reduction in service to the Owner. The Contractor shall respond to the Owner's request for warranty service within 24 hours during customary business hours.
 - 2. At the end of the final start-up/testing, if equipment and systems are operating satisfactorily to the Owner and Engineer, the Owner shall sign certificates certifying that the control system's operation has been tested and accepted in accordance with the terms of this specification. The date of Owner's acceptance shall be the start of warranty.
 - 3. Central server and configuration tool software, project specific software, graphics, database, and firmware updates shall be provided to the Owner at no charge during warranty period. Written authorization by Owner must, however, be granted prior to the installation of such changes.
 - 4. The system provider shall provide a web-accessible on-line resource that provides the Owner access to a question/answer forum, graphics library, user tips, upgrades, and manufacturer training schedules.
 - 5. The contractor shall provide access to a help desk support system during the first year warranty. Telephone support will be provided by a factory trained technician who has <u>immediate</u> access to all relevant documentation including design drawings, operation and maintenance manuals. Telephone support shall be provided between the hours of 8:00 am to 5:00 pm, Monday through Friday excluding Holidays. A report shall be generated for any call over 5 minutes that details the reported problem and resolution. A copy of each report shall be sent to the engineer for review.

1.12OWNERSHIP OF PROPRIETARY MATERIAL

A. The Owner shall sign a copy of the manufacturer's standard software and firmware licensing agreement as a condition of this contract. All software licensing shall be made to the <u>Owner not the BAS Contractor or vendor</u>, and such license shall grant use of all programs and application software to owner as defined by the manufacturer's license agreement, but shall protect manufacturer's rights to disclosure of trade secrets contained within such software. All software shall be capable of adding other manufacture licensed vendors if of the same firmware. Any and all required IDs, passwords, and software keys for access to any

component or software program shall be provided to the owner. All project-developed hardware and software shall become the property of the Owner. These items include but are not limited to:

- 1. Project graphic images
- 2. Record drawings
- 3. Project database
- 4. Project-specific application programming code
- 5. All documentation
- 6. All software, software licenses and software keys

PART 2: PRODUCTS

2.0 SECTION INCLUDES

- .1 Materials
- .2 Communication
- .3 Operator Interface
- .4 Application and Control Software
- .5 Building Controllers
- .6 Custom Application Controllers
- .7 Application Specific Controllers
- .8 Input/Output Interface
- .9 Auxiliary Control Devices

2.1 MATERIALS

A. All products used in this installation shall be new, currently under manufacture, and shall be applied in similar installations for a minimum of 2 years. The installation shall not be used as a test site for any new products unless explicitly approved by the Owner's representative in writing. Spare parts shall be available for at least 5 years after completion of this contract.

2.2 COMMUNICATION

- A. Each Building Controller shall communicate to a Niagara 4 Web Supervisor workstation via ISO 8802-3 (Ethernet) network.
- B. Each Building Controller shall perform communications to a network of Custom Application and Application Specific Controllers utilizing the ANSI/EIA/CEA standard ASHRAE, ANSI, and ISO 16484-5 BACnet protocol.
- C. The Controls Contactor shall provide all communication media, connectors, repeaters, hubs, and routers necessary for the internetwork. An active 10BaseT jack will be provided adjacent to each Building Control Panel and PC Workstation for connection to this network.
- E. Remote service software access via a 56K baud modem shall allow for communication with any and all controllers on the BAS network.
- F. All database values (i.e., points, software variable, custom program variables) of any one building controller shall be readable by any other building controller on the internetwork. An operator/installer shall not be required to set up any communications services to perform internetwork value passing.
- G. The BAS shall be designed around the BACnet open architecture standards where possible and is the preferred method of integration. Integration of proprietary third-party devices and applications is NOT allowd.

2.3 OPERATOR INTERFACE

- A. Owner will access BAS daily operations through use of any designated workstations setup through system security functions. PC hardware shall be provided by the Controls Contractor and must meet the standards described in section B below. Each workstation shall be able to access all operator-level information in the system through use of a standard Microsoft Internet Explorer web browser. These workstations shall reside on the enterprise-wide network as the central server and building controllers.
- B. Operator Workstation Components.
 - 1. PCs shall include the latest Microsoft Windows and Explorer software that supports the Niagara 4 platform.
 - Furnish all required serial, parallel, and network communication ports, and all cables for proper system operation. Each PC shall include a minimum 19", color monitor with 1024 x 768 screen resolution.
- C. Provide a web browser user interface. There shall be no vendor-proprietary software required to be installed on user PCs.
 - 1. The system shall provide summary tables by equipment type per site. Room or space summary tables shall provide names, space temperatures, setpoints, and variance from setpoint. Provide a means to sort columns of data viewed by ascending or descending value for any chosen data type.
 - 2. The system shall provide a user option to reformat summary tables and information for printing.
 - 3. The central server shall be capable of presenting selected data parameters such that they may be viewed and changed by the user. For example, adjustable data parameters may include space temperature setpoints, relative humidity setpoints, discharge air setpoints, static pressure setpoints,
 - 4. Provide the ability to reset diagnostic messages and perform control overrides
- D. Central Server Components. The central server shall be provided by the FMS contractor and consist of the following (minimum):
 - 1. System shall utilize a server class PC, tower or rack mounted
 - 2. Two Xeon 2.8GHz, 1MB L3 cache processors
 - 3. 2GB, DDR266 SDRAM memory
 - 4. Four (4) 73GB SCSI HD (each) in RAID 5 or RAID 10 configuration
 - 5. DVD+R/W or CD ROM
 - 6. Microsoft Windows Server 2003 (IIS 6.0)
 - 7. Microsoft SQL Server 2005
 - 8. .NET Framework 1.1
 - 9. Furnish all required serial, parallel, and network communication ports, and all cables for proper system operation. The server shall include a minimum 17", color monitor with 1024 x 768 screen resolution.
- E. System Software
 - 1. System Graphics. The operator interface shall provide graphically-oriented web pages as designated.
 - a) The system shall include a three-dimensional color floor plan graphic. The floor plans shall be color coded by zone to match scheduling. Clicking on a zone shall bring up a larger version of that particular zone in a three dimensional colored graphic.
 - b) Each piece of major HVAC equipment shall be represented by a three-dimensional graphic with appropriate animations
 - c) Provide a method for the operator to easily move between graphic displays on the screen.
 - d) The system must dynamically generate and serve web pages based on standard or custom web page templates in combination with content derived from the database in any building control panel.

- e) Dynamic points shall include analog and binary values, dynamic text, static text, and animation files. Graphics shall have the ability to show animation of equipment.
- 2. Engineering Units. Allow for selection of the desired engineering units (i.e. Inch pound or SI) in the system. Unit selection shall be able to be customized by user to select the desired units for each measurement.
- 3. Site Management
 - a) The system must allow for grouping of the many sites in an enterprise in a logical manner.
 - b) The system shall provide a search function to allow users to search for sites or groups of sites by name or partial names.
 - c) The system must provide the necessary means to add, remove, and manage sites.
- F. System Applications. The central server shall serve operator interface web pages and provide off-line storage of system information. Provide the following applications within the system.
 - 1. Automatic System Database Save and Restore. The central server shall store on the hard disk backup tables of data including trends, alarms, custom settings and user profiles. This data shall be backed up once a day. This database shall be updated whenever a change is made in the system. The storage of this data shall be automatic and not require operator intervention.
 - 2. Manual Database Save and Restore. A system operator with the proper password clearance shall be able to archive the database manually at any time.
 - 3. System Configuration. The central server shall serve web pages as the interface for configuring the operator-level functions of the system. A user with proper security shall be able to configure the system to allow for future changes or additions.
 - 4. On-Line Help and Training. Provide a context sensitive, on line help system to assist the operator in operation and editing of the system. On-line help shall be available for all system functions and shall provide the relevant data for that particular screen. Additional help shall be available through the use of hypertext links onscreen.
 - 5. Security. The system shall support state-of-the-art encryption between server and web browser. Web browser interface shall utilize Secure Socket Layer SSLv3 encryption technology. Web server shall utilize TLS encryption. Server security shall accommodate a minimum of 1000 individually password protected users. Each user shall be assigned a user name and password and security level. User names and passwords shall be case sensitive and able to have up to 32 characters. User security shall be set up through the web browser as an administrative function. Each user will be assigned to a security level. Security levels shall be hierarchical in nature the higher security levels have all rights of lower levels. There shall be at least four (4) user security levels corresponding to user roles. A System Administrator shall be able to define the data view and edit capabilities for each security level. Users shall be automatically logged off of the system after a specified period of inactivity.
 - 6. System Diagnostics. The system shall automatically monitor the operation of all workstations, network connections, building management panels, and controllers. The failure of any device shall be annunciated to the operator.
 - 7. Alarm Management The central server shall provide the following alarm handling functions:
 - a) Receiving alarms from each building panel.
 - b) The central server shall store specified alarms in an alarm log database.
 - c) Displaying an alarm log.
 - d) Forward alarms via e-mail or phone call as specified by the user.
 - e) Alarm sorting and/or filtering by alarm and/or site attribute.
 - f) Store alarm data in a standard format accessible to a user-specified peer database/server.
 - g) Storing and purging the alarm log.
 - h) Provide a means of acknowledging and deleting alarms from the viewable alarm log(s).
 - i) Provide a printer-friendly format for printing alarm logs.
 - 8. Alarm and Event Log. The operator shall be able to view all logged system alarms and events from any location in the system. An operator with the proper security level may acknowledge and clear alarms. All that have not been cleared by the operator shall be archived to the hard disk on the central server.

- 9. Trend Logs. The operator shall be able to define a trend log for any data in the system. This definition shall include interval, start-time, and stop-time. Trend intervals of 1, 5, 15, 30, and 60 minutes as well as user-defined intervals shall be selectable. The system operator shall be able to determine how many samples are stored in each trend. Trend data shall be sampled and stored on the Building Controller panel, then harvested and be archived on the central server hard disk. Additionally, provide the capability to sample directly from the building controller database to the central server. Trend data shall be able to be viewed and printed from the operator interface web pages. Trends must be viewable in a text-based format or graphically. Trends shall also be storable in a tab delimited ASCII format for use by other industry standard word processing and spreadsheet packages, and be exportable to a file for use in other software tools, available in a non-proprietary file format to be used by another database.
- 10. Dynamic Graphical Trending. The system shall have the ability to display collected data in a graphical chart. Trend viewing capabilities shall include the ability to show up to 5 points on a chart. Each data point trend line shall be an individual color. Trend data shall be able to be stored indefinitely on the central server, based on server storage capacity and data archiving practices.
- 11. Object and Property Status and Control. Provide a method for the operator to view, and edit if applicable, the status of any object and property in the system.
- 12. Reports and Logs. Provide a reporting function that presents the system operator stored data in either a table format, as a chart, or as a report that can be printed. Data in a table format shall list the data values as well as a date and time stamp. Allow the user to present data log pages of a collection from a single piece of equipment or a building panel summary. Provide the ability to view data points on a static graph or configured for a specified length of time. The system shall be capable of storing trend data in a database, and providing an interface to allow for retrieval of data by network peer servers and databases.
- G. Workstation Applications Editors. The system web user interface shall support dedicated screens for editing of control system applications. The application programs shall be executed at the appropriate controller panels.

Scheduling. An editor for an enterprise-wide scheduling application shall be provided. Provide a method by which a system operator can make permanent changes to one or many building schedules without the need to repeat any steps. The system shall provide temporary changes to one or more schedules at one or more building locations. Provide individual scheduling for zones as noted on the drawings.

- 1. Manual Control and Override. Provide a means of manually controlling analog and binary output points.
- H. Custom Application Programming. Provide software configuration tools [installed on operator PCs and/or Portable Operator's Terminals as designated] to create, modify, and debug custom application programming. The operator shall be able to create, edit, and download custom programs at the same time that all other system applications are operating. The system shall be fully operable while custom routines are edited, compiled, and downloaded.

2.4 APPLICATION AND CONTROL SOFTWARE

- A. Furnish the following applications software for building and energy management. All software applications shall reside and run in the system controllers. Editing of applications shall occur at operator workstations served web-based user interface pages.
- B. Scheduling. Provide the capability to schedule each object or group of objects in the system. Each of these schedules shall include the capability for start, stop, and optimal start actions. When a group of objects are scheduled together, provide the capability to define advances and delays for each member.
- C. Optimal Start. The scheduling application shall support an optimal start algorithm. This shall calculate the thermal characteristics of a zone and start the equipment prior to occupancy to achieve the desired space temperature at the specified occupancy time. The algorithm shall calculate separate sets of heating and cooling rates for zones that have been unoccupied for less than and greater than 24 hours. Provide the

ability to modify the start algorithm based on outdoor air temperature. Provide an early start limit in minutes to prevent the system from starting before an operator determined time limit.

- D. Demand Limiting. The demand limiting program shall monitor building power consumption from signals generated by a pulse generator (provided by others) mounted at the building power meter, or from a watt transducer or current transformer attached to the building feeder lines.
 - 1. The demand limiting program shall be based on a predictive sliding window algorithm. The sliding window duration and sampling interval shall be set equal to that of the local Electrical Utility.
 - 2. Control system shall be capable of demand limiting by resetting HVAC system setpoints to reduce load while maintaining a widened band of comfort control in the space.
 - 3. Input capability shall also be provided for an end-of-billing period indication.
- E. Maintenance Management. The system shall monitor equipment status and generate maintenance messages based upon user designated run time, starts, and/or calendar date limits.
- F. PID Control. A PID (proportional-integral-derivative) algorithm with direct or reverse action and anti-wind-up shall be supplied. The algorithm shall calculate a time-varying analog value used to position an output or stage a series of outputs. The controlled variable, set-point, and PID gains shall be user-selectable. The setpoint shall optionally be chosen to be a reset schedule.
- G. Timed Override. A standard application shall be utilized to enable/disable temperature control when a user selects on/cancel at the zone sensor, workstation, or the operator display. The amount of time that the override takes precedence will be selectable from the workstation.
- H. Staggered Start. This application shall prevent all controlled equipment from simultaneously restarting after a power outage. The order in which equipment (or groups of equipment) is started, along with the time delay between starts shall be user-selectable.
- I. System Calculations. Provide software to allow instantaneous power (e.g. KW), flow rates (e.g. L/s [GPM]) to be accumulated and converted to energy usage data. Provide an algorithm that calculates a sliding-window KW demand value. Provide an algorithm that calculates energy usage and weather data (heating and cooling degree days). These items shall all be available for daily, previous day, monthly and the previous month.
- J. Anti-Short Cycling. All binary output points shall be protected from short cycling. This feature shall allow minimum on-time and off-time to be selected.

2.5 BUILDING CONTROLLERS

- A. General. Provide Building Controllers to provide the performance specified in section 1 of this division. Each of these panels shall meet the following requirements.
 - 1. The Building Automation System shall be composed of one or more independent, standalone, microprocessor based Building Controllers to manage the global strategies described in System software section.
 - 2. The Building Controller shall have sufficient memory to support its operating system, database, and programming requirements.
 - The operating system of the Controller shall manage the input and output communications signals to allow distributed controllers to share real and virtual point information and allow central monitoring and alarms.
 - 4. Controllers that perform scheduling shall have a real time clock.
 - 5. Data shall be shared between networked Building Controllers.
 - 6. The Building Controller shall utilize BACnet standard protocols for communication to unit controllers.
 - 7. The Building Controller shall continually check the status of its processor and memory circuits. If an abnormal operation is detected, the controller shall:

- a) Assume a predetermined failure mode.
- b) Generate an alarm notification.

c) Create a retrievable file of the state of all applicable memory locations at the time of the failure.

d) Automatically reset the Building Controller to return to a normal operating mode.

B. Communications. Each Building Controller shall reside on the enterprise-wide network, which is same high-speed network as the central server and PC workstations. The enterprise-wide network will be provided by the owner and supports the Internet Protocol (IP). Local connections of the Building Controller shall be on ISO 8802-3 (Ethernet). Each Building Controller shall also perform routing to a network of Custom Application Specific Controllers. Each Building Controller shall perform communications to a network of Custom Application and Application and Application and BACnet MS/TP.

- C. Environment. Controller hardware shall be suitable for the anticipated ambient conditions. Controller used in conditioned ambient shall be mounted in an enclosure, and shall be rated for operation at 32° F to 120° F.
- D. Serviceability. Provide diagnostic LEDs for power, communications, and processor. The Building Controller shall have a display on the main board that indicates the current operating mode of the controller. All wiring connections shall be made to field removable, modular terminal strips or to a termination card connected by a ribbon cable. The primary logic board shall be removable without disconnecting field wiring.
- E. Memory. The Building Controller shall maintain all BIOS and programming information in the event of a power loss for at least 72 hours.
- F. Immunity to power and noise. Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shut-down below 80% nominal voltage.

2.6 CUSTOM APPLICATION CONTROLLERS

- A. General. Provide Custom Application Controllers to provide the performance specified in section 1 of this division. Each of these panels shall meet the following requirements.
 - 1. The Controller shall have sufficient memory to support its operating system, database, and programming requirements.
 - 2. Controllers that perform scheduling shall have a real time clock.
 - The operating system of the Controller shall manage the input and output communications signals to allow distributed controllers to share real and virtual point information and allow central monitoring and alarms.
 - 4. The Controller shall continually check the status of its processor and memory circuits. If an abnormal operation is detected, the controller shall assume a predetermined failure mode, and generate an alarm notification.
 - Custom application controllers shall be BACnet certified. In those instances in which BACnet certified devices are not available, the FMS contractor shall provide BACnet devices with application source code, device resource files, and external interface definitions.
- B. Environment. Controller hardware shall be suitable for the anticipated ambient conditions.
 - 1. Controller used in conditioned ambient shall be mounted in NEMA 1 type enclosures, and shall be rated for operation at 0° C to 50° C [32° F to 120° F].
 - 2. Controllers used outdoors and/or in wet ambient shall be mounted within NEMA 4 type waterproof enclosures, and shall be rated for operation at -40° C to 70° C [-40° F to 158° F].

- C. A local operator interface shall be provided at building locations where specified in the sequence of operations or point list. The operator interface shall be provided for interrogating and editing data. A system security password shall be available to prevent unauthorized use of the keypad and display.
- D. Serviceability. Provide diagnostic LEDs for power, communications, and processor. All low voltage wiring connections shall be made such that the controller electronics can be removed and/or replaced without disconnection of field termination wiring.
- E. Memory. The Controller shall maintain all BIOS and programming information in the event of a power loss for at least 72 hours.
- F. Immunity to power and noise. Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal voltage.
- 2.7 APPLICATION SPECIFIC CONTROLLERS
- A. General. Application specific controllers (ASC) are microprocessor-based DDC controllers, which through hardware or firmware design are dedicated to control a specific piece of equipment. They are not fully user programmable, but are customized for operation within the confines of the equipment they are designed to serve.
 - 1. Each ASC will contain sufficient I/O capacity to control the target system.
- B. Environment. The hardware shall be suitable for the anticipated ambient conditions.
 - Controller used in conditioned ambient spaces shall be mounted in NEMA 1 type rated enclosures. Controllers located where not to be disturbed by building activity (such as above ceiling grid), may be provided with plenum-rated enclosures and non-enclosed wiring connections for plenum cabling. All controllers shall be rated for operation at 32° F to 120° F.
 - 2. Controllers used outdoors and/or in wet ambient shall be mounted within NEMA 4 type waterproof enclosures, and shall be rated for operation at -40° F to 150° F.
- C. Serviceability. Provide diagnostic LEDs for power and communications. All wiring connections shall be clearly labeled and made to be field removable.
- D. Memory. The Application Specific Controller shall maintain all BIOS and programming information in the event of a power loss for at least 90 days.
- E. Immunity to Power and noise. Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80%.
- F. Transformer. Power supply for the ASC must be rated at minimum of 125% of ASC power consumption, and shall be fused or current limiting type.
- 2.8 INPUT/OUTPUT INTERFACE
- A. Hard-wired inputs and outputs may tie into the system through Building, Custom, or Application Specific Controllers.
- B. All input points and output points shall be protected such that shorting of the point to itself, another point, or ground will cause no damage to the controller. All input and output points shall be protected from voltage up to 24V of any duration, such that contact with this voltage will cause no damage to the controller.
- C. Binary inputs shall allow the monitoring of on/off signals from remote devices. The binary inputs shall provide a wetting current of at least 12 mA to be compatible with commonly available control devices.

- D. Pulse accumulation input points. This type of point shall conform to all the requirements of Binary Input points, and also accept up to 3 pulses per second for pulse accumulation, and shall be protected against effects of contact bounce and noise.
- E. Analog inputs shall allow the monitoring of low voltage (0-10 Vdc), current (4-20 mA), or resistance signals (thermistor, RTD). Analog inputs shall be compatible with, and field configurable to commonly available sensing devices.
- F. Binary outputs shall provide for on/off operation. Terminal unit and zone control applications may use 2 outputs for drive-open, drive-close (tri-state) modulating control.
- G. Analog outputs shall provide a modulating signal for the control of end devices. Outputs shall provide either a 0-10 Vdc or a 4-20 mA signal as required to provide proper control of the output device.

2.9 AUXILIARY CONTROL DEVICES

- A. Motorized dampers, unless otherwise specified elsewhere, shall be as follows:
 - 1. Damper frames shall be 16 gauge galvanized sheet metal or 1/8" extruded aluminum with reinforced corner bracing.
 - 2. Damper blades shall not exceed 8" in width or 48" in length. Blades are to be suitable for medium velocity performance (2,000 fpm). Blades shall be not less than 16 gauge.
 - 3. Damper shaft bearings shall be as recommended by manufacturer for application.
 - 4. All blade edges and top and bottom of the frame shall be provided with compressible seals. Side seals shall be compressible stainless steel. The blade seals shall provide for a maximum leakage rate of 10 CFM per square foot at 2.5" w.c. differential pressure.
 - 5. All leakage testing and pressure ratings will be based on AMCA Publication 500.
 - 6. Individual damper sections shall not be larger than 48" x 60". Provide a minimum of one damper actuator per section.
- B. Control dampers shall be parallel or opposed blade types as scheduled on drawings.
- C. Electric damper/valve actuators.
 - 1. The actuator shall have electronic overload or digital rotation sensing circuitry to prevent damage to the actuator throughout the rotation of the actuator.
 - 2. Where shown, for power-failure/safety applications, an internal mechanical, spring return mechanism shall be built into the actuator housing.
 - 3. All rotary spring return actuators shall be capable of both clockwise or counter clockwise spring return operation. Linear actuators shall spring return to the retracted position.
 - 4. Proportional actuators shall accept a 0-10 VDC or 0-20 mA control signal and provide a 2-10 VDC or 4-20 mA operating range.
 - 5. All non-spring return actuators shall have an external manual gear release to allow manual positioning of the damper when the actuator is not powered. Spring return actuators with more than 60 in-lb. torque capacity shall have a manual crank for this purpose.
 - 6. Actuators shall be provided with a conduit fitting and a minimum 1m electrical cable and shall be prewired to eliminate the necessity of opening the actuator housing to make electrical connections.
 - 7. Actuators shall be Underwriters Laboratories Standard 873 listed.
 - 8. Actuators shall be designed for a minimum of 60,000 full stroke cycles at the actuator's rated torque.
- D. Control Valves
 - 1. Control valves shall be two-way or three-way type for two-position or modulating service as scheduled or shown.

- 2. Close-off (differential) Pressure Rating: Valve actuator and trim shall be furnished to provide the following minimum close-off pressure ratings:
 - a) Water Valves:
 - i. Two-way: 150% of total system (pump) head.
 - ii. Three-way: 300% of pressure differential between ports A and B at design flow or 100% of total system (pump) head.
 - b) Steam Valves: 150% of operating (inlet) pressure.
- 3. Water Valves:
 - a) Body and trim style and materials shall be per manufacturer's recommendations for design conditions and service shown, with equal percentage ports for modulating service.
 - b) Sizing Criteria:
 - i. Two-position service: Line size.
 - Two-way modulating service: Pressure drop shall be equal to twice the pressure drop through heat exchanger (load), 50% of the pressure difference between supply and return mains, or [5] psi, whichever is greater.
 - iii. Three-way Modulating Service: Pressure drop equal to twice the pressure drop through the coil exchanger (load), [5] psi maximum.
 - iv. Valves 1/2" through 2" shall be bronze body or cast brass ANSI Class 250, spring loaded, Teflon packing, quick opening for two-position service. Two-way valves to have replaceable composition disc, or stainless steel ball.
 - v. 2-1/2" valves and larger shall be cast iron ANSI Class 125 with guided plug and Teflon packing.
 - c) Water valves shall fail normally open or closed as scheduled on plans or as follows:
 - i. Heating coils in air handlers normally open.
 - ii. Chilled water control valves normally closed.
 - iii. Other applications as scheduled or as required by sequence of operation.
 - d) Zone valves shall be sized to meet the control application and they shall maintain their last position in the event of a power failure.
- 4. Steam Valves:
 - a) Body and trim materials shall be per manufacturer's recommendations for design conditions and service. Linear ports for modulating service.
 - b) Sizing Criteria:
 - i. Two-position service: pressure drop 10% to 20% of inlet psig.
 - ii. Modulating service 15 psig or less: pressure drop 80% of inlet psig.
 - iii. Modulating service 16 to 50 psig: pressure drop 50% of inlet psig.
 - iv. Modulating service over 50 psig: pressure drop as scheduled on plans.
- E. Binary Temperature Devices
 - 1. Low-Voltage Space Thermostats shall be 24 V, bimetal-operated, mercury-switch type, with either adjustable or fixed anticipation heater, concealed setpoint adjustment, 13°C-30°C (55°F-85°F) setpoint range, 1°C (2°F) maximum differential, and vented cover.
 - 2. Line-Voltage Space Thermostats shall be bimetal-actuated, open-contact type or bellows-actuated, enclosed, snap-switch type or equivalent solid-state type, with heat anticipator, UL listing for electrical rating, concealed setpoint adjustment, 13°C-30°C (55°F-85°F) setpoint range, 1°C (2°F) maximum differential, and vented cover.
 - Low-Limit airstream thermostats shall be UL listed, vapor pressure type. Element shall be at least 6 m (20 ft) long. Element shall sense temperature in each 30 cm (1 ft) section and shall respond to lowest sensed temperature. Low-limit thermostat shall be manual reset only.
- F. Temperature Sensors

- 1. Temperature sensors shall be Resistance Temperature Device (RTD) or Thermistor.
- 2. Duct sensors shall be rigid or averaging as shown. Averaging sensors shall be a minimum of 1.5m [5 feet] in length.
- 3. Immersion sensors shall be provided with a separable stainless steel well. Pressure rating of well is to be consistent with the system pressure in which it is to be installed.
- 4. Space sensors shall be equipped with set-point adjustment, override switch, display, and/or communication port as shown on the drawings.
- 5. Provide matched temperature sensors for differential temperature measurement. Differential accuracy shall be within 0.1 C [0.2 F].
- 6. Note: The drawings indicate a distinction between thermostats and temperature sensors. Thermostats to have a digital display, timed override and adjustability. Temperature sensors shall not have a digital display or user adjustability options.
- G. Humidity Sensors
 - 1. Duct and room sensors shall have a sensing range of 20% to 80% with accuracy of $\pm 5\%$ R.H.
 - 2. Duct sensors shall be provided with a sampling chamber.
 - Outdoor air humidity sensors shall have a sensing range of 20% to 95% R.H. It shall be suitable for ambient conditions of -40° C to 75° C [-40° F to 170° F].
 - 4. Humidity sensor's drift shall not exceed 1% of full scale per year.
- H. Static Pressure Sensors
 - 1. Sensor shall have linear output signal. Zero and span shall be field-adjustable.
 - 2. Sensor sensing elements shall withstand continuous operating conditions plus or minus 50% greater than calibrated span without damage.
 - Water pressure sensor shall have stainless steel diaphragm construction, proof pressure of 150 psi minimum. Sensor shall be complete with 4-20 mA output, required mounting brackets, and block and bleed valves. Mount in location accessible for service.
 - 4. Water differential pressure sensor shall have stainless steel diaphragm construction, proof pressure of 150 psi minimum. Over-range limit (DP) and maximum static pressure shall be 3,000 psi. Transmitter shall be complete with 4-20 mA output, required mounting brackets, and five-valve manifold. Mount in a location accessible for service.
- I. Low Limit Thermostats
 - 1. Safety low limit thermostats shall be vapor pressure type with an element 6m [20 ft] minimum length. Element shall respond to the lowest temperature sensed by any one foot section.
 - 2. Low limit shall be manual reset only.
- J. Carbon Dioxide (CO₂) Sensors
 - Carbon Dioxide sensors shall measure CO₂ in PPM in a range of 0-2000 ppm. Accuracy shall be +/-3% of reading with stability within 5% over 5 years. Sensors shall be duct or space mounted as indicated in the sequence of operation.
- K. Flow Switches
 - 1. Flow-proving switches shall be either paddle or differential pressure type, as shown.
 - Paddle type switches (water service only) shall be UL listed, SPDT snap-acting with pilot duty rating (125 VA minimum). Adjustable sensitivity with NEMA 1 Type enclosure unless otherwise specified.

- Differential pressure type switches (air or water service) shall be UL listed, SPDT snap-acting, pilot duty rated (125 VA minimum), NEMA 1 Type enclosure, with scale range and differential suitable for intended application, or as specified.
- 4. Current sensing relays may be used for flow sensing or terminal devices.
- L. Relays
 - 1. Control relays shall be UL listed plug-in type with dust cover. Contact rating, configuration, and coil voltage suitable for application.
 - 2. Time delay relays shall be UL listed solid-state plug-in type with adjustable time delay. Delay shall be adjustable plus or minus 200% (minimum) from set-point shown on plans. Contact rating, configuration, and coil voltage suitable for application. Provide NEMA 1 Type enclosure when not installed in local control panel.
- M. Transformers and Power Supplies
 - 1. Control transformers shall be UL listed, Class 2 current-limiting type, or shall be furnished with overcurrent protection in both primary and secondary circuits for Class 2 service.
 - 2. Unit output shall match the required output current and voltage requirements. Current output shall allow for a 50% safety factor. Output ripple shall be 3.0 mV maximum Peak-to-Peak. Regulation shall be 0.10% line and load combined, with 50 microsecond response time for 50% load changes. Unit shall have built-in over-voltage protection.
 - 3. Unit shall operate between 0° C and 50° C.
 - 4. Unit shall be UL recognized.
- N. Current Switches
 - 1. Current-operated switches shall be self-powered, solid state with adjustable trip current. The switches shall be selected to match the current of the application and output requirements of the DDC system.
- O. Local Control Panels
 - 1. All indoor control cabinets shall be fully enclosed NEMA 1 Type construction with hinged door, and removable sub-panels or electrical sub-assemblies.
 - 2. Interconnections between internal and face-mounted devices shall be pre-wired with color-coded stranded conductors neatly installed in plastic troughs and/or tie-wrapped. Terminals for field connections shall be UL listed for 600-volt service, individually identified per control/interlock drawings, with adequate clearance for field wiring. Control terminations for field connection shall be individually identified per control drawings.
 - 3. Provide on/off power switch with over-current protection for control power sources to each local panel.
- P. Centralized Air Quality Monitoring System

1.1 OVERVIEW

A. This document contains the specification and input/output summaries for a Facility Monitoring System (FMS). The system architecture shall utilize local room, duct and outside air probes networked to distributed Air Data Routers and Sensors Suites communicating over a data and air sampling network. The air sampling network shall consist of an air packet transportation network that shall transport air samples from the environment being monitored to distributed Sensor Suites located throughout the facility. The air sampling network shall consist of intelligent air packet routers, an electrically conductive MicroDuct[®] network, structured cable and where applicable OpitiNet[®] tubing. Gathering of air samples shall occur via room, duct mounted, and outside air sampling probes located as indicated in the documents.

1.2 DEFINITIONS

- A. **ADR** refers to the Aircuity Air Data Router
- B. BAS refers to the Building Automation System. (Similar terms are: EMS, Energy Management System; BMS, Building Management System; FMS, Facility Management System; or ATC, Automatic Temperature Control.)
- C. **FMC** refers to the Facility Monitoring System Contractor. The FMC is the Contractor responsible for the implementation of this Section of the Specifications
- D. **FMS** refers to the hardware, software and other components comprising the Facility Monitoring System as herein described
- A. I/O refers to Input/Output. Thus, "I/O device" means "Input/Output device"
- B. IMS refers to the Aircuity Information Management Server
- C. LACS refers to the Laboratory Airflow Control System
- D. **OSI** refers to the OptiNet Systems Integrator
- E. **PCM2** refers to a pump control module
- F. SST refers to the Aircuity Sensor Suite

PART 2 PRODUCTS

- 2.1 CONTRACTOR RESPONSIBILITIES:
 - A. The FMC shall furnish all necessary hardware, wiring, structured cable, tubing, computing equipment and software required to provide a complete and functional system necessary to perform the design intent and as defined in this specification.
 - B. Installation of all FMS components; and all electrical work required as an integral part of this section as noted in Part 3 Execution including but not limited to Sensor Suites, Air Data Routers, Room, Duct, and Outside Air Probes, Transformers, Vacuum Pumps, Information Management Servers, Structured Cable, and where applicable OpitiNet[®] tubing, etc., shall be by A QUALIFIED INSTRUMENTATION AND CONTROL FOR HVAC" CONTRACTOR
 - C. The owner accomplishes his own changeout of sensors. Provide full cost of 5 years of sensor replacements as part of the current contract with the owner accomplishing his own changing of the sensor.

2.2 SYSTEM REQUIREMENTS

- A. All material and equipment used shall be standard components, regularly manufactured and available by the manufacturer and not custom designed especially for this project. All systems and components, except site specific software, shall have previously been thoroughly tested and proven in actual use prior to installation on this project.
- B. The system shall have the ability to host multiple sensors for the purpose of simultaneously sensing multiple parameters from a single test area's environment.
- C. The system shall provide the end user the ability to select which environmental parameters will be sensed on a test area by test area basis.
- D. The system shall have the ability to make true differential measurements by utilizing the same suite of sensors to evaluate both the contaminant levels of a test area and the source of the ventilation air.
- E. The system shall have the ability to perform application specific computations using sensed contaminant levels for the purposes of generating ventilation command signals to be read by a BAS or LACS via hardwired outputs or BACnet over IP connections.
- F. The system shall have the ability to have third party data (i.e. total supply flow, total general exhaust flow, fume hood sash position, room/fume hood occupancy statuses, etc.) written to it by a BAS or LACS via

hardwired inputs or BACnet over IP connections for the purposes of generating analytical data and reports based of off actual system performance.

- G. system shall have the ability to have third party data (i.e. supply air flow, return air flow, occupancy statuses, etc.) written to it by a BAS via hardwired inputs or BACnet over IP connections for the purposes of generating analytical data and reports based of off actual system performance.
- H. The system architecture shall be fully modular permitting expansion of application software, system peripherals, and field hardware.
- I. The system, upon completion of the installation and prior to acceptance of the project, shall perform all operating functions as detailed in this specification.

2.3 EQUIPMENT

- A. System Hardware
 - 1. The FMC shall provide the following:
 - All Air Data Routers, Sensor Suites, Sensor Suite Sensors, Room, Duct, and Outside Air Probes, Information Management Servers, Vacuum Pumps, Structured Cable, OptiNet Tubing, Transformers and when required, an OptiNet Systems Integrator to perform the functions listed.
- B. System Software
 - 1. The FMC shall provide all software identified in this specification. The database required for implementation of these specifications shall be provided by the FMC, including point descriptors, test sequences, reports and point summaries. The FMC shall provide and create the system using the latest software release, at the time of Shop Drawing approval.
 - 2. The FMC shall provide a BACnet compatible integration server and software to interface with the facility's BAS. Communication shall be via BACnet over IP.
- C. Building Ethernet Connection Cabling:
 - 1. The controls contractor shall provide CAT-5e or CAT-6 network drops and cabling between the FMS Information Management Server and Final Building Ethernet Connection(s) shall be coordinated with the owner's IT Group.
- D. Both the FMS manufacturer and FMC shall have quality control procedures for design and manufacture of Facility Monitoring Systems for precision monitoring, indoor air quality, energy savings and preventative maintenance.
- E. The FMC shall provide all zone attribute data and programming and shall coordinate object naming conventions and network map requirements with the owner's internal BAS department. The naming convention shall be submitted with the FMC Shop Drawings for review and approval by owner's BAS department.

2.4 SYSTEM OVERVIEW

- 1. The purpose of the FMS is to establish with extreme precision the proper amount of ventilation needed based on analysis of the air within the facility for airborne contaminants. This analysis will involve precise comparison between air within any space being ventilated and the air being supplied to it, the air outside the building, or both as indicated in specific applications.
- 2. Data captured during the analysis and through the ventilation management process will be analyzed and formatted into a host of on screen displays, analytical reports, and analysis based notification of operational deficiencies. These analyses will encompass data sets gathered over time, and should not be confused with simple alarm notifications.
- A. AIR DATA ROUTERS

- 1. The Air Data Router shall be furnished as a complete, self contained, unit housing all electronics, air solenoid valves, sampling manifolds, firmware, and software. Unit shall be furnished with all internal devices and wiring assembled and tested at the factory.
- 2. The Air Data Router shall feature backbone connections capable of accepting OptiNet Structured Cable for the purpose of daisy chaining all ADRs. OptiNet tubing shall not be used to daisy chain ADRs.
- 3. Air Data Routers shall receive commands from the Sensor Suite to open the solenoid valve of each test area to be monitored while simultaneously closing all other solenoid valves in the system. A direct path between the test area being sampled and the virtual sensors located with the Sensor Suite shall be established to draw a continuous stream of air through the OSC and/or OptiNet Tubing.
- 4. Air Data Routers shall consist of an enclosure; terminations areas for both field wiring and Structured Cable or, with the provision of enlarger fittings (catalog number OT-E11), OptiNet Tubing connections; a communications/processor board; high capacity solenoid valves; and sampling manifold.
- 5. Air Data Router shall have the ability to interface to either the FMS Structured Cable or OptiNet Tubing. Air Data Router shall utilize an internal, factory pre-assembled air sampling manifold to interface to the on-board solenoid valves, and push to connect speed fittings for ease of interface to the Structured Cable or, with the provision of enlarger fittings (catalog number OT-E11), OptiNet Tubing. Romex connectors and knockouts shall be factory furnished and installed on the Router.
- 6. Air Data Routers shall be capable of sampling of up to four zones. Air Data Routers shall be sized and configured with the appropriate number of zones noted on the plans and/or specifications.
 - a) Air Data router shall be capable of accepting universal 0–10Vdc or 4–20mA inputs and outputs through expansion boards for interfacing to other third party devices and controllers.
- 7. Up to 30 Air Data Routers shall communicate on an isolated RS-485 network with the Sensor Suite.
- 8. All point data, algorithms and application software within the Air Data Routers shall be programmable from the Information Management Server. Each Air Data Router shall contain both software and firmware to receive and perform full test sequencing schemes downloaded from the Server.
- 9. Each Air Data Router shall contain a serial port for the interface with a portable computer. Air Data Router and network integration shall be possible through this port.
- 10. Air Data Routers shall be capable of proper operation in an ambient temperature environment of 40 degrees F to 120 degrees F (4.4°–49°C), 0–90% RH (non-condensing).
- 11. Air Data Routers shall have LED indication for visual status of communication and power.
- 12. Air Data Routers shall operate on 24Vac power fed from a common 120/24Vac transformer. Low voltage power shall be distributed to the Air Data Routers through the associated structured cable or tubing.

B. SENSOR SUITE

- 1. The Sensor Suite shall be a distributed, network based, multipoint sensing device. The Sensor Suite shall be furnished as a complete, self contained unit housing all electronics, sensing card cage, sampling manifolds, flow regulators, pressure regulators, firmware, and software.
- 2. The Sensor Suite shall provide communications between the Air Data Router sub network and the Information Management Server over an isolated RS-485 network. The Sensor Suite shall support communications with a sub network of 30 Air Data Routers; 30 other Sensor Suites, and an Information Management Server.
- 3. The Sensor Suite base unit shall consist of an enclosure; hinged door with keyed lock; terminations

area for both field wiring and Structured Cable subnet connections for limb A and B; a communications/processor board; electronic flow measurement and controller assembly; and sensor bay.

4. The Sensor Suite shall utilize a card cage to allow for the ease of selection and installation of a diverse array of environmental and specialty sensors. At a minimum, the Sensor Suite shall incorporate the following sensors to meet the required applications:

Element	Dual Wavelength, Non-Dispersive Infrared Sensor
Range	0-3000 ppm
Accuracy	\pm 75 ppm up to 1000 ppm
Repeatability	± 9 ppm
Resolution	3 ppm
Response	10 seconds

- 5. The Sensor Suite shall have the ability to "multitask" by concurrently drawing an air sample from one limb while sensing the parameters of the air sample in the other limb.
- 6. The Sensor Suite shall be modular in nature, and allow for the addition and removal of the sensors for application specific sensing requirements, and ease of calibration and service.
- 7. The Sensor Suite shall house an on-board flow regulator, orifice plate, and differential pressure sensor to maintain a continuous, regulated flow rate through the Structured Cable.
- 8. On-board diagnostics shall continuously perform system checks.
- 9. The Sensor Suite will continuously monitor atmospheric pressure and compensate sensor outputs accordingly as the atmospheric pressure changes.
- 10. Each Sensor Suite shall contain a serial port for the interface with a portable computer. Sensor Suite and network integration shall be possible through this port.
- 11. Sensor Suites shall be capable of proper operation in an ambient temperature environment of 40 degrees F to 120 degrees F (4.4°–49°C), 0–90% RH (non-condensing).
- 12. Sensor Suites shall have LED indication for visual status of communication and power.
- 13. Sensor Suites shall operate on 24Vac power fed from a common 120/24Vac transformer connected to the Sensor Suite provided by the FMC.
- 14. To mitigate the potential for Sensor Suite failure, the Sensor Suite shall not be mounted to the same support structure as the vacuum pumps.

C. HIGH FLOW VACUUM PUMP

- 1. EACH Sensor Suite will be equipped with a High Flow Vacuum Pump (HFP) that will draw samples from the sampling ports in the system, through the Sensor Suite, and then discharge them. Samples will be discharged into the pump room
- 2. EACH Sensor Suite will be provided with a Pump Control Module (PCM2) card for monitoring system vacuum pressure and, for systems featuring dual pump systems, controlling automatic pump switchover upon primary pump failure.
- 3. The HFP will meet the following specifications:
 - a) Minimum Vacuum Pressure: -8.5 PSIg
 - b) Minimum Flow Rate: 29 LPM (1.02 SCFM)

- 4. Pump mounting: Pump shall be mounted securely using the factory supplied mounting assembly to prevent it from moving due to vibration, and in a location where the sound of the pump will not be heard outside the immediate area. The pump mounting assembly shall not be secured to the same structure as the IMS or Sensor Suite.
- 5. Standby pump with automatic switchover: Provides a second pump, identical to the first, with an automatic switchover controller that will automatically take over should the on-line pump stop for any reason other than a complete failure of all local AC power. In the event this occurs, or if some other event occurs resulting in a loss of vacuum at the SST, the standby pump will be placed in operation and a notification will be sent to the Aircuity remote data center, notifying customer support that the backup pump is in operation, prompting a field visit. At any point, if there is a sustained loss of vacuum at the SST, a notification will be sent to the Aircuity remote data center, and all BACnet points whose integrity is affected by the loss of vacuum condition will be marked as "unreliable", which can be observed by the BMS, so that they can respond accordingly. The notification will be reset once the loss of vacuum condition is remedied.

D. INFORMATION MANAGEMENT SERVER

- 1. The Information Management Server (Server) shall provide network management of Sensor Suites, integration to the BAS, and interface to the web based Aircuity Knowledge Center for viewing and outputting graphs, charts and data derived from the Ventilation Management System.
- 2. The hardware platform for the Server shall, at a minimum, consist of:
 - a. PC processor with minimum 64-bit word structure.
 - b. Minimum 1.86 GHz processor speed.
 - c. Minimum 2GB on board RAM
 - d. Hard drive or equal high-speed data storage, minimum 250 gigabytes.
 - e. Two (2) Gigabit LAN connections: (10/100)
 - f. Dual RS-232 Serial Ports
 - g. Operating System shall be Windows 7.
- 3. Information Management Server includes an Uninterruptable Power Supply capable of sustaining the IMS power for a minimum of 5 minutes to accommodate cycling from normal to emergency power and back.
- 4. The controls contractor shall provide CAT-5e or CAT-6 network drops and cabling between the FMS Information Management Server and:
 - a. The owner's Building Ethernet Network to serve as the path to the offsite archival and analysis system (the Aircuity Knowledge Center)
 - b. The owner's BACnet communications network (if different from the above) to serve as the connection to the BAS.
 - c. Final Building Ethernet Connection shall be coordinated with the owner's IT Group.
- 5. The Server shall be located within 25 feet of the nearest Sensor Suite and be connected to the Server through the RS-232 serial port.
- 6. To mitigate the potential for hard drive failure, the IMS shall not be mounted to the same support structure as the vacuum pumps.

E. STRUCTURED CABLE

- 1. The FMS shall utilize a pre-engineered system of Structured Cable to facilitate network wide communications, distribution of low voltage power to Air Data Routers and Sensor Suites, and provide a sampling conduit for air samples all within a single cable.
- 2. The cable shall contain the necessary wires to distribute communications, data and low voltage power

throughout the FMS. As a minimum, Structured cable shall consist of:

- a) Communications 22 AWG twisted shield pair with drain wire
- b) Low Voltage Power 18 AWG, 3 wire
- 3. An inner pathway, MicroDuct, shall be furnished as an integral part of the Structured Cable to facilitate collection of zone air samples. MicroDuct shall be lined with a smooth, electrically conductive, chemically inert surface to insure air samples remain pure and uncorrupted and do not adhere to the wall lining during transport. Aircuity OSC or stainless steel tubing only. No exceptions. Polyethylene tubing, copper tubing, galvanized pipe are not acceptable. See below for stainless steel specifications.
- 4. Structured cable shall not require any specialized tools for installation. Installation of the cable shall follow traditional local area network practices.
- F. OPTINET TUBING
 - 1. The FMS shall utilize a pre-engineered system of OptiNet Tubing to provide a low cost sampling conduit for air samples when the only contaminants of concern are carbon dioxide (CO2).
 - 2. OptiNet Tubing shall be 3/8" O.D. (1/4" I.D.), dimensionally stable and shall conform to NFPA 90A flame and smoke spread indices for return air plenum installations.
 - 3. OptiNet Tubing shall not require any specialized tools for installation. Installation of the tubing shall follow traditional local area network practices.
 - 4. OptiNet Tubing shall require the use of enlarger fittings (catalog number OT-E11) for all OptiNet Tubing connections made to ADRs and duct probes. Enlarger fittings shall not be required for connecting OptiNet Tubing to Room Sensors.
 - 5. The minimum length of tubing run between an ADR test area connection and an end device shall be no shorter than 20 feet.
 - a) Dedicated wiring specifically used for the FMS consisting of a minimum of:
 - 1) Communications 22 AWG twisted shield pair with drain wire
 - 2) Low Voltage Power 18 AWG, 3 wire

G. ROOM, DUCT, and OUTSIDE AIR PROBES

- 1. Room Sensors:
 - a. A semi-flush mounted, sampling port with an optional integral temperature sensor housed within one enclosure; the port within the enclosure will accept the MicroDuct from the Structured Cable or OptiNet Tubing (for CO2/CO only applications).
 - b. Temperature Sensing Element:
 - 1) Thermistor: range 30–120°F (-1–49°C) Accuracy: ± 0.75 °F (± .42 °C)
 - Platinum RTD: range -30–130°F (-34–54°C) Accuracy: ± 0.30 °F (± .17°C)
 - c. Internal coarse filter to screen out large particulate matter from entering the MicroDuct.
 - d. Option to provide CO2 monitoring only shall be permitted
- 2. Duct Probe Duct and Outdoor Air Mount
 - a. A duct temperature sensor and air sample probe is to be mounted within one enclosure. Duct sample probe to accept integral MicroDuct from Structured Cable or, with the provision of an additional enlarger fitting (catalog number OT-E11), OptiNet Tubing (for CO2/CO only applications).

- b. Temperature Sensing Element:
 - Platinum RTD: range -30–130°F (-34–54°C) Accuracy: ± .30 °F (± .17°C)
- c. Internal coarse filter to screen out large particulate matter from entering the MicroDuct.
- d. Outdoor Air Locations A NEMA 4X weatherproof enclosure shall be provided.
- e. Option to provide CO2 monitoring only shall be permitted
- 3. Outside Air Probe
 - a. A duct temperature sensor and air sample probe is to be mounted within one enclosure. Duct sample probe to accept integral MicroDuct from Structured Cable or, with the provision of an additional enlarger fitting (catalog number OT-E11), OptiNet Tubing (for CO2/CO only applications). Temperature Sensing Element:
 - Platinum RTD: range -30–130°F (-34–54°C) Accuracy: ± .30 °F (± .17°C)
 - b. Internal coarse filter to screen out large particulate matter from entering the MicroDuct.
 - c. NEMA 4X Weatherproof enclosure
 - d. Probe is to be mounted in a location where it will not be exposed to direct sunlight.
 - e. Option to provide CO2 monitoring only shall be permitted
- H. Sensors:
 - 1. Sensors are the property of Aircuity whose warranty is covered under the OptiNet Assurance Services contract agreement.
 - 2. Sensors shall be installed in a listed enclosure (the Sensor Suite) in a climate controlled environment which is maintained between 40°F–120°F and 0–90% RH (non-condensing).
 - 3. Quality of sensors: All sensors shall possess the properties published in section 2.5-B.4 of this specification. For each set of installed sensors a certificate of calibration shall be made available for viewing on each project's web based Aircuity Advisor Services portal.
 - 4. Sensors shall be physically removed from the sensor suite, and replaced with recalibrated sensors a minimum of every 6 months after the initial sensor installation.
 - 5. Immediately after replacement, sensors are to be shipped back to Aircuity in the postage paid return box provided by Aircuity.

2.6 SYSTEM SOFTWARE OVERVIEW

- A. The FMC shall provide all software required for configuration, operation and commissioning of the FMS system specified herein. All functionality described herein shall be regarded as a minimum. The FMC shall provide the following as a minimum:
 - 1. Completed database.
 - 2. Configuration of all Air Data Router, Sensor Suite, Server and user interface application programs.
 - 3. All Configuration Tools, and all software licenses, required to configure and operate all products installed on this project.
 - 4. The ability to override raw sensed data for the purposes of commissioning the system after integration with a BMS.
- B. SYSTEM CONFIGURATION

1. Database Creation and Modification. All changes shall be done utilizing standard procedures. The system shall allow changes to be made at the local site through the Information Management Server.

C. WEB BASED USER INTERFACE AND DATA MANAGEMENT SYSTEM

- 1. Included with the system shall be a fully integrated web based user interface and data management system. The data management system shall be password protected and shall be able to store sampled data from all zones for online viewing and reporting.
- 2. The data management system will be sized to record and retain every sample taken by the system, along with other data gathered from other systems or direct interface points, for a minimum of 20 years. Systems that retain only a portion of the archived data in an active data base and require accessing older data via a separate archive are not acceptable.
- 3. Unlimited data access, viewing, report generation and remote data storage shall be provided with the FMS for the duration of the project commissioning and for the entire warranty period.

D. SAMPLE SEQUENCING

- 1. The system shall allow the trained technician to designate any zone to be scheduled through the Information Management Server.
- 2. The trained technician shall be able to make all schedule additions, modifications and deletions to the sample schedules. The trained technician shall have the capability to edit all schedules and then download any or all schedule changes to the FMS.

2.7 SUBMITTALS

- A. As soon as Submittals are prepared, an electronic version shall be provided simultaneously with the mailing of the paper copies. This version shall be transmitted in electronic format, via e-mail, to expedite the approval process.
- B. Shop Drawings shall include:
 - 1. Index: The first sheet of the Shop Drawings shall be an Index of all sheets in the set.
 - 2. Legend: A description of symbols and acronyms used shall be provided at the beginning of the set of Shop Drawings.
 - 3. Communications Riser: A single-page diagram depicting the system architecture complete with a communications riser. Riser shall include room locations and addressing for each Air Data Router and Sensor Suite. Include a Bill of Material for all equipment in this diagram but not included with the unique controlled systems.
 - 4. Device Addressing Scheme: Install controllers implementing an addressing scheme consistent with a reference-document. The addressing scheme shall be submitted, reviewed and approved by the owner's BAS Group prior to implementation.
 - 5. Equipment Numbering: Equipment numbering scheme shall be submitted, reviewed and approved by the owner's BAS Group prior to implementation.
 - 6. Systems Summary: Drawings shall include a table listing each piece of equipment and the area(s) served by each piece of equipment.
 - 7. System Schematic: Drawings shall include a single-line representation of all areas being monitored and/or controlled, including all field devices required for properly controlling equipment and implementing the sequences of operation for this project.
 - 8. Point-to-point Wiring Details: Drawings shall include point-to-point wiring details and must show all field devices, routers, sensor suites, controllers, panel devices, wiring terminal numbers and any special information (i.e. shielding requirements) for properly monitoring areas and controlling equipment.

- 9. Bill of Material: Drawings shall include a bill of the material necessary and used for properly controlling equipment and implementing the required sequences of operation.
- 10. Configuration Details: Drawings shall include test and cluster sequence schedules for each test point.
- 11. As-Built Drawings and documentation shall be created after the final system checkout, by modifying and adding to the Shop Drawings and completing the OptiNet system vacuum decay worksheet. As-Built Drawings shall show exact installation locations of equipment as well as indicate installed cable paths and lengths. As-Built Drawings will be acknowledged in writing by the project design engineer and the owner's representative after the final checkout of the system. The system will not be considered complete until the As-Built Drawings have received their final approval. The FMC shall provide four sets of As-Built Drawings.
- C. Operation and Maintenance Manuals
 - 1. Operation and Maintenance (O&M) manuals for the system shall include project specific, detailed information describing the specific installation. Manual shall contain as a minimum:
 - a) System overview
 - b) Networking architecture
 - c) Hardware cut-sheets and product descriptions
 - d) Wiring diagrams for all controllers and field hardware

2.8 WARRANTY

A. Repair or replace any defective product and correct any defect in material or workmanship for a period of 12 months following substantial completion.

2.9 ANNUAL SERVICES AGREEMENT

- A. At the time of sensors are shipped from the factory as described later in this specification, the FMC will transmit an agreement for annual services to the owner marked "PAID IN FULL" that will provide material only for all maintenance and calibration of system for a period of **3** years. Manufacturer to provide training for complete maintenance and calibration of system for three individuals on owner's staff. One individual to receive full factory certification training to maintain and service their system. At a minimum, twice a year, provide calibrated sensors for switch out by owner. This service shall include, but not be limited to the following:
 - a. Provide a factory certified pre-packaged, certified, industry traceable, factory calibrated sensors for swap out by owner. Removed sensors shall be returned to the manufacturer by owner for factory recalibration, internal cleaning, upgrades, sensor element replacement, and component and board repairs.
 - b. All costs for the repair and replacement of any defective sensor, and for any consumable element or part on the sensor shall be included. Owner to be trained to troubleshoot and replace defective elements.
 - c. Firmware upgrades to correct bugs, fixes and patches for the sensors shall be provided to the owner for his installation.

PART 3 EXECUTION

- 3.1 GENERAL
 - A. Install all equipment and systems specified herein in accordance with the manufacturer's most current version of the installation guide. In the event of conflicting information between this document and the installation guide, the most stringent requirement shall apply.
 - B. Verify that mechanical and control systems are complete and ensure that the systems are capable of being started and operated in a safe and normal condition before attempting to operate the FMS.

- C. Install software in the Management Server. Implement all features of programs to specified requirements and as appropriate for sequence of operation.
- D. Connect and configure equipment and software to achieve sequence of operation specified.

3.2 FIELD DEVICE INSTALLATION

- A. All room probes shall be mounted so as to be accessible in accordance with ADA Guidelines, unless otherwise noted on the drawings.
- B. Freestanding enclosures and panels shall be supported on steel unistrut frames, or approved equal, and be securely anchored to the floor and be well braced.
- C. Enclosures and panels mounted directly to the wall shall be provided with all clearances required by the manufacturer's installation guide.
- D. A minimum of 3' working clearance shall be provided in front of all enclosures and panels; clearance shall be ensured to permit the enclosure door to open at least 90° from its closed position.
- E. Mounting height shall be a maximum 6'-6" to the top of the Sensor Suite enclosure.
- F. All field devices shall be installed in a location which is easily accessible after installation for the purposes of troubleshooting & future modifications.
- G. IMSs and SSTs shall not be installed on the same support structure or wall as the vacuum pump bracket.
- 3.3 CONTROL POWER
 - A. Class 2 step-down transformers shall provide 24VAC power for all Air Data Routers, Sensor Suites, and associated FMS components from nearest electrical power panel noted below or as indicated on the electrical drawings—coordinate the installation and location thereof with Electrical Contractor and all other trades.
 - 1. The primary side of all Class 2 step-down transformers shall be fed by dedicated branch circuits with grounding conductors from the nearest building electrical distribution power panel. Branch circuits shall be installed per local state and federal codes by a licensed electrician.
 - 2. The secondary side of all class 2 step-down transformers, used for the purposes of providing power to Air Data Routers, Sensor Suites and associated FMS components, shall not be grounded.
 - 3. The IMS and OSI (if applicable) shall be powered from the battery backup side of the UPS shipped with every IMS. The UPS shall be powered from a 120VAC dedicated power receptacle installed per local state and federal codes by a licensed electrician.
 - 4. Where applicable, all FMS equipment shall be powered by the same source of emergency power as the air handling units and BAS themselves. For example, if the Air Handling units are served by the building's generators, the FMS must also be served by the generators.

3.4 FINAL INSTALLATION OF CRITICAL SENSORS

- A. Sensors will be held at the manufacturer's location and not shipped to the site until checkout & startup of the all other portions of the FMS is complete, and mechanical systems are operational and ready to implement the sequences that will result in ventilation being performed on demand as indicated by the FMS.
- B. At the time sensors are shipped the Annual Services Agreement marked PAID IN FULL described above will be transmitted to the owner.

3.5 ACCEPTANCE OF COMPLETED FMS INSTALLATION

- A. Upon completion of the installation, the FMC shall start up the system and perform all necessary calibration, testing, and debugging operations including, but not limited to, the vacuum decay test. An acceptance test shall be performed by the FMC in the presence of the design engineer, job site project manager, and owner's representative. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections.
- B. After electrical circuitry has been energized, start units to confirm proper unit operation. Remove malfunctioning units, replace with new units, and retest.
- C. Demonstrate compliance with specifications, including calibration and testing, and air sampling test sequences. Adjust, calibrate, and fine tune equipment to achieve sequence of operation specified.
- D. The acceptance test shall include, but not be limited to:
 - 1. The FMC shall verify the proper operation of all input/outputs.
 - 2. The FMC shall verify all inputs meet or exceed manufacturer's stated tolerances for accuracy.
 - 3. The FMC shall verify that all on-line graphical displays of air sampling test data accurately represent the real time state of the field conditions.
 - 4. The FMC shall verify the reliability of all communications of all Air Data Routers and Sensor Suites.
 - 5. The test shall include functional verification of all interfaces and system integration required to meet the scope of this project.
 - 6. Participation in a joint session with the BAS contractor to demonstrate that the complete sequence of operation is being executed accordingly.
- E. Acceptance: When the field test procedures have been successfully demonstrated to the design engineer, job site project manager, or owner's representative and the system performance is deemed satisfactory, the system parts will be accepted for beneficial use and placed under warranty. At this time, a "notice of completion" shall be issued by the owner's representative and the warranty period shall start.

3.6 TRAINING

- A. The FMC shall provide factory-trained instructor to give full instructions to designated personnel in the operation, maintenance, and programming of the system. Instructors shall be thoroughly familiar with all aspects of the subject matter they are to teach. The training shall be specifically oriented to the system and interfacing equipment installed.
- B. Instructions shall include 2 parts, the "New Equipment Orientation" and the "Product & Service Training".
- C. New Equipment Orientation: A "walk-through" session shall include showing where all field equipment is located throughout the area involved in the project.
- D. Product & Service Training: Train on-site personnel on the navigation and interpretation of the data and information provided by the system.
 - 1. Train personnel on procedures and schedules for troubleshooting, servicing, and maintaining equipment.
 - 2. Provide operator training on modification of data display, zone descriptors, executing commands, resetting default values, and requesting reports.

FACILITY MONITORING SYSTEM INTERFACE

A. The building will be equipped with a Facility Monitoring System (FMS) as specified in other sections of

these specifications. The purpose of the system is to analyze key elements of the indoor environment and to provide direction to the mechanical systems via the BAS. Directions to be achieved shall be accomplished by monitoring and analysis of airborne parameters such as particulates, volatile organic compounds (VOCs), moisture content, gases such as carbon monoxide and carbon dioxide (CO, CO2), and others as indicated in the FMS specification. As a result of this analysis the FMS will provide the BAS with changes in operational parameters, most significantly airflow rates. The system will also provide analysis of how the indoor environment responds as a result of the mechanical system modes of operation, and provide optional performance reports and other data to building management.

- B. BAS CONTRACTOR'S RESPONSIBILITY: The BAS contractor shall be required to implement an interface between the BAS and the FMS which shall communicate with the BAS via BACnet. The BAS contractor shall be responsible for:
 - 1. Obtaining and reading the most current copy of Aircuity's Protocol Implementation Conformance Statement (PICS).
 - 2. Entering the FMS in the BAS so it is a recognized component in the BAS, by providing a unique BACnet Device Object Instance Number, and fixed IP Address.
 - 3. Entering the necessary data points in the BAS data base. These data points and their associated properties (present value, units, reliability, etc) shall be read from the FMS and serve as data values to be used as input points in the building control systems for values such as minimum outside air levels, overall ventilation rates, humidity levels, and others as indicated in the specification or on the drawings at a rate of once a minute.
 - 4. Implementing the necessary control sequences to respond to the directions from the FMS. The BAS shall be responsible for prioritizing all command signals so that life safety control functions (such as smoke control) are not overruled by Aircuity's recommended ventilation command signal.
 - 5. Provide qualified on-site staff during start up of the FMS to insure that communication is functional, that data values are received from the FMS, that control BAS sequences as a result of this data are implemented properly and effectively, and that necessary data is transmitted to the FMS.
 - 6. The BAS contractor shall communicate, in writing, to the FMS contractor the required formats of all airflow command signals generated by the FMS (i.e. BAS requires all ventilation commands to be in units of CFM)

PART 3: EXECUTION

3.0 SECTION INCLUDES:

- .1 Examination
- .2 Protection
- .3 General Workmanship
- .4 Field Quality Control
- .5 Wiring
- .6 Fiber Optic Cable
- .7 Installation of Sensors
- .8 Flow Switch Installation
- .9 Actuators
- .10 Warning Labels
- .11 Identification of Hardware and Wiring
- .12 Controllers
- .13 Programming

- .14 Cleaning
- .15 Training
- .16 Acceptance

3.1 EXAMINATION

- A. The project plans shall be thoroughly examined for control device and equipment locations, and any discrepancies, conflicts, or omissions shall be reported to the Architect/Engineer for resolution before rough-in work is started.
- B. The contractor shall inspect the site to verify that equipment is installable as shown, and any discrepancies, conflicts, or omissions shall be reported to the Architect/Engineer for resolution before rough-in work is started.
- C. Contractor shall provide a Site Assessment Report that provides information about the feasibility of the Customer's existing IT and Building Automation System infrastructure to support the enterprise-wide system capabilities.

3.2 PROTECTION

- A. The Contractor shall protect all work and material from damage by his/her work or workers, and shall be liable for all damage thus caused.
- B. The Contractor shall be responsible for his/her work and equipment until finally inspected, tested, and accepted. The Contractor shall protect his/her work against theft or damage, and shall carefully store material and equipment received on site that is not immediately installed. The Contractor shall close all open ends of work with temporary covers or plugs during storage and construction to prevent entry of foreign objects.

3.3 GENERAL WORKMANSHIP

- A. Install equipment, piping, wiring/conduit parallel to building lines (i.e. horizontal, vertical, and parallel to walls) wherever possible.
- B. Provide sufficient slack and flexible connections to allow for vibration of piping and equipment.
- C. Install all equipment in readily accessible location as defined by chapter 1 article 100 part A of the NEC. Control panels shall be attached to structural walls unless mounted in equipment enclosure specifically designed for that purpose. Panels shall be mounted to allow for unobstructed access for service.
- D. Verify integrity of all wiring to ensure continuity and freedom from shorts and grounds.
- E. All equipment, installation, and wiring shall comply with acceptable industry specifications and standards for performance, reliability, and compatibility and be executed in strict adherence to local codes and standard practices.
- 3.4 FIELD QUALITY CONTROL
- A. All work, materials and equipment shall comply with the rules and regulations of applicable local, state, and federal codes and ordinances as identified in Part 1 of this Section.
- B. Contractor shall continually monitor the field installation for code compliance and quality of workmanship. All visible piping and or wiring runs shall be installed parallel to building lines and properly supported.
- C. Contractor shall arrange for field inspections by local and/or state authorities having jurisdiction over the work.
3.5 CENTRAL SERVER INSTALLATION

- A. The controls contractor shall perform complete installation and configuration of the following:
 - 1. Server hardware
 - 2. Server operating system
 - 3. Server database software
 - 4. Server application software

3.6 WIRING

- A. All control and interlock wiring shall comply with the national and local electrical codes and Division 16 of these specifications. Where the requirements of this section differ with those in Division 16, the requirements of this section shall take precedence.
- B. Where Class 2 wires are in concealed and accessible locations including ceiling return air plenums, approved cables not in raceway may be used provided that circuits meet NEC Class 2 (current-limited) requirements. (Low-voltage power circuits shall be sub-fused when required to meet Class 2 current-limit.)
- C. All cables shall be UL listed for application, i.e., cables used in ceiling plenums shall be UL listed specifically for that purpose.
- D. Do not install Class 2 wiring in conduit containing Class 1 wiring. Boxes and panels containing high voltage may not be used for low voltage wiring except for the purpose of interfacing the two (e.g. relays and transformers).
- E. Where class 2 wiring is run exposed, wiring shall be run parallel along a surface or perpendicular to it, and bundled, using approved wire ties at no greater than 3 m [10 ft] intervals. Such bundled cable shall be fastened to the structure, using specified fasteners, at 1.5 m [5 ft] intervals or more often to achieve a neat and workmanlike result.
- F. All wire-to-device connections shall be made at a terminal blocks or terminal strip. All wire-to wire connections shall be at a terminal block, or with a crimped connector. All wiring within enclosures shall be neatly bundled and anchored to permit access and prevent restriction to devices and terminals.
- G. Maximum allowable voltage for control wiring shall be 120V. If only higher voltages are available, the Control System Contractor shall provide step down transformers.
- H. All wiring shall be installed as continuous lengths, where possible. Any required splices shall be made only within an approved junction box or other approved protective device.
- I. Install plenum wiring in sleeves where it passes through walls and floors. Maintain fire rating at all penetrations in accordance with other sections of this specification and local codes.
- J. Size of conduit and size and type of wire shall be the design responsibility of the Control System Contractor, in keeping with the manufacturer's recommendation and NEC.
- K. Control and status relays are to be located in designated enclosures only. These relays may also be located within packaged equipment control panel enclosures. These relays shall not be located within Class 1 starter enclosures.
- L. Follow manufacturer's installation recommendations for all communication and network cabling. Network or communication cabling shall be run separately from other wiring.
- M. Adhere to Division 16 requirements for installation of raceway.

- N. This Contractor shall terminate all control and/or interlock wiring and shall maintain updated (as-built) wiring diagrams with terminations identified at the job site.
- O. Flexible metal conduits and liquid-tight, flexible metal conduits shall not exceed 3' in length and shall be supported at each end. Flexible metal conduit less than 1/2" electrical trade size shall not be used. In areas exposed to moisture, including chiller and boiler rooms, liquid-tight, flexible metal conduits shall be used.
- 3.7 FIBER OPTIC CABLE SYSTEM
- A. All cabling shall be installed in a neat and workmanlike manner. Minimum cable and unjacketed fiber bend radii as specified by cable manufacturer shall be maintained.
- B. Maximum pulling tensions as specified by the cable manufacturer shall not be exceeded during installation. Post installation residual cable tension shall be within cable manufacture's specifications.
- C. Fiber optic cabinets, hardware, and cable entering the cabinet shall be installed in accordance with manufacturers' instructions. Minimum cable and unjacketed fiber bend radii as specified by cable manufacturer shall be maintained.

3.8 INSTALLATION OF SENSORS

- A. Install sensors in accordance with the manufacturer's recommendations.
- B. Mount sensors rigidly and adequate for the environment within which the sensor operates.
- C. Room temperature sensors shall be installed on concealed junction boxes properly supported by the wall framing.
- D. All wires attached to sensors shall be air sealed in their conduits or in the wall to stop air transmitted from other areas affecting sensor readings.
- E. Install duct static pressure tap with tube end facing directly down-stream of air flow.
- F. Sensors used in mixing plenums, and hot and cold decks shall be of the averaging type. Averaging sensors shall be installed in a serpentine manner horizontally across duct. Each bend shall be supported with a capillary clip.
- G. All pipe mounted temperature sensors shall be installed in wells. Install all liquid temperature sensors with heat conducting fluid in thermal wells.
- H. Wiring for space sensors shall be concealed in building walls. EMT conduit is acceptable within mechanical and service rooms.
- I. Install outdoor air temperature sensors on north wall complete with sun shield at designated location.

3.9 FLOW SWITCH INSTALLATION

- A. Use correct paddle for pipe diameter.
- B. Install and adjust flow switch in accordance with manufacturers' instructions.
- C. Assure correct flow direction and alignment.
- D. Mount in horizontal piping flow switch on top of the pipe.

CONTROLS – DIRECT DIGITAL

3.10ACTUATORS

- A. Mount and link control damper actuators per manufacturer's instructions.
 - 1. To compress seals when spring return actuators are used on normally closed dampers, power actuator to approximately 5 degrees open position, manually close the damper, and then tighten the linkage.
 - 2. Check operation of damper/actuator combination to confirm that actuator modulates damper smoothly throughout stroke to both open and closed positions.
 - 3. Valves Actuators shall be mounted on valves with adapters approved by the actuator manufacturer. Actuators and adapters shall be mounted following manufacturer's recommendations.

3.11 WARNING LABELS

IDENTIFICATION OF HARDWARE AND WIRING

- A. All wiring and cabling, including that within factory-fabricated panels, shall be labeled at each end within 2" of termination with a cable identifier and other descriptive information.
- B. Permanently label or code each point of field terminal strips to show the instrument or item served.
- C. Identify control panels with minimum 1 cm (1/2") letters on nameplates.
- D. Identify all other control components with permanent labels. Identifiers shall match record documents. All plug-in components shall be labeled such that removal of the component does not remove the label.

3.12CONTROLLERS

- A. Provide a separate Controller for each major piece of HVAC equipment. A custom application controller may control more than one system provided that all points associated with that system are assigned to the same controller. Points used for control loop reset such as outside air or space temperature are exempt from this requirement.
- B. Building Controllers and Custom Application Controllers shall be selected to provide a minimum of 15% spare I/O point capacity for each point type found at each location. If input points are not universal, 15% of each type is required. If outputs are not universal, 15% of each type is required. A minimum of one spare is required for each type of point used.
 - 1. Future use of spare capacity shall require providing the field device, field wiring, points database definition, and custom software. No additional Controller boards or point modules shall be required to implement use of these spare points.

3.13PROGRAMMING

- A. Provide sufficient internal memory for the specified control sequences and trend logging. There shall be a minimum of 25% of available memory in building controllers free for future use.
- B. Point Naming: System point names shall be modular in design, allowing easy operator interface without the use of a written point index.
- C. Software Programming
 - 1. Provide programming for the system as written in the specifications and adhere to the sequence strategies provided. All other system programming necessary for the operation of the system but not specified in this document shall also be provided by the Control System Contractor. Imbed

into any custom-written control programs sufficient comment statements or inherent flow diagrams to clearly describe each section of the program. The comment statements shall reflect the language used in the sequence of operations.

- D. Operators' Interface
 - 1. Standard Graphics. Provide graphics for each major piece of equipment and floor plan in the building. This includes each Chiller, Air Handler, VAV Terminal, Fan Coil, Boiler, and Cooling Tower. These standard graphics shall show all points dynamically as specified in the points list.
 - 2. The controls contractor shall provide all the labor necessary to install, initialize, start-up, and troubleshoot all operator interface software and their functions as described in this section. This includes any operating system software, the operator interface database, and any third party software installation and integration required for successful operation of the operator interface.
- E. Demonstration: A complete demonstration and readout of the capabilities of the monitoring and control system shall be performed. The contractor shall dedicate a minimum of 8 hours on-site with the Owner and his representatives for a complete functional demonstration of all the system requirements. This demonstration constitutes a joint acceptance inspection, and permits acceptance of the delivered system for on-line operation.

3.15 CLEANING

- A. This contractor shall clean up all debris resulting from his or her activities daily. The contractor shall remove all cartons, containers, crates, etc. under his control as soon as their contents have been removed. Waste shall be collected and placed in a location designated by the Construction Manager or General Contractor.
- B. At the completion of work in any area, the Contractor shall clean all of his/her work, equipment, etc., making it free from dust, dirt and debris, etc.
- C. At the completion of work, all equipment furnished under this Section shall be checked for paint damage, and any factory finished paint that has been damaged shall be repaired to match the adjacent areas. Any metal cabinet or enclosure that has been deformed shall be replaced with new material and repainted to match the adjacent areas.

3.16 ACCEPTANCE

A. The control systems will not be accepted as meeting the requirements of Completion until all tests described in this specification have been performed to the satisfaction of both the Engineer and Owner. Any tests that cannot be performed due to circumstances beyond the control of the Contractor may be exempt from the Completion requirements if stated as such in writing by the Owner's representative. Such tests shall then be performed as part of the warranty.

SECTION 260501 - GENERAL PROVISIONS - ELECTRICAL

1. GENERAL

- A. The Instructions to Bidders, General and Special Conditions, and all other contract documents shall apply to the Contractor's work as well as to each of his Sub Contractor's work. Each Contractor is directed to familiarize himself in detail with all documents pertinent to this Contract. In case of conflict between these General Provisions and the General and/or Special Conditions, the affected Contractor shall contact the Engineer for clarification and final determination.
- B. The Contractor shall be governed by any alternates, unit prices and Addenda or other contract documents insofar as they may affect his part of the work.
- C. The work included in this division consists of the furnishing of all labor, equipment, transportation, supplies, material and appurtenances and performing all operations necessary for the satisfactory installation of complete and operating electrical systems indicated on the drawings and/or specified herein.
- D. Any materials, labor, equipment or services not mentioned specifically herein which may be necessary to complete or perfect any part of the electrical systems in a substantial manner, in compliance with the requirements stated, implied, or intended in the drawings and specifications, shall be included as part of this Contract. The Contractor shall give written notice of any materials or apparatus believed inadequate or unsuitable; in violation of laws, ordinances, rules or regulations of authorities having jurisdiction; and any necessary items of work omitted a minimum of ten days prior to bid. In the absence of such written notice and by the act of submitting his bid, it shall be understood that the Contractor has included the cost of all required items in his bid, and that he will be responsible for the approved satisfactory functioning of the entire system without extra compensations.
- E. It is not the intent of this section of the specifications (or the remainder of the contract documents) to make any specific Contractor, other than the Contractor holding the prime contract, responsible to the Owner, Architect and Engineer. All transactions such as submittal of shop drawings, claims for extra costs, requests for equipment or materials substitution, shall be done through the Contractor to the Architect (if applicable), then to the Engineer.
- F. This section of the Specifications or the arrangement of the contract documents shall not be construed as an attempt to arbitrarily assign responsibility for work, material, equipment or services to a particular trade Contractor or Sub-Contractor. Unless stated otherwise, the subdivision and assignment of work under the various sections shall be the responsibility of the Contractor holding the prime contract.
- G. It is the intent of this Contract to deliver to the Owner a "like new" project once work is complete. Although plans and specifications are complete to the extent possible, it shall be responsibility of the Contractors involved to remove and/or relocate or re-attach any existing or new systems which interfere with new equipment or materials to be installed by other trades without additional cost to the Owner.
- H. The Contractor shall provide interim life safety and fire detection measures as required by the Authority Having Jurisdiction, Division 1 specifications, NFPA, and applicable Codes. This includes temporary relocations of heat/smoke detection, exit signage, and egress lighting in existing buildings as applicable.
- I. In general, and to the extent possible, all work shall be accomplished without interruption of the existing facilities' operations. Each Contractor shall advise the Architect, Owner and Engineer (as applicable) in writing at least one week prior to the deliberate interruption of any services. The Owner shall be advised of the exact time that interruption will occur and the length of time the interruption will occur. Failure to

comply with this requirement may result in complete work stoppage by the Contractors involved until a complete schedule of interruptions can be developed.

- J. Whenever utilities are interrupted, either deliberately or accidentally, the Contractor shall work continuously to restore said service. The Contractor shall provide tools, materials, skilled journeymen of his own and other trades as necessary, premium time as needed and coordination with all applicable utilities, including payment of utility company charges (if any), all without request for extra compensation to the Owner, except where otherwise provided for in the contract document.
- K. The Contractor shall be responsible for maintaining existing fire alarm, paging, access control, intrusion detection, CCTV, nurse call systems, etc., in occupied spaces in renovation and addition projects. The Contractor shall be required to disconnect and remove all existing devices in renovated areas (where directed as such) without affecting system operations. All costs associated with said work shall be borne by the Contractor.
- L. Definitions:
 - (1) Prime Contractor The Contractor who has been engaged by the Owner in a contractual relationship to accomplish the work.
 - (2) Electrical Contractor Any Contractor whether bidding or working independently or under the supervision of a General Contractor, that is: the one holding the Prime Contract and who installs any type of Electrical work, such as: power, lighting, television, telecommunications, data, fiber optic, intercom, fire detection and alarm, security, video, underground or overhead electrical, etc.

<u>Note</u>: Any reference within these specifications to a specific entity, i.e., "Electrical Contractor" is not to be construed as an attempt to limit or define the scope of work for that entity or assign work to a specific trade or contracting entity. Such assignments of responsibility are the responsibility of the Contractor or Construction Manager holding the prime contract, unless otherwise provided herein.

- (3) Electrical Sub-Contractor Each or any Contractor contracted to, or employed by, the Electrical Contractor for any work required by the Electrical Contractor.
- (4) Engineer The Consulting Mechanical-Electrical Engineers, either consulting to the Owner, Architect, other Engineers, etc.
- (5) Architect The Architect of Record for the project, if any.
- (6) Furnish Deliver to the site in good condition.
- (7) Provide Furnish and install in complete working order.
- (8) Install Install equipment furnished by others in complete working order.
- (9) Contract Documents All documents pertinent to the quality and quantity of all work to be performed on the project. Includes, but not limited to: Plans, Specifications, Addenda, Instructions to Bidders, (both General and Sub-Contractors), Unit Prices, Shop Drawings, Field Orders, Change Orders, Cost Breakdowns, Construction Manager's Assignments, Architect's Supplemental Instructions, Periodical Payment Requests, etc.

2. INTENT

- A. It is the intent of these specifications and all associated drawings that the Contractor provide finished work, tested, and ready for operation. Wherever the word "provide" is used, it shall mean "furnish and install complete and ready for use."
- B. Minor details not usually shown or specified, but necessary for the proper installation and operation, shall be included in the work, the same as if herein specified or shown.

3. ELECTRICAL DRAWINGS AND SPECIFICATIONS

- A. The drawings are diagrammatic only and indicate the general arrangement of the systems and are to be followed insofar as possible. If deviations from the layouts are necessitated by field conditions, detailed layouts of the proposed departures shall be submitted in writing to the Engineer for review before proceeding with the work. The Contract Drawings are not intended to show every vertical or horizontal offset which may be necessary to complete the systems. Contractors shall, however, anticipate that additional offsets may be required and submit their bid accordingly.
- B. The drawings and specifications are intended to supplement each other. No Contractor or supplier shall take advantage of conflict between them, or between parts of either, but should this condition exist, the Contractor or supplier shall request a clarification of the condition at least ten days prior to the submission of bids so that the condition may be clarified by Addendum. In the event that such a condition arises after work is started, the interpretation of the Engineer shall be the determining factor. In all instances, unless modified in writing and agreed upon by all parties thereto, the Contract to accomplish the work shall be binding on the affected Contractor.
- C. The drawings and specifications shall be considered to be cooperative and complimentary and anything appearing in the specifications which may not be indicated on the drawings or conversely, shall be considered as part of the Contract and must be executed the same as though indicated by both.
- D. The Contractor shall make all his own measurements in the field and shall be responsible for correct fitting. He shall coordinate this work with all other branches of work in such a manner as to cause a minimum of conflict or delay.
- E. The Engineer shall reserve the right to make minor adjustments in location of conduit, fixtures, outlets, switches, etc., where he considers such adjustments desirable in the interest of concealing work or presenting a better appearance.
- F. The Contractor shall evaluate ceiling heights called for on Architectural Plans. Where the location of Electrical equipment may interfere with ceiling heights, the Contractor shall call this to the attention of the Engineer in writing prior to making the installation. Any such changes shall be anticipated and requested sufficiently in advance so as to not cause extra work on the part of the Contractor or unduly delay the work.
- G. Special Note: Always check ceiling heights indicated on Drawings and Schedules and insure that these heights may be maintained after all mechanical and electrical equipment is installed. If a conflict is apparent, notify the Engineer in writing for instructions.
- H. Should overlap of work between the various trades become evident, this shall be called to the attention of the Engineer. In such event neither trade shall assume that he is to be relieved of the work which is specified under his branch until instructions in writing are received from the Engineer.
- I. The drawings are intended to show the approximate location of equipment, materials, etc. Dimensions given in figures on the drawings shall take precedence over scaled dimensions and all dimensions whether

given in figures or scaled shall be verified in the field. In case of conflict between small and large scale drawings, the larger scale drawings shall take precedence.

- J. The Contractor and his Sub Contractors shall review all drawings in detail as they may relate to his work (structural, architectural, site survey, mechanical, etc.). Review all drawings for general coordination of work, responsibilities, ceiling clearances, wall penetration points, chase access, fixture elevations, etc. Make any pertinent coordination or apparent conflict comments to the Engineers at least ten days prior to bids, for issuance of clarification by written addendum.
- K. Where on any of the drawings a portion of the work is drawn out and the remainder is indicated in outline, or not indicated at all, the parts drawn out shall apply to all other like portions of the work. Where ornament or other detail is indicated by starting only, such detail shall be continued throughout the courses or parts in which it occurs and shall also apply to all other similar parts of the work, unless otherwise indicated.

4. EXAMINATION OF SITE AND CONDITIONS

- A. The Contractor shall inform himself of all of the conditions under which the work is to be performed, the site of the work, the structure of the ground, the obstacles that may be encountered, the availability and location of necessary facilities and all relevant matters concerning the work. All Contractors or suppliers shall carefully examine all Drawings and Specifications and contract documents to determine the kind and type of materials to be used throughout the project and which may, in any way, affect the execution of his work.
- B. The Contractor shall fully acquaint himself with all existing conditions as to ingress and egress, distance of haul from supply points, routes for transportation of materials, facilities and services, availability of temporary or permanent utilities, etc. The Contractor shall include in his work all expenses or disbursements in connection with such matters and conditions. The Contractor shall verify all work shown on the drawings and conditions at the site, and shall report in writing to the Engineer ten days prior to bid, any apparent omissions or discrepancies in order that clarifications may be issued by written addendum. No allowance is to be made for lack of knowledge concerning such conditions after bids are accepted.

5. EQUIPMENT AND MATERIALS SUBSTITUTIONS OR DEVIATIONS

- A. When any Contractor requests review of substitute materials and/or equipment, and when under an approved formal alternate proposal, it shall be understood and agreed that such substitution, if approved, will be made without additional cost regardless of changes in connections, spacing, service, mounting, etc. In all cases where substitutions affect other trades, the Contractor offering such substitutions shall advise all such Contractors of the change and shall reimburse them for all necessary changes in their work. Any drawings, Specifications, Diagrams, etc., required to describe and coordinate such substitutions or deviations shall be professionally prepared at the responsible Contractor's expense. Special Note: Review of Shop Drawings by the Engineer does not absolve the Contractor of this responsibility
- B. References in the specifications to any article, device, product, material, fixture, form, or type of construction by name, make, or catalog number shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition. Each Contractor, in such cases, may, at his option, use any article, device, product, material, fixture, form, or type of construction which in the judgment of the Engineer is equivalent to that specified, provided the provisions of paragraph (A) immediately preceding are met. Substitutions shall be submitted to the Engineer a minimum of ten days prior to bid date for approval to bid in written form thru addenda or other method selected by the Engineer. If prevailing laws of cities, towns, states or countries are more stringent than these specifications regarding such substitutions, then those laws shall prevail over these requirements.

- C. Wherever any equipment and material is specified <u>exclusively</u> only such items shall be used unless substitution is accepted in writing by the engineers.
- D. The Contractor shall furnish along with his proposal a list of specified equipment and materials which he proposes to provide. Where several makes are mentioned in the Specifications and the Contractor fails to state which he proposes to furnish, the Engineer shall have the right to choose any of the makes mentioned without change in price.
- E. The Contractor shall review the contract documents and if a material substitution form is required for each proposed substitution, it shall be submitted per requirements.

6. SUPERVISION OF WORK

A. Each Contractor and Sub-Contractors shall personally supervise the work or have a competent superintendent on the project site at all times during progress of the work, with full authority to act for him in matters related to the project.

7. CODES, RULES, PERMITS, FEES, REGULATIONS, ETC.

- A. The Contractor shall give all necessary notices, obtain and pay for all permits, government sales taxes, fees, and other costs including utility connections or extensions, in connection with his work. As necessary, he shall file all required plans, utility easement requests and drawings, survey information on line locations, load calculations, etc., prepare all documents and obtain all necessary approvals of all utility and governmental departments having jurisdiction; obtain all required certificates of inspection for his work and deliver same to the Engineer before request for acceptance and final payment for the work.
- B. Ignorance of Codes, Rules, regulations, utility company requirements, laws, etc., shall not diminish or absolve Contractor's responsibilities to provide and complete all work in compliance with such.
- C. The Contractor shall include in the work, without extra cost, any labor, materials, services, apparatus or drawings required in order to comply with all applicable laws, ordinances rules and regulations, whether or not shown on drawings and/or specified.
- D. All materials furnished and all work installed shall comply with the current edition of the National Electrical Codes, National Fire Codes of the National Fire Protection Association, the requirements of local utility companies, and with the requirements of all governmental agencies or departments having jurisdiction.
- E. All material and equipment for the electrical systems shall bear the approval label, or shall be listed by the Underwriters' Laboratories, Incorporated. Listings by other testing agencies may be acceptable with written approval by the Engineer.
- F. All electrical work is to be constructed and installed in accordance with plans and specifications which have been approved in their entirety and/or reflect any changes requested by the State Fire Marshal, as applicable or required. Electrical work shall not commence until such plans are in the hands of the Electrical Contractor.
- G. The Contractor shall insure that his work is accomplished in accord with OSHA Standards and any other applicable government requirements.
- H. Where conflict arises between any code and the plans and/or specifications, the code shall apply except in the instance where the plans and specifications exceed the requirements of the code. Any changes required

as a result of these conflicts shall be brought to the attention of the Engineer at least ten working days prior to bid date, otherwise the Contractor shall make the required changes at his own expense. The provisions of the codes constitute minimum standards for wiring methods, materials, equipment and construction and compliance therewith will be required for all electrical work, except where the drawings and specifications require better materials, equipment, and construction than these minimum standards, in which case the drawings and specifications shall be the minimum standards.

8. COST BREAKDOWNS/SCHEDULE OF VALUES

A. Within thirty days after acceptance of the Contract, the Contractor is required to furnish to the Engineer one copy of a detailed cost breakdown on each respective area of work. These cost breakdowns shall be made on forms provided or approved by the Engineer or Architect. Payments will not be made until satisfactory cost breakdowns are submitted. Refer to the end of this section for a sample of expected level and breakout being required.

9. CORRECTION PERIOD

- A. All equipment, apparatus, materials, etc., shall be the best of its respective kind. The Contractor shall replace all materials at his own expense, which fail or are deemed defective as described in the General Conditions. The effective date of completion of the work shall be the date each or any portion of the work is accepted by the Architect or Engineer as being substantially complete.
- B. Items of equipment which have longer guarantees, as called for in these specifications or as otherwise offered by the manufacturer, such as generators, engines, batteries, transformers, etc., shall have warranties and guarantees completed in order, and shall be in effect at the time of final acceptance of the work by the Engineer. The Contractor shall present the Engineer with such warranties and guarantees at the time of final acceptance of the work. The Owner reserves the right to use equipment installed by the Contractor prior to date of final acceptance. Such use of equipment shall in no way invalidate the guarantee except that Owner shall be liable for any damage to equipment during this period due to negligence of his operator or other employee.

10. INSPECTION, APPROVALS AND TESTS

- A. Before requesting a final review of the installation from the Architect and/or Engineer, the Contractor shall thoroughly inspect his installation to assure that the work is complete in every detail and that all requirements of the Contract Documents have been fulfilled. Failure to accomplish this may result in charges from the Architect and/or Engineers for unnecessary and undue work on their part.
- B. The Contractor shall provide as part of this contract electrical inspection by a competent Electrical Inspection Agency, licensed to provide such services in the Commonwealth of Kentucky. The name of this agency shall be included in the list of materials of the Form of Proposal by the Contractor. All costs incidental to the provision of electrical inspections shall be borne by the Electrical Contractor.
- C. The Contractor shall advise each Inspection Agency in writing (with an information copy of the correspondence to the Architect and/or Engineer) when he anticipates commencing work. Failure of the Inspection Agency to inspect the work in the stage following and submit the related reports may result in the Contractor's having to expose concealed work not so inspected. Such exposure will be at the expense of the responsible Contractor.
- D. Inspections shall be scheduled for rough as well as finished work. The rough inspections shall be divided into as many inspections as may be necessary to cover all roughing-in without fail. Report of each such

inspection visit shall be submitted to the Architect, Engineer and the Contractor within three days of the inspection.

- E. Approval by an Inspector does not relieve the Contractor from the responsibilities of furnishing equipment having a quality of performance equivalent to the requirements set forth in these plans and specifications. All work under this contract is subject to the review of the Architect and/or Engineer, whose decision is binding.
- F. Before final acceptance, the Contractor shall furnish three copies of the certificates of final approval by the Electrical Inspector (as well as all other inspection certificates) to the Engineer with one copy of each to the appropriate government agencies, as applicable. Final payment for the work shall be contingent upon completion of this requirement.
- G. The Contractor shall test all wiring and connections for cross connects, continuity and grounds before equipment and fixtures are connected, and when indicated or required, demonstrate by continuity/load/voltage test and Megger Test the installation of any circuit or group of circuits. Where such tests indicate the possibility of faulty insulation, locate the point of such fault, replacing same with new and demonstrate by further test the elimination of such defect. The secondary service entrance conductors from the utility (source) transformer to the main service disconnecting means shall be megger tested. The results of this test shall be turned over to the engineer for review and approval. Any conductor failing the test shall be replaced and any costs associated shall be borne by the contractor.

11. COMPUTER-BASED SYSTEM SOFTWARE

A. For all equipment, controls, hardware, computer-based systems, programmable logic controllers, and other materials provided as a part of the work, software that is installed shall be certified in writing to the Engineer and Owner by the manufacturer and/or writer to be free of programming errors that might affect the functionality of the intended use.

12. CHANGES IN ELECTRICAL WORK

REFER TO GENERAL AND SPECIAL CONDITIONS.

13. CLAIMS FOR EXTRA COST

REFER TO GENERAL AND SPECIAL CONDITIONS.

14. SURVEYS, MEASUREMENTS AND GRADES

- A. The Contractor shall lay out his work and be responsible for all necessary lines, levels, elevations and measurements. He must verify the figures shown on the drawings before laying out the work and will be held responsible for any error resulting from his failure to do so.
- B. The Contractor shall base all measurements, both horizontal and vertical from established bench marks. All work shall agree with these established lines and levels. Verify all measurements at site and check the correctness of same as related to the work.
- C. Should the Contractor discover any discrepancy between actual measurements and those indicated, which prevents following good practice or the intent of the drawings and specifications, he shall notify the Engineer thru normal channels of job communication and shall not proceed with his work until he has received instructions from the Engineer.

15. TEMPORARY USE OF EQUIPMENT

- A. The permanent electrical equipment, when installed, may be used for temporary services, subject to an agreement among the Contractors involved, the Owner, and with the consent of the Engineer. Should the permanent systems be used for this purpose, each Contractor shall pay for all temporary connections required and any replacements required due to damage without cost, leaving the equipment and installation in "as new" condition. The Contractor may be required to bear utility costs, user fees, etc.
- B. Permission to use the permanent equipment does not relieve the Contractors who utilize this equipment from the responsibility for any damages to the building construction and/or equipment which might result because of its use.

16. TEMPORARY SERVICES

A. The Contractor shall arrange for temporary electrical and other services which he may require to accomplish his work. In the absence of other provisions in the contract, the Contractor shall provide for his own temporary services of all types, including the cost of connections, utility company fees, construction, removal, etc., in his bid.

17. RECORD DRAWINGS

A. The Contractor shall insure that any deviations from the design are being recorded daily or as necessary on record drawings being maintained by the Contractor. Dimensions from fixed, visible permanent lines or landmarks shown in vertical and horizontal ways shall be utilized. Compliance shall be a requirement for final payment. Pay particular attention to the location of underfloor or underground exterior incontract or utility-owned or leased service lines, main switches and other appurtenances important to the maintenance and safety of the Electrical System. Keep information in a set of drawings set aside at the job site especially for this purpose. Deliver these record drawings electronically to the Engineer in AutoCad 2000 format (or more recent version) along with the hand marked field set. Electronic bid drawings will be furnished to the Contractor for his use at the completion of the work.

18. MATERIALS AND WORKMANSHIP

- A. All electrical equipment, materials and articles incorporated in the work shall be new and of comparable quality to that specified. All workmanship shall be first-class and shall be performed by electricians skilled and regularly employed in their respective trades. The Contractor shall determine that the equipment he proposes to furnish can be brought into the building(s) and installed within the space available. All equipment shall be installed so that all parts are readily accessible for inspection, maintenance, replacement, etc. Extra compensation will not be allowed for relocation of equipment for accessibility or for dismantling equipment to obtain entrance into the building(s).
- B. All conduit and/or conductors shall be concealed in or below walls, floors or above ceilings unless otherwise noted. All fixtures, devices and wiring required shall be installed to make up complete systems as indicated on the drawings and specified herein.
- C. All materials, where applicable, shall bear Underwriters' Laboratories label or that of another Engineerapproved testing agency, where such a standard has been established.
- D. Each length of conduit, wireway, duct, conductor, cable, fitting, fixture and device used in the electrical systems shall be stamped or indelibly marked with the makers mark or name.

- E. All electrical equipment shall bear the manufacturer's name and address and shall indicate its electrical capacity and characteristics.
- F. All electrical materials, equipment and appliances shall conform to the latest standards of the National Electric Manufacturers Association (NEMA) and the National Board of Fire Underwriters (NBFU) and shall be approved by the Owner's insuring agency if so required.

19. QUALIFICATIONS OF WORKMEN

- A. All electrical work shall be accomplished by qualified workmen competent in the area of work for which they are responsible. Untrained and incompetent workmen as evidenced by their workmanship shall be relieved of their responsibilities in those areas. The Engineer shall reserve the right to determine the quality of workmanship of any workman and unqualified or incompetent workmen shall refrain from work in areas not satisfactory to him. Requests for relief of a workman shall be made through the normal channels of responsibility established by the Architect or the contract document provisions.
- B. All electrical work shall be accomplished by Journeymen electricians under the direct supervision of a licensed Electrician. All applicable codes, utility company regulations, laws and permitting authority of the locality shall be fully complied with by the Contractor.
- C. Special electrical systems, such as Fire Detection and Alarm Systems, Intercom or Sound Reinforcement Systems, Telecommunications or Data Systems, Lightning Protection Systems, Video Systems, Special Electronic Systems, Control Systems, etc., shall be installed by workmen normally engaged or employed in these respective trades. As an exception to this, where small amounts of such work are required and are, in the opinion of the Engineer, within the competency of workmen directly employed by the Contractor involved, they may be provided by this Contractor.

20. CONDUCT OF WORKMEN

A. The Contractor shall be responsible for the conduct of all workmen under his supervision. Misconduct on the part of any workmen to the extent of creating a safety hazard, or endangering the lives and property of others, shall result in the prompt relief of that workman. The consumption or influence of alcoholic beverages, narcotics or illegally used controlled substances on the jobsite is strictly forbidden.

21. COOPERATION AND COORDINATION BETWEEN TRADES

- A. The Contractor is expressly directed to read the General Conditions and all detailed sections of these specifications for all other trades and to study all drawings applicable to his work, including Architectural, Mechanical, Structural and other pertinent Drawings, to the end that complete coordination between trades will be affected.
- B. Refer to Coordination Among Trades, Systems Interfacing and Connection of Equipment Furnished by Others section of these Specifications for further coordination requirements.

22. PROTECTION OF EQUIPMENT

A. The Contractor shall be entirely responsible for all material and equipment furnished by him in connection with his work and special care shall be taken to properly protect all parts thereof from damage during the construction period. Such protection shall be by a means acceptable to the Engineer. All rough-in conduit shall be properly plugged or capped during construction in a manner approved by the Engineer. Equipment damaged while stored on site either before or after installation shall be repaired or replaced (as determined by the Engineer) by the responsible Contractor.

23. CONCRETE WORK

- A. The Contractor shall be responsible for the provision of all concrete work required for the installation of any of his systems or equipment. If this work is provided by another trade, it will not relieve the Electrical Contractor of his responsibilities relative to dimensions, quality of workmanship, locations, etc. In the absence of other concrete specifications, all concrete related to Electrical work shall be 3000 PSI minimum compression strength at 28 days curing and shall conform to the standards of the American Concrete Institute Publication ACI-318. Heavy equipment shall not be set on pads for at least seven days after pour.
- B. All concrete pads shall be complete with all pipe sleeves, embeds, anchor bolts, reinforcing steel, concrete, etc., as required. Pads larger than 18" in width shall be reinforced with minimum #4 round bars on 6" centers both ways. All reinforcing steel shall be per ASTM requirements, tied properly, lapped 18 bar diameters and supported appropriately up off form, slab or underlayment. Bars shall be approximately 3" above the bottom of the pad with a minimum 2" cover. All parts of pads and foundations shall be properly rodded or vibrated. If exposed parts of the pads and foundations are rough or show honeycomb after removing forms properly adhered repairs shall be made. If structural integrity is violated, the concrete shall be replaced. All surfaces shall be rubbed to a smooth finish.

<u>Special Note</u>: All pads and concrete lighting standard bases shall be crowned slightly so as to avoid water ponding beneath equipment.

- C. In general, concrete pads for small equipment shall extend 6" beyond the equipment's base dimensions. For large equipment with service access panels, extend pads 18" beyond base or overall dimensions to allow walking and servicing space at locations requiring service access.
- D. Exterior concrete pads shall be 4" minimum above grade and 4" below grade on a tamped 4" dense grade rock base unless otherwise noted or required by utility company. Surfaces of all foundations and bases shall have a smooth finish with three-quarter inch radius or chamfer on exposed edges, trowelled or rubbed smooth. All exterior pads shall be crowned approximately 1/8" per foot, sloping from center for drainage.

24. RESTORATION OF NEW OR EXISTING SHRUBS, PAVING, ETC.

A. The Contractor shall restore to their original condition all paving, curbing surfaces, drainage ditches, structures, fences, shrubs, existing or new building surfaces and appurtenances, and any other items damaged or removed by his operations. Replacement and repairs shall be in accordance with good construction practice and shall match materials employed in the original construction of the item to be replaced. All repairs shall be to the satisfaction of the Engineer, and in accord with the Architect's standards for such work, as applicable.

25. MAINTENANCE OF EXISTING UTILITIES AND LINES

A. The locations of all piping, conduits, cables, utilities and manholes existing, or otherwise, that come within the contract construction site, shall be subject to continuous uninterrupted maintenance with no exception unless the Owner of the utilities grants permission to interrupt same temporarily, if need be. Provide one week's written notice to Engineer, Architect and Owner prior to interrupting any utility service or line. Also see Article 1. - General, this section.

- B. Known utilities and lines as available to the Engineer are shown on the drawings. However, it is additionally required that, prior to any excavation being performed, each Contractor ascertain that no utilities or lines, known or unknown, are endangered by the excavation.
- C. If the above mentioned utilities or lines occur in the earth within the construction site, the Contractor shall first probe and make every effort to locate the lines prior to excavating in the respective area. Electromagnetic utility locators and acoustic pipe locators shall be utilized to determine where metallic and non-metallic piping is buried prior to any excavation.
- D. Cutting into existing utilities and services shall be done in coordination with and as designated by the Owner of the utility. The Contractor shall work continuously to restore service(s) upon deliberate or accidental interruption, providing premium time and materials as needed without extra claim to the Owner.
- E. The Contractor shall repair to the satisfaction of the Engineer any surface or subsurface improvements damaged during the course of the work, unless such improvement is shown to be abandoned or removed.
- F. Machine excavation shall not be permitted within ten feet of existing gas or fuel lines. Hand excavate only in these areas, in accord with utility company, agency or other applicable laws, standards or regulations.
- G. Protect all new or existing lines from damage by traffic, etc. during construction.
- H. Protect existing trees, indicated to remain with fencing or other approved method. Hold all new subsurface lines outside the drip line of trees, offsetting as necessary to protect root structures. Refer to planting or landscaping plans, or in their absence, consult with the Architect.

26. SMOKE AND FIRE PROOFING

A. The Contractor shall not penetrate rated fire walls, ceilings or floors with conduit, cable, bus duct, wireway or other raceway system unless all penetrations are protected in a code compliant manner which maintains the rating of the assembly. Smoke and fire stop all openings made in walls, chases, ceiling and floors. Patch all openings around conduit, wireway, bus duct, etc., with appropriate type material to smoke stop walls and provide needed fire rating at fire walls, ceilings and floors. Smoke and fire proofing materials and method of application shall be approved by the local authority having jurisdiction.

27. QUIET OPERATION, SUPPORTS, VIBRATION AND OSCILLATION

- A. All work shall operate under all conditions of load without any objectionable sound or vibration, the performance of which shall be determined by the Engineer. Noise from moving machinery or vibration noticeable outside of room in which it is installed, or annoyingly noticeable noise or vibration inside such room, will be considered objectionable. Sound or vibration conditions considered objectionable by the Engineer shall be corrected in an approved manner by the Contractor (or Contractors responsible) at his expense.
- B. All equipment subject to vibration and/or oscillation shall be mounted on vibration supports suitable for the purpose of minimizing noise and vibration transmission, and shall be isolated from external connections such as piping, ducts, etc., by means of flexible connectors, vibration absorbers or other approved means. Surface mounted equipment such as panels, switches, etc., shall be affixed tightly to their mounting surface.

C. The Contractor shall provide supports for all equipment furnished by him using an approved vibration isolating type as needed. Supports shall be liberally sized and adequate to carry the load of the equipment and the loads of attached equipment, piping, etc. All equipment shall be securely fastened to the structure either directly or indirectly through supporting members by means of bolts or equally effective means. No work shall depend on the supports or work of unrelated trades unless specifically authorized in writing by the Architect or Engineer.

28. FINAL CONNECTIONS TO EQUIPMENT

A. The roughing-in and final connections to all electrically operated equipment furnished under this and all other sections of the contract documents or by others, shall be included in the Contract and shall consist of furnishing all labor and materials for connection. The Contractor shall carefully coordinate with equipment suppliers, manufacturers representatives, the vendor or other trades to provide complete electrical and dimensional interface to all such equipment (kitchen, hoods, mechanical equipment, panels, refrigeration equipment, etc.).

29. WELDING

A. The Contractor shall be responsible for quality of welding done by his organization and shall repair or replace any work not done in accordance with the Architect's or structural Engineer's specifications for such work. If required by the Engineer, the responsible Contractor shall cut at least three welds during the job for X-raying and testing. These welds are to be selected at random and shall be tested as a part of the responsible Contractor's work. Certification of these tests and X-rays shall be submitted, in triplicate, to the Engineer. In case a faulty weld is discovered, the Contractor shall be required to furnish additional tests and corrective measures until satisfactory results are obtained.

30. ACCESSIBILITY

- A. The Contractor shall be responsible for the sufficiency of the size of shafts and chases, the adequate clearance in partitions and above suspended ceilings for the proper installation of his work. He shall cooperate with the General Contractor (or Construction Manager) and all other Contractors whose work is in the same space, and shall advise each Contractor of his requirements. Such spaces and clearances shall be kept to the minimum size required to ensure adequate clearance and access.
- B. The Contractor shall locate all equipment which must be serviced, operated, or maintained in fully accessible positions. Equipment shall include but not be limited to junction boxes, pull boxes, contactors, panels, disconnects, controllers, switchgear, etc. Minor deviations from drawings may be made to allow for better accessibility, and any change shall be approved where the equipment is concealed.
- C. Each Contractor shall provide (or arrange for the provision by other trades) the access panels for each concealed junction box, pull box, fixtures or electrical device requiring access or service as shown on Engineer's plans or as required. Locations of these panels shall be identified in sufficient time to be installed in the normal course of work. All access panels shall be installed in accord with the Architect's standards for such work.
- D. Access Doors; in Ceilings or Walls:
 - (1) In mechanical, electrical, or service spaces:

14 gauge aluminum brushed satin finish, 1" border.

(2) In finished areas:

14 gauge primed steel with 1" border to accept the architectural finishes specified for the space. Confirm these provisions with the Architect prior to obtaining materials or installing any such work.

(3) In fire or smoke rated partitions, access doors shall be provided that equal or exceed the required rating of the construction they are mounted in.

31. ELECTRICAL CONNECTIONS

- A. The Contractor shall furnish and install all power wiring complete from power source to motor or equipment junction box, including power wiring through starters. The Contractor shall install all starters not factory mounted on equipment. Unless otherwise noted, the supplier of equipment shall furnish starters with the equipment. Also refer to Divisions 11, 14, 20, 21, 22, 23 and 25 of the Specifications, shop drawings and equipment schedules for additional information.
- B. All control, interlock, sensor, thermocouple and other wiring required for equipment operation shall be provided by the Contractor. All such installations shall be fully compliant with all requirements of Division 26 and 27 regardless of which trade actually installs such wiring. Motors and equipment shall be provided for current and voltage characteristics as indicated or required. All wiring shall be enclosed in raceways unless otherwise noted.
- C. Each Contractor or sub-contractor, prior to bidding the work, shall coordinate power, control, sensor, interlock and all other wiring requirements for equipment or motors with all other contractors or sub-contractors, to ensure all needed wiring is provided in the Contract. Failure to make such coordination shall not be justification for claims of extra cost or a time extension to the Contract.

32. MOTORS

- A. Each motor shall be provided by the equipment supplier, installer or manufacturer with conduit terminal box and N.E.C. required disconnecting means as indicated or required. Three-phase motors shall be provided with external thermal overload protection in their starter units. Single-phase motors shall be provided with thermal overload protection, integral to their windings or external, in control unit. All motors shall be installed with NEMA-rated starters as specified and shall be connected per the National Electrical Code.
- B. The capacity of each motor shall be sufficient to operate associated driven devices under all conditions of operation and load and without overload, and at least of the horsepower indicated or specified. Each motor shall be selected for quiet operation, maximum efficiency and lowest starting KVA per horsepower as applicable. Motors producing excessive noise or vibration shall be replaced by the responsible contractor. See Division 20, 22 and 23 of the Specifications for further requirements and scheduled sizes.
- C. All three-phase motors shall be tested for proper rotation. Correct wiring if needed and retest. Document testing and corrective action in operations and maintenance manual.

33. CUTTING AND PATCHING

A. Unless otherwise indicated or specified, the Contractor shall provide cutting and patching necessary to install the work specified in this Division. Patching shall match adjacent surfaces to the satisfaction of the Engineer and shall be in accord with the Architect's standards for such work, as applicable.

- B. No structural members shall be cut without the approval of the Structural Engineer and all such cutting shall be done in a manner directed by him.
- C. When installing conduit, pipe, or any other work in insulated concrete form (ICF) walls, the responsible subcontractor for the work shall provide spray foam insulation to patch the rigid insulation to maintain full integrity of the insulating value of the wall after the mechanical and electrical work is complete. Furthermore all new work shall NOT be installed in concrete center of wall. All mechanical and electrical installations shall be on the interior side of the concrete.

34. ANCHORS

A. Each Contractor shall provide and locate all inserts required for his work before the floors and walls are built, or shall be responsible for the cost of cutting and patching required where inserts were not installed, or where incorrectly located. Each Contractor shall do all drilling required for the installation of his hangers. Drilling of anchor holes may be prohibited in post-tensioned concrete construction, in which case the Contractor shall request approved methods from the Architect and shall carefully coordinate setting of inserts, etc., with the Structural Engineer and/or Architect.

35. WEATHERPROOFING

- A. Where any work pierces waterproofing, including waterproof concrete, the method of installation shall be as approved by the Architect and/or Engineer before work is done. The Contractor shall furnish all necessary sleeves, caulking and flashing required to make openings absolutely watertight.
- B. Wherever work penetrates roofing, it shall be done in a manner that will not diminish or void the roofing guarantee or warranty in any way. Coordinate all such work with the roofing installer.

36. OPERATING INSTRUCTIONS

- A. Upon completion of all work and all tests, each Contractor shall furnish the necessary skilled labor and helpers for operating his systems and equipment for a period of three days of eight hours each, or as otherwise specified. During this period, instruct the Owner or his representative fully in the operations, adjustment, and maintenance of all equipment furnished. Give at least one week's written notice to the Owner, Architect and Engineer in advance of this period. The Engineer may attend any such training sessions or operational demonstrations. The Contractor shall certify in writing to the Engineer that such demonstrations have taken place, noting the date, time and names of the Owner's representative that were present.
- B. Each Contractor shall furnish three complete bound sets for approval to the Engineer of typewritten and/or blueprinted instructions for operating and maintaining all systems and equipment included in this contract. All instructions shall be submitted in draft, for approval, prior to final issue. Manufacturer's advertising literature or catalogs will not be acceptable for operating and maintenance instructions.
- C. Each Contractor, in the above mentioned instructions, shall include the maintenance schedule for the principal items of equipment furnished under this contract and a detailed, easy to read parts list and the name and address of the nearest source of supply.
- D. Formatting & content shall follow the guidelines outlined in the latest version of ASHRAE Applications Handbook, Guideline 4. As a minimum, the following shall be included:
 - The operation and maintenance document directory should provide easy access and be well organized and clearly identified.

- Emergency information should be immediately available during emergencies and should include emergency and staff and/or agency notification procedures.
- The operating manual should contain the following information:
 - I. General Information
 - a. Building function
 - b. Building description
 - c. Operating standards and logs
 - II. Technical Information
 - a. System description
 - b. Operating routines and procedures
 - c. Seasonal start-up and shutdown
 - d. Special procedures
 - e. Basic troubleshooting
- The maintenance manual should contain the following information:
 - I. Equipment data sheets
 - a. Operating and nameplate data
 - b. Warranty
 - II. Maintenance program information
 - a. Manufacturer's installation, operation, and maintenance instructions
 - b. Spare parts information
 - c. Preventive maintenance actions
 - d. Schedule of actions
 - e. Action description
 - f. History
- Test reports document observed performance during start-up and commissioning.

37. SCAFFOLDING, RIGGING AND HOISTING

A. The Contractor shall furnish all scaffolding, rigging, hoisting, and services necessary for erection and delivery into the premises of any equipment and apparatus furnished. Remove same from premises when no longer required.

38. CLEANING

- A. The Contractor shall, at all times, keep the area of his work presentable to the public and clean of rubbish caused by his operations; and at the completion of the work, shall remove all rubbish, all of his tools, equipment, temporary work and surplus materials, from and about the premises, and shall leave the work clean and ready for use. If the Contractor does not attend to such cleaning immediately upon request, the Engineer may cause cleaning to be done by others and charge the cost of same to the responsible Contractor. Each Contractor shall be responsible for all damage from fire which originates in, or is propagated by, accumulations of his rubbish or debris.
- B. After completion of all work and before final acceptance of the work, each Contractor shall thoroughly clean all equipment and materials and shall remove all foreign matter such as grease, dirt, plaster, labels, stickers, etc., from the exterior of materials, equipment and all associated fabrication. Pay particular attention to finished area surfaces such as lighting fixture lenses, lamps, reflectors, panels, etc.

39. PAINTING

A. Each fixture device, panel, junction box, etc., that is located in a finished area shall be provided with finish of color and type as selected or approved by the Architect or Engineer. If custom color is required, it shall be provided at no additional cost to the Owner. All other equipment, fixtures or devices located in finished or unfinished areas, that are not required to have or are provided with finish color or coating shall be provided in a prime painted condition, ready to receive finish paint or coating. All galvanized metal in finished areas shall be properly prepared with special processes to receive finish paint as directed and approved by the Architect.

40. INDEMNIFICATION

A. The Contractor shall hold harmless and indemnify the Engineer, employees, officers, agents and consultants from all claims, loss, damage, actions, causes of actions, expense and/or liability resulting from, brought for, or on account of any personal injury or property damage received or sustained by any person, persons, (including third parties), or any property growing out of, occurring, or attributable to any work performed under or related to this contract, resulting in whole or in part from the negligence of the Contractor, any subcontractor, any employee, agent or representative.

41. HAZARDOUS MATERIALS

- A. The Contractor is hereby advised that it is possible that asbestos and/or other hazardous materials are or were present in this building(s). Any worker, occupant, visitor, inspector, etc., who encounters any material of whose content they are not certain shall promptly report the existence and location of that material to the Contractor and/or Owner. The Contractor shall, as a part of his work, insure that his workers are aware of this potential and what they are to do in the event of suspicion. He shall also keep uninformed persons from the premises during construction. Furthermore, the Contractor shall insure that no one comes near to or in contact with any such material or fumes therefrom until its content can be ascertained to be non-hazardous.
- B. CMTA, Inc., Consulting Engineers, have no expertise in the determination of the presence of hazardous materials. Therefore, no attempt has been made by them to identify the existence or location of any such material. Furthermore, CMTA nor any affiliate thereof will neither offer nor make any recommendations relative to the removal, handling or disposal of such material.
- C. If the work interfaces, connects or relates in any way with or to existing components which contain or bear any hazardous material, asbestos being one, then, it shall be the Contractor's sole responsibility to contact the Owner and so advise him immediately.
- D. The Contractor by execution of the contract for any work and/or by the accomplishment of any work thereby agrees to bring no claim relative to hazardous materials for negligence, breach of contract, indemnity, or any other such item against CMTA, its principals, employees, agents or consultants. Also, the Contractor further agrees to defend, indemnify and hold CMTA, its principals, employees, agents and consultants, harmless from any such related claims which may be brought by any subcontractors, suppliers or any other third parties.

42. ABOVE-CEILING AND FINAL PUNCH LISTS

- A. The Contractor shall review each area and prepare a punch list for each of the subcontractors, as applicable, for at least two stages of the project:
 - (1) For review of above-ceiling work that will be concealed by tile or other materials well before substantial completion.

- (2) For review of all other work as the project nears substantial completion.
- B. When <u>all</u> work from the Contractor's punch list is complete at each of these stages and <u>prior</u> to completing ceiling installations (or at the final punch list stage), the Contractor shall request that the Engineer develop a punch list. This request is to be made in writing seven days prior to the proposed date. After all corrections have been made from the Engineer's punch list, the Contractor shall review and initial off on <u>each</u> item. This signed-off punch list shall be submitted to the Engineer. The Engineer shall return to the site <u>once</u> to review each punch list and all work <u>prior to</u> the ceilings being installed and at the final punch list review.
- C. If additional visits are required by the Engineer to review work not completed by this review, the Engineer shall be reimbursed directly by the Contractor by check or money order (due net 10 days from date of each additional visit) at a rate of \$140.00 per hour for extra trips required to complete either of the above-ceiling or final punch lists.



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The following is CMTA's guide for required electrical information relative to the Schedule of Values. Please utilize all items that pertain to this project and add any specialized system as required. A thorough and detailed schedule of values will allow for fair and equitable Pay Application approval and minimize any discrepancies as to the status of the job.

Electrical

Description of Work	Scheduled Value	Labor	Material
Shop Drawings			
Mobilization/Permits			
Temporary Utilities			
Demolition			
Switchgear Modifications			
Branch Panels			
Feeder Conduit			
Branch Conduit			
Feeder Wire			
Branch Wiring			
Fire Alarm Conduit & Wiring			
Fire Alarm Devices			
Light Fixture Interior			
Light Fixture Exterior			
Lighting Control System			
Wiring Devices			
Intercom/Paging Conduit			
Intercom/Paging Wiring			

Intercom/Paging Devices		
CCTV System Conduit		
Data System Conduit		
Electrical Inspection		
Owner Training		
Record Drawings		
O & M Manuals		
Punch List / Closeout		

SECTION 260502 - SCOPE OF THE ELECTRICAL WORK

1. GENERAL

Each Electrical Contractor's attention is directed to Section 260501 - General Provisions, Electrical, and all other Contract Documents as they apply to his work.

2. SCOPE OF THE ELECTRICAL WORK

The Electrical work for this project includes all labor, materials, equipment, fixtures, excavation, backfill and related items required to completely install, test, verify place in service and deliver to the Owner complete electrical systems in accordance with the accompanying plans and all provisions of these specifications. This work shall primarily include, but is not limited to the following:

- A. All conduits, conductors, outlet boxes, fittings, etc.
- B. All switchgear, panels, disconnect switches, fuses, contactors, starters, etc.
- C. All wiring devices and device plates.
- D. All light fixtures and lamps.
- E. Electrical connection to all electrically operated equipment furnished and/or installed by others, including powered casework, kitchen equipment, etc.
- F. Digital video surveillance system rough-in.
- G. Data rough-in.
- H. Paging/Intercom system.
- I. Master clock system.
- J. Fire alarm system.
- K. All necessary coordination with electric utility company, telephone company, cable television company, etc. to ensure that work, connections, etc., that they are to provide is accomplished and that service to this facility is delivered complete prior to occupancy.
- L. Paying all necessary fees and cost for permits, inspections, work by utility companies (power, telephone, CATV, etc). The Contractor shall contact the utility companies prior to submitting a bid to determine exactly these charges will be.

SECTION 260503 - SHOP DRAWINGS, LITERATURE, MANUALS, PARTS LISTS, AND SPECIAL TOOLS

1. SHOP DRAWINGS

- A. Each Contractor shall submit to the Architect and/or Engineer, within thirty days after the date of the Contract, seven sets of shop drawings and/or manufacturer's descriptive literature on all equipment required for the fulfillment of his contract. Each shop drawing and/or manufacturer's descriptive literature shall have proper notation indicated on it and shall be clearly referenced so the specifications, schedules, light fixture numbers, panel names and numbers, etc., so that the Architect and/or Engineer may readily determine the particular item the Contractor proposes to furnish. All data and information scheduled, noted or specified by hand shall be noted in color red on the submittals. The Contractor shall make any corrections or changes required and shall resubmit for final review as requested. Review of such drawings, descriptive literature and/or schedules shall not relieve the Contractor from responsibility for deviation from drawings or specifications unless they have, in writing, directed the reviewer's attention to such deviations at the time of submission of drawings, literature and manuals; nor shall it relieve them from responsibility for errors or omissions of any nature in shop drawings, literature and manuals; nor shall it relieve them from responsibility for errors or omissions of any nature in shop drawings, literature and manuals.
- B. If the Contractor fails to comply with the requirements set forth above, the Architect and/or Engineer shall have the option of selecting any or all items listed in the specifications or on the drawings, and the Contractor will be required to provide all materials in accordance with this list.
- C. Review of shop drawings by the Engineer applies only to conformance with the design concept of the project and general compliance with the information given in the contract documents. In all cases, the installing Contractor alone shall be responsible for furnishing the proper quantity of equipment and/or materials required, for seeing that all equipment fits the available space in a satisfactory manner and that piping, electrical and all other connections are suitably located.
- D. The Engineer's review of shop drawings, schedules or other required submittal data shall not relieve the Contractor from responsibility for the adaptability of the equipment or materials to the project, compliance with applicable codes, rules, regulations, information that pertains to fabrication and installation, dimensions and quantities, electrical characteristics, and coordination of the work with all other trades involved in this project.
- E. No cutting, fitting, rough-in, connections, etc., shall be accomplished until reviewed equipment shop drawings are in the hands of the Contractors concerned. It shall be each Contractor's responsibility to obtain reviewed shop drawings and to make all connections, etc. in the neatest and most workmanlike manner possible. Each Contractor shall coordinate with all the other Contractors having any connections, roughing-in, etc., to the equipment, to make certain proper fit, space coordination, voltage and phase relationships are accomplished.
- F. In accord with the provisions specified hereinbefore, shop drawings, descriptive literature and schedules shall be submitted on each of the following indicated items as well as any equipment or systems deemed necessary by the Engineer:

Power Equipment

- Switchgear and panelboards.
- Circuit breakers or fusible switches, per each type.
- Power and lighting contactors.
- Disconnect switches.
- Fuses, per each type required.

- Magnetic starters, if not submitted with unit equipment by supplier.
- Control components (relays, timers, selector switches, pilots, etc.)

Raceways

- Cable tray and each type of cable tray fitting.
- Wireways and each type of wireway fitting.
- Surface-mounted metal or plastic raceways, with each type of fitting.
- J-hook or Bridle ring assemblies.

Devices

- Each type of wiring device and their coverplates.
- Any special items not listed above.

Lighting

- Light fixtures, each by type, marked to indicate all required accessories and lamp selection. Also provide original color selection chart to allow Architect and/or Engineer to indicate color selection.
- Lighting standards or poles.
- Photocells, time clocks or other lighting accessories.
- Lighting control system schematic, functional & programming data, along with building specific floor plan drawings indicating each device, master controller, input device locations and specific interconnect/wiring requirements for each device.

Systems

<u>Note</u>: Each system submittal is to be complete with legible cutsheets for all devices, equipment, special wiring, etc. Include system specific wiring schematics showing each device and its specific interconnect/wiring requirements. For rack mounted equipment, provide a scalable elevation drawing with proposed component locations & specific interconnect wiring requirements for each component/panel. Also provide scale building specific layout drawings that indicate device placement, wiring, etc. Refer to the specific system's specification for additional submittal requirements where required.

- Fire alarm system.
- Building paging/intercom audio system.
- Clock/program system.

Miscellaneous

- Control panel assemblies.
- Non-standard junction/pullboxes.
- Manholes, hand holes, and all outdoor electrical equipment and fittings.

2. SPECIAL WRENCHES, TOOLS AND KEYS

A. Each Contractor shall provide, along with the equipment provided, any special wrenches or tools necessary to dismantle or service equipment or appliances installed by him. Wrenches shall include necessary keys, handles and operators for valves, switches, breakers, etc. and keys to electrical panels, emergency generators, alarm pull boxes and panels, etc. At least two of any such special wrench, keys,

etc. shall be turned over to the Architect prior to completion of the project. Obtain a receipt that this has been accomplished and forward a copy to the Engineer.

3. FIRE ALARM SHOP DRAWINGS

A. The Contractor and equipment supplier shall submit to the Architect and/or Engineer, fire alarm system shop drawings complete with catalog cuts, descriptive literature and complete system wiring diagrams for their review prior to the Contractor's submittal to the Commonwealth's Department of Housing, Buildings and Construction or other governing authority for their review. No work shall be done until drawings are approved by the Kentucky Department of Housing, Buildings and Construction.

4. MAINTENANCE AND OPERATION MANUALS

- A. Prior to substantial completion of the project, the Contractor shall deliver to the Engineers (in addition to the required Shop Drawings) three complete copies of operation and maintenance instructions and parts lists for all equipment provided. Formatting and content shall follow the guidelines outlined in the latest version of ASHRAE Application Handbook, Guideline 4. As a minimum, the following shall be included:
- The **operation and maintenance document directory** should provide easy access and be well organized and clearly identified.
- **Emergency information** should be immediately available during emergencies and should include emergency and staff and/or agency notification procedures.
- The operating manual should contain the following information:
 - I. General Information
 - a. Building function
 - b. Building description
 - c. Operating standards and logs
 - II. Technical Information
 - a. System description
 - b. Operating routines and procedures
 - c. Seasonal start-up and shutdown
 - d. Special procedures
 - e. Basic troubleshooting
- The maintenance manual should contain the following information:
 - I. Equipment data sheets
 - a. Operating and nameplate data
 - b. Warranty
 - II. Maintenance program information
 - a. Manufacturer's installation, operation, and maintenance instructions
 - b. Spare parts information
 - c. Preventive maintenance actions
 - d. Schedule of actions
 - e. Action description
 - f. History
- Test reports document observed performance during start-up and commissioning.

SECTION 260504 - SLEEVING, CUTTING, PATCHING AND REPAIRING

1. GENERAL

- A. The Contractor shall be responsible for all openings, sleeves, trenches, etc. that he may require in floors, roofs, ceilings, walls, etc. and shall coordinate all such work with the General Contractor and all other trades. <u>He shall determine and coordinate any openings which he is to provide before submitting a bid proposal in order to avoid conflict and disagreement during construction</u>. Improperly located openings shall be reworked at the expense of the responsible Contractor.
- B. The Contractor shall plan his work ahead and shall place sleeves, frames or forms through all walls, floors and ceilings during the initial construction, where it is necessary for conduit, buss duct, conductors, wireways, etc. to go through; however, when this is not done, this Contractor shall do all cutting and patching required for the installation of his work, or he shall pay other trades for doing this work when so directed by the Architect. Any damage caused to the building by the workmen of the responsible Contractor must be corrected or rectified by him at his own expense.
- C. The Contractor shall cut holes in casework, equipment panels, etc. (if any), as required to pass pipes in and out.
- D. The Contractor shall notify other trades in due time where he will require openings of chases in new concrete or masonry. He shall set all concrete inserts and sleeves for his work. Failing to do this, he shall cut openings for his work and patch same as required at his own expense.
- E. Openings in slabs and walls shall be cut with core drill. Hammer devices will not be permitted. Edges of trenches and large openings shall be scribe cut with a masonry saw.
- F. Cast iron sleeves shall be installed through all walls where pipe enters the building below grade. Sleeves shall be flush with each face of the wall and shall be sufficiently larger than the entering pipe to permit thorough caulking with lead and oakum between pipe and sleeve for waterproofing.
- G. In all cases, sleeves shall be at least two inches larger than nominal pipe diameter.
- H. Sleeves passing through roof or exterior wall or where there is a possibility of water leakage and damage shall be caulked water tight for horizontal sleeves and flashed and counter-flashed with lead (4 lb.) or copper and soldered to the piping, lapped over sleeve and properly weather sealed. Any roof penetration shall not void or lessen the warranty in any way.
- I. All rectangular or special shaped openings in plaster, stucco or similar materials including gypsum board shall be framed by means of plaster frames, casing beads, wood or metal angle members as required. The intent of this requirements is to provide smooth even termination of wall, floor and ceiling finishes as well as to provide a fastening means for lighting fixtures, panels, etc. Lintels shall be provided where indicated over all openings in bearing walls, etc.
- J. No cutting is to be done at points or in a manner that will weaken the structure and unnecessary cutting must be avoided. If in doubt, contact the Architect.
- K. The Contractor shall be responsible for properly shoring, bracing, supporting, etc. any existing and/or new construction to guard against cracking, settling, collapsing, displacing or weakening while openings are being made. Any damage occurring to the existing and/or new structures, due to failure to exercise proper precautions or due to action of the elements, shall be promptly and properly made good to the satisfaction of the Architect.

L. All work improperly done or not done at all as required by the Contractor will be performed by others. The cost of this work shall be paid for by the Contractor who is in non-compliance with the Contract.

2. SLEEVES, PLATES AND ESCUTCHEONS

- A. The Contractor shall provide and locate all sleeves required for his work before the floors and surface being penetrated are built, otherwise the Contractor shall core drill for conduits where sleeves were not installed, or where incorrectly located. Core drilling is the only acceptable alternative to sleeves. Do not chisel openings. Where sleeves are placed in exterior walls or in slabs on grade, the space between the conduit and the sleeves shall be made completely and permanently water tight.
- B. Conduits that penetrates fire and/or smoke rated assemblies shall have sleeves installed as required by the manufacturer of the rating seal used.
- C. At all other locations either pipe sleeves or core drilled openings are acceptable.
- D. Where thermal expansion does not occur, the wall may be sealed tight to the conduit.
- E. Sleeves shall be constructed of rigid steel conduit. Sleeves in floors shall extend 6" above finished floor level.
- F. Fasten sleeves securely in floors, walls, so that they will not become displaced when concrete is poured or when other construction is built around them. Take precautions to prevent concrete, plaster or other materials being forced into the space between pipe and sleeve during construction.
- G. In all areas where ducts are exposed and ducts pass thru floors, the opening shall be surrounded by a 4 inch high by 3 inch wide concrete curb.
- H. Escutcheon plates shall be provided for all conduit passing thru walls, floors and ceilings. Plates shall be nickel plated, of the split ring type, of size to match the pipe or conduit. Where plates are provided for pipes passing thru sleeves which extend above the floor surface, provide deep recessed plates to conceal the sleeves.
- I. When installing conduit, pipe, or any other work in insulated concrete form (ICF) walls, the responsible subcontractor for the work shall provide spray foam insulation to patch the rigid insulation to maintain full integrity of the insulating value of the wall after the mechanical and electrical work is complete. Furthermore all new work shall NOT be installed in concrete center of wall. All mechanical and electrical installations shall be on the interior side of the concrete.

SECTION 260505 - DEMOLITION, RESTORATION AND SALVAGE

1. GENERAL

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and all other divisions of these specifications apply to work specified in this section.

2. DESCRIPTION OF WORK

- A. This section covers all demolition, restoration and salvage required to perform the electrical work indicated on the drawings, specified and/or as required to complete the project. It is the intent of this section of work to remove all existing electrical equipment, materials, etc. which are not required for the completed building and to restore any and all finished surfaces to their original type and conditions. To accomplish these requirements, the Contractor(s) shall, at his own expense, engage the services of others already performing finish work on this project. All work shall be completed to the satisfaction of the Architect/Engineers whose decisions shall be final. This requirement shall apply to all restoration work whether indicated or specified.
- B. The Contractor shall lawfully dispose of any removed P.C.B.-bearing ballasts (containing polychlorinated biphenyl), and all mercury-vapor bearing lamps, in accordance with all state, local, federal and other applicable laws and regulations.

3. ELECTRICAL

- A. Where electrical fixtures, equipment or other materials are removed and/or relocated, all abandoned conduit and conductors shall be removed in exposed areas. In concealed areas, materials shall be abandoned in place or removed as indicated and patch all openings.
- B. The Contractor shall be responsible for the removal and/or relocation of any electrical equipment, fixtures, devices, appurtenances, etc., which may, in the course of construction, interfere with the installation of any new and/or relocated Architectural, Mechanical, Electrical, Structural or Fire Protection Systems whether indicated or not.

4. REPAIR

A. Unless otherwise indicated, the Contractor shall be responsible for the patching and repairing of all holes, etc. in the ceiling, wall and floors where electrical equipment is removed.

5. SALVAGE

A. It is the intent of this section to deliver to the Owner all components of any electrical system which may be economically reused by him. The Contractor shall make every effort to remove reusable components without damage and deliver them to a location designated by the Owner.

SECTION 260508 - COORDINATION AMONG TRADES, SYSTEMS INTERFACING AND CONNECTION OF EQUIPMENT FURNISHED BY OTHERS

1. COORDINATION

- A. The Contractor is expressly directed to read the General Conditions and all sections of these specifications for all other trades and to study all drawings applicable to his work, including Architectural, Plumbing, Fire Protection, Mechanical and Structural drawings, to the end that complete coordination between trades will be affected. Each Contractor shall make known to all other contractors the intended positioning of materials, raceways, supports, equipment and the intended order of his work. Coordinate all work with other trades and proceed with the installation in a manner that will not create delays for other trades or affect the Owner's operations.
- B. Special attention to coordination shall be given to points where raceways, fixtures, etc., must cross other ducts or conduit, where lighting fixtures must be recessed in ceilings, and where fixtures, conduit and devices must recess into walls, soffits, columns, etc. It shall be the responsibility of each Contractor to leave the necessary room for other trades. No extra compensation or time will be allowed to cover the cost of removing fixtures, devices, conduit, ducts, etc. or equipment found encroaching on space required by others.
- C. The Contractor shall be responsible for coordination with all trades to ensure that they have made provision for connections, operational switches, disconnect switches, fused disconnects, etc., for electrically operated equipment provided under this or any other division of the specifications, or as called for on the drawings. Any connection, circuiting, disconnects, fuses, etc., that are required for equipment operation shall be provided as a part of this contract.
- D. If any discrepancies occur between accompanying drawings and these specifications and drawings and specifications covering other trade's work, each trade shall report such discrepancies to the Architect far enough in advance so that a workable solution can be presented. No extra payment will be allowed for relocation of fixtures, devices, conduit, and equipment not installed or connected in accordance with the above instructions.
- E. In all areas where air diffusers, devices, lighting fixtures and other ceiling-mounted devices are to be installed, the Mechanical Trade(s) and the Electrical Trade and the General Trades shall coordinate their respective construction and installations so as to provide a combined symmetrical arrangement that is acceptable to the Architect and Engineer. Where applicable, refer to reflected ceiling plans. Request layouts from the Architect or Engineer where in doubt about the potential acceptability of an installation.

2. INTERFACING

Each Electrical Trade, Specialty Controls Trade, Mechanical Trade and the General Trades, etc., shall insure that coordination is affected relative to interfacing of all systems. Some typical interface points are (but not necessarily all):

- A. Connection of Power lines to Owner's existing or new services.
- B. Connection of all controls to equipment.
- C. Electrical power connections to electrically operated (or controlled) equipment.
- D. Electrical provisions for all equipment provided by other trades or suppliers within this contract.

3. CONNECTION OF EQUIPMENT FURNISHED BY OTHERS

- A. Each Contractor shall make all connections to equipment furnished by others, whenever such equipment is shown on any part of the drawings or mentioned in any part of the Specifications, unless otherwise specifically specified hereinafter.
- B. All drawings are complementary, one trade of the other. It is the Contractor's responsibility to examine all drawings and specifications to determine the full scope of his work. The project Engineers have arranged the specifications and drawings in their given order solely as a convenience in organizing the project, and in no way shall they imply the assignment of work to specific trades, contractors, subcontractors or suppliers.
- C. Supervision to assure proper installation, functioning and operation shall be provided by the Contractor furnishing the equipment or apparatus to be connected.
- D. Items indicated on the drawings as rough-in only (RIO) will be connected by the equipment supplier or Owner, as indicated. The Contractor shall be responsible for rough-in provisions only as indicated. These rough-ins shall be in accord with the manufacturer's or supplier's requirements.
- E. For items furnished by others, relocated, or RIO, the Contractor shall obtain from the supplier or shall field determine as appropriate, the exact rough-in locations and connection sizes for the referenced equipment.
- F. The Contractor shall be responsible for coordinating with the General and all other trades, as necessary, to determine any and all final connections that he is to make to equipment furnished by others.

SECTION 260519 - CONDUCTORS, IDENTIFICATION, SPLICING DEVICES & CONNECTORS

1. GENERAL

- A. This section of the Specifications covers all of the electrical power, lighting, and control power (line voltage) conductors, but does not include communications, data or signal system conductors, which are specified separately in these specifications.
- B. All conduits installed without conductors shall have a 200 lb. test nylon string installed for future use, tied off securely at each end.
- C. No more than 40% conduit fill is permitted for <u>any</u> conduit system, including video, intercom, data, power or other signal circuits unless specifically indicated otherwise on the plans.
- D. Lighting circuits: No more than five conductors shall be installed in conduit except for switch legs and travelers in multi-point switching arrangements.
- E. Receptacle circuits: If multiple circuits are pulled in a single homerun, a dedicated neutral shall be provided for each phase conductor. In these cases, a maximum of seven conductors are permitted in a single conduit. Conductors shall be derated per N.E.C.
- F. Intentional or unintentional painting of exposed low voltage or line voltage cabling is prohibited. The contractor shall ensure that exposed cabling is adequately protected from direct painting or overspray whether painting is required within the electrical specifications or required by other disciplines/trades. The contractor shall review the painting requirements for all disciplines and shall provide cabling protection as required. Where exposed cabling is being installed in exposed ceiling or wall spaces that are required to be painted, the contractor shall provide alternate options for cable colors and shall provide submittals for such cabling to engineer for approval.

2. MATERIALS

A. CONDUCTORS

- (1) All conductors shall be 98% conductive annealed copper unless otherwise noted, UL listed and labeled.
- (2) Lighting and receptacle branch circuits shall be not less than No. 12 copper wire or of the sizes shown on the drawings with Type THW, THHN or THWN insulation. All feeder circuits shall be Type THW or THWN of the size as shown on the Contract Drawings. THHN wiring shall only be installed in overhead, dry or damp locations. THWN or THW wiring shall be used for all circuits pulled in underground or other wet locations.
- (3) Conductors No. 10 and smaller sizes of wire shall be solid. Conductors No. 8 and larger sizes shall be stranded.
- (4) Conductors for fire alarm wiring shall be stranded and in full compliance with N.E.C. 760. All fire alarm conductors shall be installed within conduit and enclosed junction boxes.
- (5) All wire on the project shall be new, in good condition, and shall be delivered in standard coils or reels.
- (6) The color of the wire shall be selected to conform with Section 210-5 of the latest edition of the National Electrical Code. Refer also to 260519-4, Color Coding.

- (7) All equipment grounding conductors shall have green color insulation or if larger than #8, shall be taped for two inches, green color at every termination and pullbox access point.
- (8) Conductors used for motor connections and connections to vibrating or oscillating equipment shall be extra flexible.
- (9) Conductors for main ground from neutral bus, equipment grounding bus, building steel, grounding grid and main cold water pipe connection shall be bare copper.
- (10) All conductors shall be identified by color code and by means of labels placed on conductors in all junction boxes and at each terminal point with Brady, Ideal, T & B or approved equivalent labels indicating source, circuit No. or terminal No.
- (11) Branch wiring and feeder conductors that are greater than 100' in length shall be increased at least one size to compensate for voltage drop. All circuits shall be installed and sized for a maximum 2% voltage drop. As calculated using 80% of the supply breaker rating as the load. Adjust conductors and conduit size accordingly for actual field installed conditions.

B. SPLICING DEVICES & CONNECTORS

- (1) Splicing devices for use on No. 14 to No. 10 AWG conductors shall be pressure type such as T & B "STA-KON", Burndy, Reliable or approved equivalent.
- (2) Wire nuts shall be spring pressure type, insulation 600V, 105°C insulation, up to #8 size. Greater than #6 Cu shall be a compression type connection, 600V insulation, cold shrink tubing, taped to restore full insulation value of the wire being spliced.
- (3) Pressure crimp-applied ring type (or fork with upturned ends) terminations shall be employed on motor and equipment terminals where such terminals are provided on motor and equipment leads or on all stranded wire terminations using No. 10 AWG or smaller conductors.
- (4) Splices, where necessary, shall be made with hydraulically-set "Hy-press" or equivalent crimped connectors. All splices shall be insulated to the full value of the wiring insulation using a cold-shrink kit or the equivalent in built-up materials.
- (5) Large connectors (lugs) at terminals shall be mechanical type, hex-head socket or crimp-on style, installed per the manufacturer's recommendations.
- (6) Exterior underground connections made between bare ground wires or to ground rods shall be exothermically welded, "Cadweld" or equivalent.
- (7) The use of split-bolt clamps will be permitted in wireways at service entrance only. Torque to 55 footpounds or as recommended by manufacturer.
- (8) No aluminum conductors shall be used.

3. INSTALLATION

A. The pulling of all wires and cable on this project shall be performed in strict compliance with applicable sections of the National Electrical Code. No conductor entering or leaving a cabinet or box shall be deflected in such a manner as to cause excess pressure on the conductor insulation. Conductors shall only be installed after insulating bushings are in place.

- B. The radius of bending of conductors shall be not less than eighteen times the outside diameter of the conductor insulation or more, if recommended by the manufacturer.
- C. Conductors installed within environmental air plenums shall be per N.E.C. Article 800 and other applicable codes, with FEP-type insulation or an approved equivalent. Also provide plenum-rated tie-wraps where plastic straps or other supports, etc., are installed in plenum areas.
- D. Where indicated, communications conductors that are installed exposed shall not be routed across ceilings or ductwork. They shall be held up against building structure or against permanent support members. They shall be installed in such a manner that they do not interfere with the access to or operation of equipment or removal of ceiling tiles. Tie-wraps shall be installed in such a manner so as to bundle conductors neatly, allowing runouts of single conductors or groups to drop down to equipment served. Install grommeting where dropping out of trays or into panels or service columns. Install sleeves with bushings where penetrating partitions. Firestop sleeves with approved material. Do not penetrate firewalls if so indicated on plans. Refer to the drawings for support requirements and details on routing exposed communications conductors.
- E. Conductors for isolated power systems shall be installed in as short a run of conduit as practicable. No pulling soap shall be used on conductors in isolated power systems.
- F. Where conductors are installed in industrial facilities, they shall be per J.I.C. standards.
- G. Maximum permissible pulling tensions, as recommended by the manufacturer for any given type of cable or wire installed shall not be exceeded. Utilize special remote readout equipment as required to ensure compliance. Use particular caution when installing twisted pair data cable or fiber optic cables -- forces permitted for pulling in are typically very low for these cable types.
- H. All cables and wiring, regardless of voltage, installed in manholes or cable vaults shall be routed in such a manner to provide a minimum of 6 feet of slack cable for future splicing. Install cables along walls by utilizing the longer route from entry to exit. If both routes are symmetrical, provide a loop of cable secured to wall. All cables shall be tied to insulated cable supports on wall-mounted racks, spaced a maximum of three feet apart.
- I. Where multiwire branch circuits are allowed, the phases and neutral shall be wire-tied together in the panelboard and in all pull boxes.

4. COLOR CODING DISTRIBUTION VOLTAGE CONDUCTORS, 600 VOLT OR LESS

- A. Conductors to be color coded as follows:
 - (1) 120/208 Volt Conductors
 Phase A Black
 Phase B Red
 Phase C Blue
 Neutral Solid White or White with tracer stripe to match phase conductor
 - (2) 277/480 Volt Conductors
 Phase A Brown
 Phase B Orange
 Phase C Yellow
 Neutral Solid Gray or White with tracer stripe to match phase conductor

- (3) Control Wiring Red, or as indicated.
- (4) Conductors within enclosures that may be energized when enclosure disconnect is off yellow, or taped with 1/2" yellow tape every 6" of length, inside enclosure. Provide lamacoid plate warning sign on front of enclosure where this condition occurs.
SECTION 260526 - GROUNDING

1. GENERAL

- A. All metallic conduit, raceways, cable trays, wireways, supports, cabinets and equipment shall be grounded in accordance with the latest issue of the National Electrical Code, as shown on the Contract Drawings and in accord with the requirements of the local authority having jurisdiction, as applicable.
- B. The size of the equipment grounding conductors, grounding electrode conductors and service grounding conductors shall be not less than that given in Article No. 250 of the National Electrical Code, and/or as shown on the Contract Drawings. Where ungrounded conductor sizes are increased to minimize voltage drop, grounded conductor sizes shall be increased in the proper proportion.
- C. Grounding bus and non-current carrying metallic parts of all equipment and raceway systems shall be securely grounded by connection to common ground.
- D. The service entrance main ground bus shall also be connected to the main cold metallic water pipe within three feet of where it enters the building, on both the house and street sides of the main shut-off valve with a properly sized bonding jumper. A properly sized bonding jumper shall also be provided to the frame of any steel structure utilized in the construction. The steel frame of the building (if any) shall be made electrically continuous.

2. MATERIALS

- A. Ground wires and cables shall be of the AWG sizes shown on the Contract Drawings or shall be sized in accord with the prevailing codes. All ground wires and cables shall be copper.
- B. All grounding fittings shall be heavy cast bronze or copper of the mechanical type except for underground installations or interconnection of grounding grid to cable, columns and ground electrodes, which shall be thermically welded type as manufactured by Cadweld, Burndy Co., Therm-O-Weld, or approved equivalent. Other bonding clamps or fittings in above ground locations shall be as manufactured by O.A. Co., T & B, Burndy, or approved equivalent.
- C. Ground electrode pipe systems shall be solid copper construction. Ground rods shall be 5/8" minimum diameter, eight feet long, copperweld steel. All ground electrode systems shall be installed in accord with manufacturer's recommendations, U.L. listings, National Electrical and National Electrical Safety Codes.

3. INSTALLATION

- A. All grounding conductors shall be protected from mechanical injury and shall be rigidly supported. Where ground conductors are run through flexible conduit and through panelboard switchboard or motor control center feeders, they shall be securely bonded to such conduit thru the use of grounding bushings at the entrance and exit. All connection of equipment shall be made with an approved type of solderless connection and same shall be bolted or clamped to equipment or conduit.
- B. All equipment grounding conductors to lighting fixtures, devices, receptacles, electric heaters, furnace and other equipment not exceeding No. 8 AWG in size shall be green colored Type "THWN".
- C. Equipment ground connections to GFI circuit breakers shall be carried and bonded to each outlet on the circuit. Provide a separate equipment grounding conductor with green color insulation.

- D. Resistance to the grounding at the service entrance equipment shall be in accordance with the N.E.C. for style of construction and shall not exceed ten ohms as measured by the described testing method.
- E. All circuits shall have a separate grounding conductor, except as otherwise noted.
- F. When grounding systems are completely installed and all grading in the area of the service grounding electrode has been completed up to finish elevations, perform a fall-of potential or other approved test to determine actual system resistance to earth. Report results to the Engineer in writing. Refer to testing provisions in this section of specifications.
- G. Where separately-derived systems are utilized as part of the power distribution network, the neutral leg of the secondary side of generators, transformers, etc., shall be connected to a grounding electrode in accordance with the manufacturer's recommendations.
- H. The Contractor shall ensure that the ground return path thru building structural steel or other means is electrically continuous back to the service grounding electrode and is of adequate capacity and impedance to carry the maximum expected fault or other current. Where no electrically continuous steel building frame is available, the Contractor shall provide a properly sized ground bar and ground conductor routed back to the main facility ground bus.
- I. Where a building's steel frame is made electrically discontinuous by masonry breaks (as at firewalls, etc.), the Contractor shall provide an accessible thermically welded bonding jumper of #500MCM copper to bond the building steel frame sections together, making the entire steel frame electrically continuous. The installation of these bonding jumpers shall be reviewed by the Engineer prior to their being covered by construction.
- J. Where lightning protection systems are utilized on the work, their electrodes and conductors shall be electrically segregated from the building service ground, except where connections to structural elements are required for the proper installation of these systems. Lightning protection grounds shall only be utilized for lightning grounding applications, in accord with U.L. and manufacturer's recommendations.
- K. Grounding connections shall <u>never</u> be made to fire protection, natural gas, flammable gas or liquid fuel piping, except where specifically indicated on the plans.
- L. Where dielectric fittings are utilized in piping systems, the piping system shall **<u>not</u>** be utilized as a ground path. Bonding jumpers shall not be utilized to bridge over such fittings. Piping systems shall <u>not</u> be utilized as ground paths except where specifically required by codes in the case of water piping.

4. GROUND TESTING PROCEDURE

- A. The actual resistance to earth of the service grounding electrode shall be measured by the Contractor via the fall-of-potential method. This testing shall be accomplished after the grounding electrode has been completely installed and the finished grade is achieved.
- B. The results of the testing shall be summarized in a written report by the Contractor, which shall be forwarded to the Engineer for review. The report shall also be included with the operation and maintenance manuals for the Owner's information and future reference. This report is to also contain a detailed description and illustrations of the testing procedure, along with the name and model number of the testing instrument(s).

- C. For the actual testing, the Contractor shall follow the procedures outlined below. A self-contained instrument such as a "Megger" or "Ground OHMMETER" shall be used that is designed to eliminate the influence of stray current effects on the accuracy of the measurements.
 - (1) Connect one side of the instrument to the grounding electrode conductor where it connects to the facility main ground bus (point C1). Disconnect and isolate the grounding electrode conductor for the test.
 - (2) Drive a copperweld reference electrode probe (point C2) into earth between 300 and 500 feet away from C1 and connect to measurement instrument.
 - (3) Drive the movable grounding probe (C3) into earth at ten equally spaced intervals, in a straight line between C1 and C2 points and note the E/I=R resistance readings on a graph at each point.
 - (4) The resistance measurements in OHMS taken from the flat part of the curve shall be averaged to determine the true grounding electrode resistance to earth.
 - (5) At completion of testing, remove reference electrode C2 and all temporary wiring and connections.
 - (6) If actual measurements of grounding electrode indicate a resistance greater than five OHMS, contact the Engineer for instructions. If deemed necessary by the Engineer, additional electrodes shall be placed and the measurement process repeated until the desired ground potential achieved.

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

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 the following:
 - 1. Hangers and supports for electrical equipment and systems.
 - 2. Construction requirements for concrete bases.
- B. Related Sections include the following:
 - 1. Division 26 Section "Vibration and Seismic Controls for Electrical Systems" for products and installation requirements necessary for compliance with seismic criteria.

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. IMC: Intermediate metal conduit.
- C. RMC: Rigid metal conduit.

1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of [five] <Insert number> times the applied force.

1.5 ACTION SUBMITTALS

A. Product Data: For the following:

- 1. Steel slotted support systems.
- 2. Nonmetallic slotted support systems.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
 - 1. Trapeze hangers. Include Product Data for components.
 - 2. Steel slotted channel systems. Include Product Data for components.
 - 3. Nonmetallic slotted channel systems. Include Product Data for components.
 - 4. Equipment supports.

1.6 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- 1.7 QUALITY ASSURANCE
 - A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code -Steel."
 - B. Comply with NFPA 70.

1.8 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit.
 - b. Cooper B-Line, Inc.; a division of Cooper Industries.
 - c. ERICO International Corporation.
 - d. GS Metals Corp.
 - e. Thomas & Betts Corporation.
 - f. Unistrut; Tyco International, Ltd.
 - g. Wesanco, Inc.
 - 3. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.

- 4. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
- 5. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
- 6. Channel Dimensions: Selected for applicable load criteria.
- B. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch- (14-mm-) diameter holes at a maximum of 8 inches (200 mm) o.c., in at least 1 surface.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit.
 - b. Cooper B-Line, Inc.; a division of Cooper Industries.
 - c. Fabco Plastics Wholesale Limited.
 - d. Seasafe, Inc.
 - 3. Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.
 - 4. Fitting and Accessory Materials: Same as channels and angles.
 - 5. Rated Strength: Selected to suit applicable load criteria.
- C. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- D. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
 - 1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Hilti Inc.
 - 2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - 3) MKT Fastening, LLC.
 - 4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.

- 2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
 - a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Cooper B-Line, Inc.; a division of Cooper Industries.
 - 2) Empire Tool and Manufacturing Co., Inc.
 - 3) Hilti Inc.
 - 4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - 5) MKT Fastening, LLC.
- 3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
- 4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
- 5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
- 6. Toggle Bolts: All-steel springhead type.
- 7. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.
- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
 - 1. Secure raceways and cables to these supports.
- D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, raceways may be supported by openings through structure members, as permitted in NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 - 1. To Wood: Fasten with lag screws or through bolts.
 - 2. To New Concrete: Bolt to concrete inserts.
 - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 - 4. To Existing Concrete: Expansion anchor fasteners.
 - 5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
 - 6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
 - 7. To Light Steel: Sheet metal screws.
 - 8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- B. Use **3000-psi**, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03 Section "Cast-in-Place Concrete".
- C. Anchor equipment to concrete base.

- 1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
- 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
- 3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).
- B. Touchup: Comply with requirements in Division 09 painting Sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

SECTION 260531 - CABINETS, OUTLET BOXES AND PULL BOXES

1. GENERAL

- A. This section of the specifications covers all electrical cabinets, outlet boxes and pull boxes.
- B. Continuous runs of conduit shall have properly sized pull boxes at least each eighty-five feet of run, or as near as possible to that limit.

2. MATERIALS & INSTALLATION

- A. Cabinets, Outlet and Pull Boxes:
 - (1) Cabinets for lighting and power, telephone, pull boxes, outlet boxes, or any other purposes specified or shown on the Contract Drawings, shall be constructed of code gauge, galvanized steel with sides formed and corner seams riveted or welded before galvanizing. <u>Boxes assembled with sheet metal</u> <u>screws will not be accepted</u>. Pull boxes shall include all boxes used to reduce the run of conduit to the required number of feet or bends, supports, taps, troughs, and similar applications and shall also be constructed as specified above.
 - (2) All cabinets and boxes for NEMA 1 and 1A application shall be provided with knockouts, as necessary, or shall be cut in the field by approved cutting tools which will provide a clean, symmetrically cut opening. All boxes, except panelboards, shall be provided with code gauge fronts with hex head or pan head screw fasteners. Outdoor cabinets shall be hinged cover with pad locking provisions. Fronts for panelboards shall be as specified for panelboards.
 - (3) Ceiling outlet boxes shall be galvanized steel, 4" octagonal, not less than 2 1/8" deep, with lugs or ears to secure covers. Those for use with ceiling lighting fixtures shall be fitted with 3/8" fixture studs fastened to the back of the boxes, where applicable. Provide adequate support with at least a 2 x safety factor for the anticipated fixture weight.
 - (4) Special size concealed outlet boxes for clocks, speakers, alarms, panels, etc., shall be provided by the manufacturer of the equipment.
 - (5) Floor outlet boxes shall be as specified in Section 262726, fully adjustable unless noted or specified otherwise.
 - (6) Unless otherwise noted on the drawings or in the specifications, outlet boxes shall be installed at the following heights to centerline of box:

Wall Switches, Control Stations				
Convenience Outlets				
Convenience Outlets - Above Counters	Bottom at 2" above top of backsplash			
T.V. Outlets				
T.V. Outlets - At Wall Brackets				
Desk Telephones				
Wall-Mounted Telephone				
Weatherproof Outlets				
Disconnects, Branch Panelboards				
Fire Alarm Manual Stations				
Fire Alarm Audio and/or Visual Units80" AFF to bottom of device or 6" below ceiling, whichever is lower.				

- (7) The location of outlets, as shown on the drawings, shall be considered as approximate only. It shall be incumbent upon this Contractor to study the general building drawings, with relation to spaces surrounding each outlet, in order to make his work fit the work of others and in order that when the devices or fixtures are installed, they will be symmetrically located and will not interfere with any other work or equipment. Any change in fixture or layout shall be coordinated with and approved by the Engineer before this change is made. Regardless of the orientation shown on the drawings, all devices shall be easily accessible when installed.
- (8) Boxes installed in fire rated assemblies shall not compromise the rating of the assembly. The Contractor is responsible for identifying assembly ratings and construction requirements prior to rough-in.
 - a. Listed single and double gang metallic outlet and switch boxes with metallic or nonmetallic cover plates may be used in bearing and nonbearing wood stud and steel stud walls with rating not exceeding 2 h. The boxes shall be fastened to the studs with the openings in the wallboard facing cut so that the clearance between the boxes and the wallboard do not exceed 1/8 in. The boxes shall be installed so that the surface area of individual boxes do not exceed 16 sq in, and the aggregate surface area of the boxes do not exceed 100 sq in per 100 sq ft of wall surface unless approved alternate protection materials are used.
 - b. Boxes located on opposite sides of walls or partitions shall be separated by a minimum horizontal distance of 24 in. This minimum separation distance between the boxes may be reduced when listed Wall Opening Protective Materials are installed according to the requirements of their Classification.
 - c. Boxes installed on opposite sides of walls or partitions of staggered stud construction shall have listed Wall Opening Protective Materials installed with the boxes in accordance with Classification requirements for the protective materials.
 - d. All installation shall be done in accordance with AHJ requirements.
- (9) All outlets, pull boxes, junction boxes, cabinets, etc., shall be sized per the current edition of the National Electrical Code.
- B. Cabinets, outlet boxes and junction or pull boxes shall be threaded for rigid-threaded conduit, dust-tight, vapor-tight or weatherproof as required for areas other than for NEMA 1 or 1A application. These shall be as manufactured by Crouse-Hinds, Appleton, Killark, or approved equivalent.
 - (1) NEMA 1 or 1A cabinets, outlet boxes or pull or junction boxes shall be as manufactured by Appleton, Steel City, T & B, or approved equivalent.
 - (2) Outlet boxes for switches, receptacles, telephone, etc., concealed in walls shall be galvanized steel, 2" X 4" X 2" with plaster cover for the number of devices as required. Where outlet boxes are installed in walls of glazed tile, brick, concrete block, or other masonry which will not be covered with plaster or in walls covered by wood wainscot or paneling, deep sectional masonry boxes shall be used and they shall be completely covered with the plates or lighting fixtures. This Contractor shall cooperate with the brick layers, block layers and carpenters to insure that the outlet boxes are installed straight and snugly in the walls. Receptacles shall be set vertically in walls, unless noted otherwise.
 - (3) Outlet boxes mounted in glazed tile, brick, concrete block or other types of masonry walls shall be mounted above or below the mortar joint. Do Not Split The Mortar Joint.

- (4) Boxes for more than two devices shall be for the number of devices required and shall be one piece. No ganging of single switch boxes will be allowed.
- (5) Outlets provided shall have only the holes necessary to accommodate the conduit at the point of installation and shall be rigidly secure in position. Boxes with knockouts removed and openings not used shall be replaced or be provided with a listed knockout closure.
- (6) Openings for conduit entrance in cabinets and boxes shall be prefabricated, punched, drilled and/or reamed. The use of a cutting torch for this purpose is prohibited.

SECTION 260533 - RACEWAYS & FITTINGS

1. GENERAL

- A. This section is intended to specify the raceways, conduit, conduit fittings, hangers, junction boxes, splice boxes, specialties and related items necessary to complete the work as shown on the drawings and specified herein.
- B. This section specifies basic materials and methods and is a part of each Division 26, 27 and 28 that implies or refers to electrical raceways specified therein.
- C. The types of raceways specified in this section include the following:
 - (1) Steel electrical metallic tubing. (E.M.T.)
 - (2) Rigid galvanized steel conduit. (G.R.S.)
 - (3) Intermediate metal conduit (I.M.C.).
 - (4) Rigid aluminum conduit.
 - (5) Flexible metal conduit (aluminum or steel)
 - (6) Liquid tight flexible metal conduit.
 - (7) Rigid nonmetallic conduit.
 - (8) Surface metal raceways.
 - (9) Wireways, wall ducts and trench ducts.
 - (10) Cable tray or cable trough.
 - (11) Duct banks, and their construction.
- D. All raceways, as listed in 1C. above and otherwise specified herein shall be provided in compliance with latest editions of all applicable U.L., NEMA, N.E.C. and A.N.S.I. standards. All conduit, raceways and fittings shall be Underwriters Laboratories listed and labeled, or bear the listing of an agency acceptable to the local authority having jurisdiction.
- E. Conduit and raceways, as well as supporting inserts in contact with or enclosed in concrete shall comply with the latest edition of all A.C.I. standards and the equipment manufacturer's recommendations for such work.
- F. P.V.C. or other non-metallic conduit shall be rated for the maximum operating temperature that could be developed by the conductors it encloses, while in normal operation.
- G. The decision of the Engineer shall be final and binding in any case where a question or inquiry arises regarding the suitability of a particular installation or application of raceways, supports or materials, if other than outlined herein.
- H. Minimum size of conduit shall be 3/4" trade size. All conduit and raceways shall be sized for the number of conductors contained, in accord with the latest edition of the National Electrical Code or any other applicable standards.
- I. The installer of raceway systems shall avoid the use of dissimilar metals within raceway installations that would result in galvanic-action corrosion.

2. MATERIALS

A. STEEL ELECTRICAL METALLIC TUBING

(1) Electrical metallic tubing, (E.M.T.) of corrosion-resistant steel construction shall be permitted for concealed installation in dry interior locations. Electrical metallic tubing shall not be installed in concrete slabs or where exposed to physical damage. Electrical metallic tubing shall be permitted for exposed work in mechanical and electrical rooms and other exposed structure areas where not subjected to physical damage, as determined by the Engineer.

B. RIGID GALVANIZED STEEL CONDUIT

- (1) Rigid galvanized steel conduit shall be used where subject to physical damage for exposed work in mechanical spaces, within factory or other industrial work areas, for exposed fit-up work on machinery, for exposed exterior damp or wet location work, in hazardous atmospheres, in exterior underground locations where installed beneath roadways, where ells occur in underground P.V.C. conduits, or where turning out of concrete encased duct banks, and at other locations as <u>specifically called out</u> on the drawings.
- (2) Rigid galvanized steel conduit shall be used for all building interior power wiring or cables of over 600 Volts.

C. INTERMEDIATE METAL CONDUIT

(1) Unless otherwise indicated on the drawings, intermediate metal conduit (I.M.C.) may be used in any location in place of rigid galvanized steel conduit, as permitted by codes, and as approved by the Engineer.

D. RIGID ALUMINUM CONDUIT

(1) Rigid aluminum conduit, shall be permitted for installation indoors in dry locations only. Under no conditions shall it be cast into concrete slabs or pass thru construction where prolonged contact will degrade the aluminum. All ells used in rigid aluminum conduit systems shall be rigid galvanized steel. Rigid aluminum conduit shall always be used for power wiring greater than 5 KVA and higher than 60 Hz frequency.

E. FLEXIBLE METAL CONDUIT

(1) Flexible conduit shall be used where permitted by NEC. It may be constructed of aluminum or steel. It shall be installed with connectors designed for the purpose. All flexible metal conduit shall be installed as a single piece. No joints shall be installed. Flexible conduit shall not be used in wet or dusty locations or where exposed to oil, water or other damaging environments. An equipment grounding conductor or bonding jumper shall be used at all flexible conduit installations. Maximum permitted length of flexible metal conduit shall be 72", as for light fixture whips unless approved in writing by Engineer.

F. LIQUIDTIGHT FLEXIBLE METAL CONDUIT

(1) Weatherproof flexible metal conduit shall be wound from a single strip of steel, neoprene covered, equivalent to "Liquatite" or "Sealtite" Type "UA". It shall be installed in such a manner that it will not tend to pull away from the connectors. Provide strain relief fittings equivalent to "Kellems" as required where subject to vibration. Flexible connections to motors in dusty areas shall be dust-tight, in areas exposed to the weather - weatherproof.

G. RIGID NON-METALLIC CONDUIT

- (1) Rigid non metallic conduit shall be constructed of P.V.C, nominally schedule 40 weight, except where encased in concrete, where it may be "EB" type. If installation will enclose utility company provided conductors, verify exact type required and install in accord with their standards, if more stringent than this specification.
- (2) Rigid non-metallic conduit may be used in exterior wet or damp locations where installed underslab or underground. It shall not be run in interior locations, except with special permission from the Engineer for use in corrosive environments, and then only if protected from physical damage. No rigid nonmetallic conduit may be installed in environmental air plenums or cast into above-grade concrete slabs. No rigid nonmetallic conduit may be installed in locations where the ambient temperature might exceed the rating of the raceway.
- (3) Where rigid non metallic conduit is placed underground, as for feeder circuits, secondaries or branch circuit runs and where ell is made upward thru a slab on grade, transition the turning ell and the riser to rigid steel conduit to a height of 6" above the concrete slab. Transition may then be made to E.M.T or other approved conduit for remainder of run.
- (4) Flexible nonmetallic conduit shall not be used, except by special permission, obtained in writing from the Engineer.
- (5) Provide equipment grounding conductors of copper, sized as required by codes, in all circuits installed in rigid nonmetallic raceways.

H. SURFACE METAL RACEWAYS

- (1) Surface metal raceways shall be constructed of code gauge corrosion-resistant galvanized steel or aluminum extrusions, and finished in an ivory, buff or grey color as selected by the Architect. Finishes shall be suitable for field painting, prepared by the installing contractor as necessary.
- (2) Surface metal raceways, where used as raceways only, shall be sized for the conductors indicated. Nominal minimum size of such raceways shall be equivalent to Wiremold Co. Series #700, or equivalent by Isotrol or other approved manufacturer.
- (3) Surface metal raceways to be furnished with integral receptacles shall have Simplex Nema 5-20R outlets spaced on centers as indicated on plans. These shall be Wiremold Co. #2200 Series or equivalent Isotrol or other approved manufacturer.
- (4) Surface metal raceways and all components and fittings shall be furnished by a single manufacturer, wherever practical. All trim and cover fittings, flush feed boxes, splices, outlet fittings, etc, necessary for a complete installation shall be provided by the installing contractor. These raceways shall be rigidly mounted with approved fasteners on not to exceed 24" centers in a run, or 6" from ends and on either side of a corner. Refer to plans for notations on exact types of these raceways and outlet configurations.

I. WIREWAYS, WALL DUCT, FLUSH FLOOR TRENCH DUCT

(1) WIREWAYS

a. Wireways of painted steel construction shall be corrosion-resistant, moisture and oil resistant where indicated or necessary. Wireways shall be furnished in norminal sizes of 2 1/2" X 2 1/2", 4" X 4", 6"" X 6", 8" X 8" or 12" X 12", as indicated on plans. Furnish with hinged covers on all

runs and removable covers on all fittings, to allow a continuous unobstructed path for conductor installation. Provide knockouts on all runs, unless otherwise indicated or prohibited by codes.

- b. Provide wireways with hangers of same manufacturer, installed so as to allow unobstructed access to wireway interior. Install at not to exceed 8'-0" centers, closer as needed at fittings and turns. Use 1/4" rod hangers minimum for up to 4"X4", 3/8" rod minimum up to 8"X8", 1/2" rod minimum for 12" X 12".
- c. Wireways shall be equivalent to Square "D" Co. "LD" series, as a minimum standard of construction and quality.

(2) WALL DUCTS

- a. Where wall duct type raceways are indicated to be installed flush, they shall be a minimum 3 1/2" deep by 10" wide (or 18" width, as indicated), furnished with screw covers to overlap flange 1" on each side. Covers shall be furnished in nominal 3'-0" lengths. Provide fully grommeted openings or bushed nipples as needed in coverplates to pass cables thru. Where indicated or required, provide transition fittings between horizontal runs of wireway and wall ducts to properly interface each raceway system.
- b. Where wall ducts are installed flush either vertically or horizontally as a collector duct, provide proper blocking and support in stud walls, adding a layer of studs as needed to prevent undercutting major structural elements of walls. Trim flange shall be set tight to wall surface with 1/16" tolerance each way.
- c. Wall ducts, if indicated to be surface mounted, shall be furnished with flangeless coverplates.
- d. All completed systems shall be provided with a factory prime painted finish, suitable for field finish painting.
- e. Wall ducts shall be equivalent to Square D Company "RWT" Series, as a standard of construction and quality.

(3) TRENCH DUCTS

- a. Trench duct is to be installed flush with finished concrete floor slab with a vertical tolerance to adjacent surfaces of 1/16" plus or minus. Nominal depth of trench duct shall be adjustable from 2 3/8" to 3 1/2", minimum 12" width unless otherwise noted on plans.
- b. Trench duct shall be constructed of code-gauge steel, 14 gauge minimum, with corrosion resistant finish. Surfaces of duct or fittings in contact with concrete shall be painted with two coats of "Asphaltum" or receive equivalent coating or taping prior to placement of concrete.
- c. Furnish trench duct with flat turns, riser transition fittings to wall duct or panelboard as shown, concrete tight couplings, internal barriers as required to separate services, reducers, end closers, tees and all other fittings as indicated or required.
- d. Furnish coverplates of aluminum, 1/4" thickness minimum, with flush fasteners in nominal 24" lengths. Furnish grommeted openings or nipples with insulated bushings as required. Coverplates shall not deflect more than .085" with application of a 200 pound concentrated load. Any compartment over 16" in width shall have additional coverplate support, to meet the deflection criteria above.

- e. Provide (as standard) an aluminum tile trim flange (verify and coordinate with floor finishes). Refer to architectural drawings, where applicable.
- f. Trench duct and coverplates shall be equivalent to Square "D" Company RSV/RCP-AL series, as a standard of quality and construction.

J. DUCT BANKS

- (1) Duct banks are defined as a raceway or raceways installed in underground locations, enclosed in a steel-reinforced concrete envelope. They shall be installed where indicated on the drawings or otherwise required.
- (2) All concrete used in duct bank construction shall be 3000 PSI minimum 28 day compressive strength unless otherwise noted, in accord with latest A.C.I. standards. Testing of concrete shall be the responsibility of the Contractor, as directed by the engineer. Place concrete against undisturbed earth, or provide forming as needed.
- (3) Duct bank raceways shall receive a minimum of 3" concrete cover all sides. Minimum size of any duct bank shall be 12" x 12" square, in cross section. In all cases, local and national codes shall apply to duct bank construction where they exceed the requirements of this specification.
- (4) Each corner of duct bank shall receive a minimum No. 4 steel reinforcing bar with 2" minimum concrete cover on all sides. Lap bars fifteen diameters at all splices. Provide stirrup bars bury 60" on center to tie bars together. Stirrups may be #3 bar. Reinforcing steel shall be rigidly supported during pour and vibration, and shall be constructed to ASTM standards.
- (5) Support for encased raceways shall be as recommended by raceway manufacturer, spaced 8'-0" maximum on centers, rigidly fastened to prevent floating of ducts during concrete pours. Supports shall be of a material compatible with the raceway, and shall be of the interlocking type, forming a rigidly braced installation. Provide base type and intermediate type spacers to suit conduit configurations and sizes.
- (6) Where rigid nonmetallic raceways leave concrete duct banks, a transition to rigid steel conduit shall be made <u>18" inside</u> the concrete envelope. Under no circumstances shall PVC, EB or similar ducts exit concrete envelope, except where duct bank ties into a manhole wall. Provide bell ends at such terminations and dowel duct bank rebars 4" into manhole wall with non-shrink grout. Refer to details on drawings, as applicable. Slope all raceways within duct bank systems such that they shall drain into manholes or pull boxes. Provide proper drainage at manholes or pull boxes to prevent water accumulation.
- (7) Where ducts transition thru manholes, pull boxes or at terminating end, each duct shall be specifically identified. A nomenclature as shown on the drawings or as agreed upon by the installer and engineer shall be utilized to identify each individual duct. A permanent means of identifying each duct, such as engraved lamacoid plates or stamped metal tags shall be used.

K. RACEWAY FITTINGS

(1) Raceway fittings (or condulets) shall be of gray iron, malleable iron or heavy copper-free cast aluminum. They shall be furnished in proper configurations, avoiding excessive plugged openings. Any openings that are left shall be properly plugged. All coverplates shall be gasketed with neoprene or similar approved materials, rated for the environment.

- (2) Where required, raceway fittings shall be provided in explosion-proof configurations rated for the atmosphere. Place conduit seal off fittings at each device in accord with applicable codes. Seal off fittings shall be packed with wadding, and poured with an approved non-shrink sealing compound.
- (3) Where conduit transitions in a run from a cold to a warm environment, (such as at a freezer, refrigerator or exterior wall) sealoff fittings shall be placed on the warm side immediately at the boundary to prevent migration of condensation within raceway systems.
- (4) Expansion fittings shall be provided at all locations where conduits or other raceways cross over expansion joints. Provide copper ground bonding jumpers across expansion fittings.
- (5) Conduit bodies, junction boxes and fittings shall be dust tight and threaded for dusty areas, weatherproof for exterior locations and vapor tight for damp areas. Conduit fittings shall be as manufactured by Crouse Hinds, Appleton, Killark or approved equivalent. All surface mounted conduit fittings as with "FS", "FD", "GUB" Types etc., shall be provided with mounting hubs.
- (6) Where lighting fixtures, appliances or wiring devices are to be suspended from ceiling outlet boxes, they shall be provided with 3/4" rigid conduit pendants. Outlet boxes shall be malleable iron, provided with self-aligning covers with swivel ball joint and No. 14 gauge steel locking ring. Provide safety chain between building structure and ballast housing of light fixtures for all fixtures, appliances or devices greater than 10 lbs weight. Fixtures shall be installed plumb and level.
- (7) Fittings for threaded raceways shall be tapered thread with all burrs removed, reamed ends and cutting oil wiped clean.
- (8) Fittings for E.M.T. conduit shall be of the compression type. Conduit stops shall be formed in center of couplings. All EMT connectors and couplings shall be of formed steel construction.
- (9) Indentation or die-cast fittings shall <u>not</u> be permitted in any raceway system.
- (10) All conduit fittings shall be securely tightened. All threaded fittings shall be engaged seven full threads. Fasteners shall be properly torqued to manufacturer's recommendations.

L. SUPPORTS AND HANGERS

- (1) Supports and hangers shall be installed in accord with all applicable codes and standards. They shall be corrosion resistant, galvanized or furnished with an equivalent protective coating. All electrical raceways shall be hung independently from the building structure with U.L. listed and approved materials. Hangers and supports depending on the support systems of other trades' work shall not be permitted, except with specific approval in writing from the Engineer. The use of tie wire for support or fastening of any raceway system is prohibited. Perforated metal tape shall not be used for raceway support.
- (2) No raceway shall be installed on acoustic tile ceiling tees, or in any location that will impair the functioning, access or code-required clearances for any equipment or system.
- (3) Supports for raceways shall be of materials compatible with the raceway, of malleable iron, spring steel, stamped steel or other approved material. Die-cast fittings are <u>not</u> permitted for supports.
- (4) The installing contractor shall provide all necessary supports and braces for raceways, in a rigid and safe installation, complying with all applicable codes.

- (5) Individual conduits run on building walls or equipment shall be secured by one hole galvanized malleable iron or stamped steel pipe strap or "minerallac" 2-piece straps. The straps are to be anchored by an approved means such as expansion anchors, toggle bolts, through bolts, etc. Where required by codes or other standards, provide spacers behind mounting clamps to space conduits off walls.
- (6) Individual conduits run on building steel shall be secured by means of clamp supports similar and equal to those manufactured by the C.C. Korn Company, Elcen Co., B-Line or approved equivalent. Provide korn clamps, bulb tee clamps, flange clamps, beam clamps, "minerallacs", etc.
- (7) Where feasible, vertical and/or horizontal runs of conduit shall be grouped in common hangers on "trapezes" of channel stock as manufactured by "Unistrut" or equivalent, 1-5/8" minimum depth, 12 gauge. Utilize conduit clamps appropriate to the channel.
- (8) Channel strut systems for supporting electrical equipment or raceways in outdoor wet or corrosive locations shall be constructed of 12 gauge minimum hot dip galvanized steel with 9/16" diameter holes on 8" centers, with finish coat of paint as manufactured by Unistrut, B-Line, Kindorf, or approved equivalent. In indoor dry locations, factory finish paint will be acceptable.
- (9) The minimum diameter of round all-thread steel rods used for hangers and supports shall be 1/4", 20 threads per inch. All-thread rod shall be furnished with a corrosion-resistant finish.
- (10) Welding directly on conduit or fittings is <u>not</u> permitted.
- (11) Provide riser support clamps for vertical conduit runs. Riser support clamps shall be of heavy gauge steel construction. Install riser support clamps at each floor level penetration, or as otherwise required.
- (12) Provide conduit cable support clamps for vertical conductor runs as required or indicated on plans. Clamps to be insulating wedging plug, with malleable iron support ring. Install within properly sized and anchored junction box.
- (13) Spring steel clips and fittings such as those manufactured by HITT-Thomas, Caddy-Erico, or approved equivalent, with black oxide finish are permitted in any indoor dry location for concealed work, where acceptable to the local authority having jurisdiction.

3. INSTALLATION

- A. This Contractor shall lay out and install all conduit systems so as to avoid any other service or systems, the proximity of which may prove injurious to the conduit, or conductors which it confines. All conduit systems, except those otherwise specifically shown to the contrary, shall be concealed in the building construction or run above ceilings. Size of all conduit shall as a minimum conform to the National Electrical Code, unless larger size is indicated on the Contract Drawings.
- B. No conduit larger shall be installed in poured concrete slabs except with permission of the structural engineer. All other shall be held below slab. Conduit shall be held at least 6" from flues or hot water pipes.
- C. All exposed conduit shall be installed with runs parallel or perpendicular to walls, structural members or intersections of vertical planes and ceilings, with right angle turns consisting of cast metal fittings or symmetrical bends unless otherwise shown. All conduit shall have supports spaced not more than eight feet apart.
- D. Conduit shall be installed in such a manner so as to insure against collection of trapped condensation. All runs of conduit shall be arranged so as to be devoid of traps. Trapped conduit runs shall be provided with

explosion proof drains at low points. Runs of conduit between junctions shall not have more than the equivalent of three 90° bends.

- E. Junction boxes shall be installed so that conduit runs will not exceed 85', as shown on the Contract Drawings.
- F. Underground electric, cable TV, telephone service or other rigid steel conduit and underfloor rigid steel conduit below the concrete floor slab shall be painted with two coats of bitumastic paint, such as "Asphaltum".
- G. All underground or underfloor conduits shall be swabbed free of all moisture and debris before conductors are pulled.
- H. At least two 1 inch and four 3/4 inch conduits shall be stubbed from flush-mounted panelboards into the nearest accessible area for future use. Provide suitable closures for these stubs. Identify each stub with a suitable hang tag.
- I. Install electrical raceways in accordance with manufacturer's written instructions, applicable requirements of latest edition of the N.E.C., and NECA "Standard of Installation", complying with recognized industry practices.
- J. Coordinate with other trades, including metal and concrete deck trades, as necessary to interface installation of electrical raceways and components.
- K. Level and square raceway runs, and install at proper elevations and required heights. Hold tight to structure or route through joists webbing wherever possible, to maximize available space and not restrict other trades.
- L. Complete installation of electrical raceways before starting installation of cables or wires within raceways.
- M. All underground conduits shall be buried to minimum depth of 24" from the top of the concrete encasement or raceway to finished grade, unless otherwise noted on plans. Observe minimum burial requirements of local utility company where their standards or regulations apply. Conduits containing primary power conductors, (higher than 600 volts to ground) shall be 42" to top below finished grade, unless otherwise noted on plans.
- N. All raceways shall be installed to maintain a minimum of 4" clearance below roof decking.

4. SPECIALTIES

- A. All EMT terminations at junction boxes, panels, etc. shall be made with case hardened locknuts and appropriate fittings, with insulated throat liners. Insulating terminations shall be manufactured as a single unit. The use of split sleeve insulators is <u>not</u> permitted.
- B. All rigid conduit, except main and branch feeders, shall have heavy fiber insulating bushings reinforced with double locknuts. All branch and main feeders shall have insulated bushings with grounding lugs and shall be bonded to enclosures with appropriately sized copper jumpers, except at pad mounted transformers. Bonding jumpers shall be installed as required by the N.E.C. and other applicable codes.
- C. All conduit stubbed through floor during construction shall have openings protected with plastic caps approved for this purpose. Connections on both ends of all flexible conduit shall be equivalent to Thomas and Betts, Ideal, Appleton, Efcor, or approved equivalent, rated for the environment.

- D. All pulling lines left in open conduit systems shall be non-metallic, left securely tied off at each end.
- E. Where spare raceways terminate in switchboards or motor control centers a fishtape barrier shall be provided.

SECTION 260544 - EXCAVATION, TRENCHING, BACKFILLING AND GRADING

1. GENERAL

- A. Each Contractor's attention is directed to Section 260501, General Provisions, Electrical and all other contract documents as they may apply to his work.
- B. Each Contractor shall include all excavating, filling, grading and related items required to complete his work as shown on the drawings and specified herein.
- C. Electrical distribution lines and underground telephone or TV cables shall, in no case, be placed in the same trench with sanitary, storm, domestic or fire protection water lines. Phone cable may, at the Contractor's option, and if acceptable to both utility companies, be placed in a common trench with power lines as long as 8" of earth separation is maintained. T.V. cable shall, in all cases, be placed in a separate trench with two feet separation from electrical power lines.
- D. Depths of bury shall be as indicated on the drawings.

2. SUBSURFACE DATA

- A. Subsurface investigations have been made and the results shown on the drawings. The information was obtained primarily for use in preparing foundation design. Each Contractor may draw his own conclusions therefrom. No responsibility is assumed by the Owner for subsoil quality or conditions other than at the locations and at the time investigations were made. No claim for extra compensation, or for extension of time, will be allowed on account of subsurface conditions inconsistent with the data shown.
- B. Materials to be excavated shall be <u>unclassified</u>, and shall include earth, rock, or any other material encountered in the excavation to the depth and extent indicated on the drawings and specified herein. No adjustment in the Contract sum will be made on account of the presence or absence of rock, shale, or other materials encountered in the excavating.

3. BENCH MARKS AND MONUMENTS

A. Maintain carefully all bench marks, monuments and other referenced points. If disturbed or destroyed, replace as directed.

4. EXCAVATION

- A. Each Contractor shall accept the site as he finds it and remove all trash, rubbish and material from the site prior to starting excavation for his work.
- B. Excavate trenches to sufficient width and depth for proper installation of the work and where required, smooth the bottom on the trench with hand tools.
- C. The removal of rock shall be accomplished by use of hand or power tools only. Blasting shall not be permitted unless authorized in writing by the Architect. Any damage to existing structures, exterior services or rock intended for bearing, shall be corrected at the responsible Contractor's expense.
- D. Keep trenches free from water while construction therein is in progress. Under no circumstances lay conduit or cable in water. Pumping or bailing water from this Contractor's trenches, which is required during construction shall be accomplished at his expense.

E. In no case shall excavation work be accomplished that will damage in any way the new structure, existing structures, equipment, etc. Each Contractor shall take the necessary steps to prevent flow of eroded earth by water or landslide onto the property of others, or against the structures. The repair of all such damage, or any other damage incurred in the course of excavation, shall be borne by the responsible Contractor.

5. BACKFILL

- A. Backfill shall be accomplished with clean debris free earth and the new earth tamped at 12" intervals so as to avoid earth sinks along the trench. The responsible Contractor will be required to return to the project and fill any sunken areas along the route of his work.
- B. Backfill trenches only after conduit and cable have been inspected, tested, and locations of pipe lines have been recorded on "as-built" drawings.
- C. The backfill below paved areas shall be brought to proper grade to receive the sub-base and paving. No paving shall be placed on uncompacted fill.
- D. The backfill below sodded or seeded areas shall be brought to within six inches of finished grade. The remaining six inches shall be backfilled with clean soil.

SECTION 260553 - IDENTIFICATIONS

1. GENERAL

- A. Equipment, disconnect switches, motor starters, pushbutton stations, special device plates, and similar materials shall be clearly marked as to their function and use. Markings shall be applied neatly and conspicuously to the front of each item of equipment with 1/2" white lamacoid plate (or equivalent) with black letters 1/4" high.
- B. The Contractor shall provide clearly legible typewritten directories in each electrical panel indicating the area, item of equipment, etc., controlled by each switch, breaker, fuse, etc. These directories are to be inserted into plastic card holders in each panel. The Contractor shall be required to demonstrate the accuracy of the panel directory for a random sampling of circuits in each panelboard as directed in the field by the Engineer with corrections made immediately soit is imperative that care be taken during installation to insure 100% accurate directories.
- C. All circuit breakers and disconnects serving fire alarm equipment shall be painted red and clearly labeled as Fire Alarm Circuits.
- D. Branch circuit panelboards and switch gear shall be provided with a white lamacoid plastic plate with 1/2" black letters for panel designation and 1/4" black letters showing voltage and feeder information. Branch circuit switches shall be designated as to function. Panelboard and switchgear labels shall indicate the source they are fed from, and the circuit number at that source. Panelboards shall also indicate color coding of the branch circuit phase conductors supplied. Clearly indicate the exact label legend to be furnished with each panelboard and switchgear on the shop drawings for each item of equipment prior to submission of shop drawings.

EXAMPLE:

PANEL "XYZ" FED FROM "MDP – 2" 120/ 208/ 3PH/ 4W – 225A BLACK-RED-BLUE CONDUCTORS

- E. Where branch circuit panelboards and switchgear are connected to an emergency source, the lamacoid plate shall be red, and the word "emergency" shall be incorporated into the legend. In healthcare applications, the NEC designated branch (life safety, critical or equipment branch) shall also be incorporated into the legend, all in ¹/₄" letters. Also provide similar plates and legends for automatic transfer switches, and equipment disconnects 100 amps and larger.
- F. Lamacoid plates shall be located at center of top of trim for branch circuit panels, switch gear, and centered at side for branch circuit switches. Fasten with self-tapping stainless steel screws or other approved method.
- G. The building service disconnect(s) shall be marked with the maximum available fault current available at that location in accordance with NEC Article 110. If a fault current study is not required by this contract, the Contractor shall obtain fault current availability data from the utility company. This requirement applies to both new and existing services if any distribution equipment is changed.

SECTION 262400 - ELECTRICAL DISTRIBUTION EQUIPMENT

1. GENERAL

A. All electrical distribution equipment shall be dead front UL listed for the purpose and application. All equipment shall meet or exceed all applicable requirements of the National Electrical Code (N.E.C.). Any device or component, i.e., switchboard, panel, breaker, switch, etc., used as service entrance equipment, shall be listed for use at 100% of the rated capacity.

<u>*NOTE TO DESIGNER, REMOVE IF NOT APPLICABLE</u> 2. UL RE-CERTIFICAITON OF EXISTING EQUIPMENT

- A. Where existing switchboards, panelboards, motor control centers, and similar are modified in a manner that changes how the original equipment was shipped from the factory the contractor shall obtain a UL Field Evaluation and the equipment shall be provided with new UL certifications and UL Field Evaluation Marking. Modifications include but are not limited to tapping of bussing, dismantling and rebuilding of gear, or the installation of aftermarket breakers, components, etc. UL re-certification shall not be required for the following conditions:
 - (1) If a new breaker listed or classified by the manufacturer for installation in the gear is provided in an existing prepared space. Contractor must submit documentation of this classification if the breaker type is not specifically noted on the panelboard product data.
 - (2) *Removal of existing breakers*
 - (3) Removal of conductors to/from gear
 - (4) Addition of conductors to/from gear

The contractor shall carry all costs associated with the evaluation and re-certification. The contractor shall submit the service agreement with the UL certified for review by the engineer prior to execution. All work shall be approved by the Authority Having Jurisdiction.

3. BRANCH PANELBOARDS

- A. This section covers lighting and power panelboards (refer to schedules, notes on Drawings and the Electrical One-Line Diagram, of the Contract Drawings).
- B. All panelboards shall be of the circuit breaker type, and shall be of one manufacturer.
- C. Branch panelboards shall be as indicated on the drawings and as specified herein. The lighting panelboards shall be of the dead-front, quick-make, quick-break, plug-in circuit breaker type, with trip indicating and trip free handles. All circuits shall be clearly and properly numbered and shall be provided with thermal magnetic protection. The panelboards shall be enclosed in code gauge, galvanized steel cabinets with smooth finished hinged doors without visible external fasteners and heavy chrome locks. Locks shall all be keyed alike. Each door shall have a directory card inside, covered with a plastic shield, filled in with black india ink or typewritten with circuit numbers and description indicated. Room numbers shall be coordinated with final room numbers as selected by Owner -- not numbers on Contract Documents.

<u>Special Note</u>: The room numbers used to fill out the panel directories shall match the actual final name and numbering scheme selected by the Owner. They shall <u>not</u> be filled out per the construction drawing numbering scheme, unless the Contractor is directed to do so by the Architect or Engineer.

D. Branch panelboards shall be surface or flush mounted as indicated on the Contract Drawings.

- E. Circuit breakers for 120/208 volt systems shall be of 10,000 A.I.C. RMS symmetrical rating unless otherwise indicated on the Contract Drawings. For 277/480 volt systems, provide circuit breakers with 14,000 A.I.C. ratings unless otherwise indicated.
- F. All main bus and connections thereto in branch panelboards shall be copper. All bus bars shall extend full length of panelboards.
- G. All circuit breakers used to switch lights shall be SWD (switching duty) rated and U.L. listed for the purpose.
- H. Where required by the National Electrical Code, provide branch arc-fault circuit interrupters (A.F.C.I.'s) in branch panelboards, whether indicated on the panel schedule or not. They shall be U.L. listed, latest edition.
- I. Where branch circuit breakers feed hermetically, sealed compressor for cooling or refrigeration equipment, provide U.L. listed H.A.C.R.-style circuit breakers.
- J. Where branch circuit breakers are indicated or required to be ground-fault circuit-interrupting type (G.F.C.I.), they shall have test and reset buttons and be U.L. listed, latest edition. Do not share neutrals with other circuits.
- K. Where branch circuit breakers are feeding H.I.D. (high-intensity-discharge) loads, they shall be rated and listed for such loads. Provide proper circuit breaker whether indicated on panel schedules or not.
- L. Arc Flash Hazard warning labels shall be affixed to all panelboards in accordance with Article 110.16 of the National Electrical Code. All components protected by a manually-operated arc energy reduction means shall have an additional label affixed that describes the location of the energy reduction means.
- M. Panels shall be Square "D", G.E., Siemens, Eaton/Cutler-Hammer or approved equivalent.
- N. Lockable breakers shall be provided for all breakers serving all HVAC equipment, Plumbing equipment, and kitchen appliances.

4. INSTALLATION INSTRUCTIONS

- A. Panelboards with circuit breakers installed before the building has been finished and cleaned shall be masked.
- B. All dust and debris shall be removed from the panels before they are energized and placed in service.
- C. All panelboard fronts shall be omitted until final punch list inspection is made. Directories for each panelboard shall be completed and available for review by the Engineer at that time.
- D. All service equipment shall be marked with the maximum available fault current and the date of the calculation. This information shall be obtained in writing from the serving utility. Provide label adjacent to the service disconnecting means. Document action of the fault current shall be included in the operation and maintenance manual. This labeling shall be provided for all new service installations, service upgrades, and any project that adds or replaces distribution panels or branch panel boards.
- E. Where applicable Provide a warning sign on the service entrance equipment indicating type and location of all on-site emergency power sources in accordance with the NEC.

- F. Where applicable Provide warning sign(s) for alternative power devices (photovoltaic, wind, fuel cell, etc.) on all equipment in accordance with the NEC.
- G. All emergency system switchgear, distribution panels and branch panelboards shall be provided with surge protection devices in accordance with the NEC. Refer to Section 264313 Surge Suppression Systems.

5. SAFETY SWITCHES

- A. Provide heavy duty safety switches as a final disconnecting means as required by NEC and/or as indicated on the Contract Drawings.
- B. All safety switches shall be NEMA Type 1, NEMA 3R, NEMA 4 stainless steel, NEMA 12, or as required by the operating environment, Heavy Duty Type HD, UL listed.
- C. All safety switches shall have switch blades that are fully visible in the "OFF" (open) position with the door open.
- D. All current carrying parts shall be plated by an electrolytic process to resist corrosion and to promote cooling.
- E. Switch mechanism shall be quick-make, quick-break, load break rated, 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 and opening action of the contacts has started. The handle and mechanism shall be an integral part of the box (not cover) with facilities for pad locking in the open or closed position with up to three padlocks. Switch doors shall be interlocked with switch handle so that the door can only be opened when the switch is in the "OFF" (open) position.
- F. Arc Flash Hazard warning labels shall be affixed to all switches in accordance with Article 110.16 of the National Electrical Code. All components protected by a manually-operated arc energy reduction means shall have an additional label affixed that describes the location of the energy reduction means.
- G. Switches shall be as manufactured by Square D., G.E., Siemens, Eaton/Cutler-Hammer or approved equivalent.

6. FUSES

- A. Upon completion of the building, the Contractor shall provide the owner with spare fuses as shown below. All fuses shall be Bussmann, Shawmut, Gould or Reliance.
 - (1) 10% (minimum of 3) of each type and rating of installed fuses shall be supplied as spares:
 - (2) Bussmann spare fuse cabinets Catalog No. SFC shall be provided to store the above spares.
- B. No fuses shall be installed in the equipment until the installation is complete, including tests and inspections required prior to being energized. All fuses shall be of the same manufacturer to insure retention of selective coordination, as designed.
- C. Circuits 601 to 6000 amperes shall be protected by current limiting BUSSMANN HI-CAP TIME DELAY FUSES KRP-C. Fuses shall employ "O" rings as positive seals between the end bells and the fuse barrel. Fuses shall be a time-delay type and must hold 500% of rated current for a minimum of 5 seconds, clear 20

times rated current in .01 seconds or less and be listed by Underwriter's Laboratories, Inc., with an interrupting rating of 200,000 amperes R.M.S. symmetrical. The fuses shall be UL Class L.

- D. Circuits 0 to 600 amperes shall be protected by current limiting BUSSMANN LOW-PEAK Dual Element Fuses, LPN-RK (250 volts) or LPS-RK (600 volts). All dual element fuses shall have separate overload and short circuit elements. Fuse shall incorporate a spring activated thermal overload element having a 284°F melting point alloy and shall be independent of the short-circuit clearing chamber. The fuse shall hold 500% of rated current for a minimum of 10 seconds and be listed by Underwriters Laboratories, Inc. with an interrupting rating of 200,000 amperes r.m.s. symmetrical. The fuses shall be UL Class RK1.
- E. Motor Circuits All individual motor circuits rated 480 amperes or less shall be protected by BUSSMANN LOW PEAK DUAL-ELEMENT FUSES LPN-RK (250 volts) or LPS-RK (600 volts). The fuses for 1.15 service factor motors shall be installed in rating approximately l25% of motor full load current except where high ambient temperatures prevail, or where the motor drives a heavy revolving part which cannot be brought up to full speed quickly, such as large fans. Under such conditions the fuse should be 150% to 200% of the Type KRP-C HI-CAP Time Delay Fuses of the rating shown on the drawings. 1.0 service factor motors shall be protected by BUSSMANN LOW-PEAK Dual-Element Fuses LPN-RK (250 volts) or LPS-RK (600 volts) installed in rating approximately 115% of the motor full load current except as noted above. The fuses shall be UL Class RK1 or L.
- F. Circuit breaker panels shall be protected by BUSSMANN LOW-PEAK Dual Element fuses LPN-RK (250 volts) or LPS-RK (600 volts) as shown on the drawings. The fuses shall be UL Class RK1.

7. DISTRIBUTION TRANSFORMERS

- A. The Contractor shall provide dry-type transformers as manufactured by Square "D", G.E., Siemens, Eaton/Cutler-Hammer or equivalent. KVA ratings shall be as indicated on the electrical plans and shall have copper windings.
- B. Three phase transformers are to have 480 volt Delta primary and 120/208V/3 /4W secondary. 30 KVA transformers and larger are to be supplied with 2-22% full capacity taps above and (4) 2-1/2% full capacity taps below primary voltage. Exceptions to the above will be shown on the electrical plans.
- C. Transformers 30 KVA and above shall be Class H, 115°C. and shall have the ability to carry a continuous 15% overload without exceeding a 115°C rise above 40° ambient.
- D. Transformer coils shall be vacuum impregnated with non-hygroscopic, thermosetting varnish. Each layer shall have end fillers or tie downs to provide maximum mechanical strength. Insulation systems and their construction techniques shall be listed by Underwriters Laboratories.
- E. Transformer coils shall have a final wrap of electrical insulating material designed to prevent injury to the coil wire. Transformers having coils with magnet wire visible will not be acceptable.
- F. All cores to be manufactured from a high grade, non-aging, silicon steel with high magnetic permeabilities, low hysteresis and eddy current losses. Magnetic flux densities are to be kept well below saturation to allow for a minimum of 10% over voltage excitation. The cores shall be clamped with structural angles (formed angles not acceptable) and bolted to the enclosure to prevent damage during shipment or rough handling.
- G. The core and coil unit shall be completely isolated from the enclosure by means of a vibration isolating system and shall be so designed as to provide for continual securement of the core and coil unit to the enclosure. Sound isolating systems requiring the removal of all tie down facilities will not be acceptable.

- H. Transformers 15 KVA thru 45 KVA shall be provided with interchangeable mounting for floor or wall.
- I. The maximum top of case temperature shall not exceed 35°C above ambient.
- J. The entire transformer enclosure shall be degreased, cleaned, phosphatized, primed and finished with baked enamel.
- K. The core and coils shall be visibly grounded to the frame of the transformer cubicle by means of a flexible grounding strap of adequate size.
- L. Sound levels shall be guaranteed by the manufacturer and substantiated by certified tests on each unit furnished. The sound levels are not to exceed the following values: 10 to 45 KVA, 42 D.B. to 150 KVA; 45 D.B., 225 to 300 KVA; 50 D.B. and 500 KVA, 54 D.B.
- M. If a particular "K" rating is specified for a dry-type transformer, that rating shall be provided.
- N. Transformers shall be as manufactured by Square D, G.E., Eaton/Cutler-Hammer, Siemens, Niagara or approved equivalent.

8. CONTACTORS

- A. General
 - (1) Contactors shall be continuously rated at the specified amperes per pole for all types of ballast and tungsten lighting, resistance and motor load. Contactors shall have totally enclosed, double-break silver-cadmium-oxide power contacts. Auxiliary arcing contacts will not be acceptable. Contact inspection and replacement shall be possible without disturbing line or load wiring. Contactors shall have straight-through wiring with all terminals clearly marked. Contactors shall have a gasketed NEMA Type 1 (NEMA 12 for electrically-held) enclosure, unless otherwise noted or required.
 - (2) Contactors shall be approved per UL 508 and/or CSA, and be designed in accordance with NEMA Standards. They shall be industrial-duty rated for applications to 600 volts maximum. I.E.C.-style contactors are not acceptable.
 - (3) Contactors shall have provisions for factory or field addition of:
 - a. Four N.O. or N.C. auxiliary contacts rated 6 amperes continuous at 600 volts.
 - b. Single or double circuit, N.O. or N.C., 30 or 60 ampere 600 volt power-pole adder.
 - c. Control-circuit fuse holder, one or two fuses.
 - d. 0.2-60 second adjustable interval timer attachment, if so indicated on plans.
 - e. Transient-suppression module for coil control circuit. Coil control to be 120 volts. Provide circuit or step-down transformer.
- B. Mechanically Held Lighting Contactors

- (1) Coil-clearing contacts shall be supplied so that the contactor coils shall be energized only during the instance of operation. Both latch and unlatch coils shall be encapsulated. Coils shall be rated for 120 volt operation.
- (2) Lighting contactors shall be Square D Class 8903 or equivalent by G.E., Siemens, Eaton/Cutler-Hammer or Allen-Bradley.

SECTION 262726 - WIRING DEVICES AND PLATES

1. GENERAL

- A. This section of the specifications includes wiring devices, cover plates, weatherproof and dust-tight closures, communications devices and floor outlets.
- B. Wiring devices are listed by manufacturer and catalog numbers to establish the quality and type required. Equivalent devices of other manufacturers will be acceptable with prior approval of the Engineer. Submit cutsheets and/or samples of each type ten days prior to bid date for review and written approval to bid. Insofar as possible, standard application or special application devices shall be by one manufacturer.

2. MATERIALS

ТҮРЕ	RATING	CONFIGURATION	COLOR	VENDOR - CAT. #		
RECEPTACLE - DUPLEX PREMIUM GRADE	125V, 20A 125V, 15A	NEMA 5-20R NEMA 5-15R	!	HUBBELL 5352* LEVITON 5362* GE 5362,* HUBBELL 5252** LEVITON 5262** GE 5262**		
	 * USE WHERE ON DEDICATED 20A CKT., OR CALLED OUT ** USE WHERE ON DEDICATED 15A CKT., OR WHERE MORE THAN ONE RECEPTACLE ON A CIRCUIT 					
RECEPTACLE - DUPLEX G.F.I. (SHALL MEET U.L. 943 STANDARD)	125V, 20A	NEMA 5-20R	!	HUBBELL GFR5352A		
RECEPTACLE - SIMPLEX	125V, 20A	NEMA 5-20R	!	HUBBELL 5361		
RECEPTACLE - DUPLEX, SAFETY TYPE (WITH TAMPER- RESISTANT SCREWS)	125V, 20A	NEMA 5-20R	!	HUBBELL HBL-8300- SG		
RECEPTACLE - DUPLEX, SAFETY TYPE (WITH TAMPER- RESISTANT SCREWS)	125V, 15A	NEMA 5-15R	!	HUBBELL HBL-8200- SG		
RECEPTACLE, DUPLEX ISOLATED GROUND WITH SURGE SUPPRESSION, INCLUDING INDICATOR LIGHT	125V, 15A	NEMA 5-15R	BLUE DEVICE	HUBBELL 5250S LEVITON 5380 ARROW-HART 5362		
RECEPTACLE, SINGLE	250V, 20A	NEMA 10-20R	BLACK	HUBBELL 6810 GE 4124		

				LEVITON 5032
RECEPTACLE, SINGLE	250V, 30A	NEMA 6-30R	BLACK	HUBBELL 9330 GE 4139 LEVITON 5372
RECEPTACLE, SINGLE	250V, 50A	NEMA 6-50R	BLACK	HUBBELL 9367 GE 4141 LEVITON 5374

NOTES:

- 1. PROVIDE MATCHING CAP (PLUG) FOR ALL RECEPTACLES 30 AMP RATED AND ABOVE AS REQUIRED FOR EQUIPMENT.
- 2. ALL RECEPTACLES SHALL BE BACK OR SIDE-WIRED, CLAMPING TYPE
- 3. FOR DRYERS AND RANGES, PROVIDE 3-POLE GROUNDING TYPE AS REQUIRED BY DEVICE. LOCATE DEVICE SO THAT DRYER OR RANGE CAN BE PUSHED TIGHTLY AGAINST WALL.
- 4. RECEPTACLES SHALL BE TAMPER RESISTANT AND WEATHER RESISTANT AND MARKED ACCORDINGLY AS REQUIRED BY N.E.C.
- 5. ALL RECEPTACLES INSTALLED IN DAMP OR WET LOCATIONS SHALL BE UL LISTED WEATHER RESISTANT TYPE.
- ! SEE ARTICLE 3, COLOR.
 - A. Small Motor Control Switches:
 - (1) For small line-to-neutral motor loads of 3/4 HP or less, single phase, rated at 120 or 277 volts, provide snap-type, H.P. rated motor starter switch with thermal overloads. Overload heaters sized to match the motor nameplate amperes and the ambient temperature shall be provided. Provide with NEMA 1, NEMA 3R or other enclosure suitable for the location and atmosphere. All manual starters in finished areas shall be in flush-mounted enclosures.

3. COLOR

- A. Color of devices shall be as selected by the architect. Samples (devices, plates or both) may be required to be submitted with other architectural color items by the Contractor. The Contractor shall coordinate any such submission required with other trades, the Prime Contractor or as needed.
- B. Where devices are controlling or supplying emergency power from a standby source, the device color shall be red, as with switch toggles or receptacle fronts. Plate color shall match others on normal power in the building unless otherwise noted.
- C. Where surface finishes next to the devices vary in color or shade throughout the project, the Contractor may be required to provide lighter or darker plates and devices to more closely match wall finishes. These variations are considered to be included in the original contract for construction.

4. PLATES AND COVERS

- A. Unless otherwise specified or noted, all wiring device plates and covers shall be smooth thermoplastic, Hubbell "P" Series or equivalent G.E. or Leviton. Color shall match device unless otherwise indicated.
- B. All kitchen, gymnasium or food service area plates shall be bright finish 302 stainless steel.
- C. Cover plates shall be of one manufacturer insofar as possible.
- D. Weatherproof plates for G.F.C.I. receptacles shall be cast aluminum, self-closing, gasketed, suitable for standard box mounting, U.L. listed for wet location use, cover closed. Vertical mounting Hubbell WP26M, horizontal mounting Hubbell WP26MH (die-cast zinc) or equivalent Leviton or G.E.
- E. Weatherproof switch plates for toggle-handle switches shall be clear silicone rubber, for standard outlet boxes. Hubbell 1795 or equivalent G.E. or Leviton.
- F. Cover plates for computer, telephone or other system outlets shall be as required to meet supplier or the owner's requirements, as applicable. Color to match other plates on project. Furnish telephone plates with wall-mounting studs if mounted at 48" or higher. See devices schedule below.

5. INSTALLATION

- A. All wiring devices in dusty areas, exposed to weather and moisture shall be installed in Type "FS" or similar conduit fittings having mounting hubs, with appropriate cover plates.
- B. Devices that have been installed before painting shall be masked. No plates or covers shall be installed until all finishing and cleaning has been completed.
- C. Provide G.F.C.I. duplex feed-thru style receptacles in accordance with new U.L. Standard 943 where indicated or required by the National Electrical Code, whether specifically called out or not. When a G.F.C.I. receptacle is on a circuit with other non-G.F.C.I. receptacles, it shall always be placed at the homerun point of the circuit and shall be wired to ground-fault interrupt protect the downstream outlets on that circuit unless specifically indicated to the contrary. Provide a "G.F.C.I. protected" label on each downstream outlet.
- D. GFCI devices shall be installed in a "readily accessible" location per NEC requirements. GFCI protected outlets required by plans or code shall be fed by a GFCI breaker or upstream GFCI device if they are not readily accessible.
- E. Where surge suppression outlets are provided, they shall be ANSI Category "A" style. They shall be installed as dedicated-circuit outlets or where indicated with multiple outlets on a circuit, they shall be placed at the homerun point of that circuit and feed-thru wired to protect the downstream outlets on that circuit.
- F. All receptacles shall be installed with ground prong at top position.
- G. All outlets not provided with wiring devices shall be closed with a blank plate matching other plates in the area.

SECTION 265113 - LIGHTING FIXTURES AND LIGHTING EQUIPMENT

1. GENERAL

- A. Furnish and install all lighting fixtures, as herein specified, complete with accessories for safe and effective operation. All fixtures shall be installed and left in an operable condition with no broken, damaged or soiled parts.
- B. All items furnished shall comply with the latest standards applicable such as U.L., NEMA, etc., and shall bear labels accordingly. All fixtures shall be the color specified or as selected by the Architect. Wherever fixtures have evident damage, they shall be restored to new condition or shall be replaced. Likewise, fixtures showing dirt, dust or fingerprints shall be restored to new condition or shall be replaced.
- C. Eight copies of light fixture factory shop drawings and cuts, showing fixture dimensions, photometric data, installation data and, if applicable, air handling data, shall be submitted to the Engineer for written approval 30 days after bid date. (Verify shop drawing quantities with the Architect.)
- D. Locate pendant, surface mounted or chain-hung industrial fixtures in mechanical rooms and similar spaces to avoid ductwork and piping. Locate around and between equipment to maximize the available light. Request a layout from the Engineer if uncertain about an installation.
- E. Alternate fixtures may be substituted for types specified by name or catalog number. Proposed substitutions must be submitted to the Engineer **ten working days prior to bid** date for written approval to bid. This written approval will only be issued in addendum form.
- F. Where emergency battery packs are provided with fixtures (if any), they shall be connected to an unswitched power line and wired in accord with the manufacturer's recommendations.
- G. All reflecting surfaces, glass or plastic lenses, downlighting Alzak cones and specular reflectors shall be handled with care during installation to avoid fingerprints or dirt deposits. It is preferred that louvers be shipped and installed with clear plastic bags to protect louvers. At close of project, and after construction air filters are changed, remove bags. Any louver or cone showing dirt or fingerprints shall be cleaned with solvent recommended by the manufacturer to a like-new condition, or replaced as necessary in order to turn over to the Owner new fixtures at beneficial occupancy.
- H. Refer to architectural details as applicable for recessed soffit fixtures or wherever fixture installations depend upon work of other trades. Coordinate all installations with other trades. Verify dimensions of spaces for fixtures, and if necessary, adjust lengths to assure proper fit and illumination of diffuser and/or area below.
- I. Warranty shall start at Final Project Completion.

2. VOLTAGE

A. All lighting fixtures will be rated 120, 277 or 480 volts, single phase as indicated or required.

3. LED FIXTURES

LED SOURCES

A. LED's shall be manufactured by a manufacturer who has produced commercial LEDs for a minimum of five (5) years.

- B. Lumen Output minimum initial delivered lumen output of the luminaire shall be as follows for the lumens exiting the luminaire in the 0-360 degree zone - as measured by IESNA Standard LM-79-08 in an accredited lab. Exact tested lumen output shall be clearly noted on the shop drawings.
- C. Lumen output shall not decrease by more than 20% over the minimum operational life of 50,000 hours at the rated ambient operating temperature.
- D. Individual LEDs shall be connected such that a catastrophic loss or the failure of one LED will not result in the loss of the entire luminaire.
- E. LED Boards shall be suitable for field maintenance and have with plug-in connectors. LED boards shall be upgradable
- F. Light Color/Quality:
 - a) Correlated Color temperature (CCT) range as per specification, between 3000K, 3500K and 4000K shall be correlated to chromaticity as defined by the absolute (X,Y) coordinates on the 2-D CIE chromaticity chart.
 - b) Color shift over 6,000 hours shall be <0.007 change in u' v' as demonstrated in IES LM80 report.
 - c) The color rendition index (CRI) shall be 80 or greater
 - d) LED boards to be tested for color consistency and shall be within a space of 2.5 MacAdam ellipses on the CIE chromaticity chart.

LED DRIVERS

- A. Driver: Acceptable manufacturer: eldoLED, Sylvania, or Philips that meet or exceed the criteria herein.
- B. Ten-year expected life while operating at maximum case temperature and 90 percent noncondensing relative humidity.
- C. Driver should be UL Recognized under the component program and shall be modular for simple field replacement.
- D. Electrical characteristics: 120 277 volt, UL Listed, CSA Certified, Sound Rated A+. Driver shall be > 80% efficient at full load across all input voltages. Input wires shall be 18AWG solid copper minimum.
- E. Dimming: Driver shall be suitable for full-range dimming. The luminaire shall be capable of continuous dimming without perceivable flicker over a range of 100 percent to <u>0.1</u> percent of rated lumen output with a smooth shut off function.
- F. Dimming shall be controlled by a 0-10V signal, or if require "DMX".
- G. Driver shall include ability to provide no light output when the control signal drops below 0.5 V, and shall consume 0.5 watts or less in this standby.
- H. Driver shall be capable of configuring a linear or logarithmic dimming curve.
- I. Drivers shall track evenly across multiple fixtures at all light levels, and shall have an input signal to output light level that allows smooth adjustment over the entire dimming range regardless of the controller type
- J. Flicker: Driver and luminaire electronics shall deliver illumination that is free from objectionable flicker as measured by flicker index (ANSI/IES RP-16-10). At all points within the dimming range from 100-0.1 percent luminaire shall have: Less than 1 percent flicker index at frequencies below 120 Hz and less than 12 percent flicker index at 120 Hz, and shall not increase at greater than 0.1 percent per Hz to a maximum of 80 percent flicker index at 800Hz
- K. Driver disconnect shall be provided where required to comply with codes.

LED ELECTRICAL

- A. THD: Total harmonic distortion (current and voltage) induced into an AC power line by a luminaire <u>shall not exceed 20 percent</u> at any standard input voltage and meet ANSI C82.11 maximum allowable THD requirements.
- B. Surge Suppression: The luminaire shall include surge protection to withstand high repetition noise and other interference. Withstand up to a 1,000 volt surge without impairment of performance as defined by ANSI C62.41 Category A. To reduce false circuit breaker tripping due to turn on inrush, the following statement ensures that electronic dimming driver will meet NEMA inrush recommendations.
- C. Rush Current: <u>Meet or exceed NEMA 410 driver inrush standard</u> of 430 Amps per 10 Amps load with a maximum of 370 Amps2 seconds.
- D. RF Interference: The luminaire and associated on-board circuitry must meet Class A emission limits referred in Federal Communications Commission (FCC) Title 47, Subpart B, Section 15 Non-Consumer requirements for EMI/RFI emissions
- E. Driver must support automatic adaptation, allowing for future luminaire upgrades and enhancements and deliver improved performance.
- F. Power Factor: The luminaire shall have a power factor of 90% or greater at all standard operating voltages and full luminaire output.

4. LAMPS

A. All incandescent lamps shall be rated 130 volts with a medium screw type base (or as required) in wattages less than 300 watts and 130 volts, mogul screw type base in 300 watts and larger.

5. LIGHT FIXTURE GENERAL REQUIREMENTS

- A. LED Recessed Lighting Fixtures General Requirements
 - (1) The following are minimum requirements for recessed LED fixtures for lay-in grid, gypsum board, plaster and concealed spline ceilings. Surface-mounted LED fixture requirements shall be similar.
 - (2) Housings shall be a minimum of 4" depth, premium grade, constructed of a minimum 22 gauge die embossed or stiffened cold rolled pre-treated rust-resistant steel. Troffers shall be equivalent to Hubbell "Versaline," Daybrite "Designer," Lightolier equivalent or Lithonia "2SPG" series.
 - (3) All parts shall be finished with polyester powder or white baked enamel (85% minimum reflectance) painted after fabrication. All wiring shall be type TFN, or THWN and shall be covered by the steel driver cover or wiring channel. Exposed wiring is not acceptable. Connection wiring shall be accessible thru a hinged access plate above driver channel in top of unit.
 - (4) The complete light fixture unit shall be UL listed and labeled. Other agency listings may be acceptable with written approval from the Engineer.
 - (5) Fixture lens doors shall be reversible, hinged, painted after fabrication, with spring-loaded or other mechanically stable positive action latches.
 - (6) Lens shall be as specified for each fixture type. If a specific manufacturer and series number of lens is listed, the substitute shall be of the exact specification (thickness, prism configurations, transparency, efficiency, photometric distribution, hardness, vandal-resistance, etc.). Minimum average thickness of any prismatic lens shall be .125".
- (7) Fixture trim and/or flanges shall conform with ceiling constructions as required. Verify all types prior to submission of shop drawings and indicate any special types on submittals. Fixtures installed in drywall or plaster ceilings to be provided with flange, screed and swing gate anchoring system.
- (8) All fixtures shall be furnished with hold down clips to meet applicable seismic codes, four clips per fixture minimum or the equivalent thereof in the installation trim. Verify thickness of drywall or plaster ceilings prior to submission of shop drawings, to allow for proper trim adjustment.
- (9) Support fixtures with one hanger wire at each end. Hanger wires shall be installed within 15° of plumb, maximum or additional support shall be provided. Wires shall be attached to the fixture body and to the building structure not to the supports of other work or equipment.
- (10) Each type of lay-in fixture shall be furnished with the proper housing flange or lip to suit the type of lay-in grid(s) being utilized on the project. The Contractor is to verify if narrow or standard grid members are being furnished and provide the proper type of light fixture trim. Indicate any special trims on shop drawing submittals.
- B. Industrial and Striplight LED Fixtures General Requirements
 - (1) Units shall have die-formed heavy gauge cold rolled steel channels and die-embossed reflectors.
 - (2) Finishes to be coated with a gloss powder paint or baked enamel finish with a minimum 85% reflectance.
 - (3) Units to have aligner clips where required for a continuous row appearance. Where continuous rows exceed twelve feet in length, provide a "unistrut" channel or similarly adequate mounting to stiffen and align row.
 - (4) Units to have captive latches for all covers and wire guards where specified. Wire guards shall be heavy-duty #14 wire gauge minimum with corrosion-resistant plated or vinyl finish.
 - (5) Units to be UL listed.
 - (6) Mounting brackets and hanging mechanisms shall be as specified in fixture descriptions, or as required. Allow a generous safety margin with all support systems, as recommended by the manufacturer.
- C. Recessed Ellipsoidal or Parabolic Cone Downlight General Requirements
 - (1) Fixture to have an extruded or die-cast aluminum housing. Retaining mechanism shall provide easy access to LED array and driver box.
 - (2) Unit to have a corrosion-resistant steel junction box with hinged access covers and thermal protector.
 - (3) Mounting/plaster frame to be heavy gauge steel with finishing trim friction support springs, for the required ceiling thickness. Trim to be of color as selected by the Architect.
 - (4) Optical system to consist of a specular clear Alzak upper ellipsoidal (or parabolic, as noted) reflector with specular Alzak cone or microgroove matte black baffle as noted in schedule. Where other than clear Alzak cone/reflector color is noted on the schedule, it shall be furnished as specified.
 - (5) Provide telescoping channel bar hangers that adjust vertically and horizontally.

- (6) Fixtures to be UL listed for thru-branch circuit wiring, recessed, and damp locations. Where installed in plaster or drywall or other inaccessible ceiling type, they shall be U.L. listed for bottom access.
- D. Exit Lights General Requirements
 - (1) Housings and canopies shall be die-cast aluminum or corrosion resistant steel. Mountings shall be wall or ceiling, universal type, to suit the installation conditions.
 - (2) Provide with stencil face, lettering color red, of sizes in accord with code, or as otherwise specified.
 - (3) Provide single or double face as scheduled, indicated on plans or as required by the local authority having jurisdiction. Adjust installation position if required for clear visibility, in accord with applicable codes.
 - (4) Complete unit to be finished in color as selected by the Architect.Provide directional arrows as indicated on plans, as scheduled to suit the means of egress or as required by the local authority having jurisdiction.
 - (5) All exit signs shall be long life LED type.
 - (6) Where emergency backup battery packs are provided with exit lights, they shall have capacities for continuous operation per applicable codes. They shall have reserve battery capacity to operate remote lamps where indicated.

6. LIGHTING FIXTURE SCHEDULE

A. Refer to the contract drawings for Lighting Fixture Schedule

7. PHOTOCELLS

- A. Provide 120, 277 or 480 volt (rated as needed), 1000 or 2000 watt photocells as needed for control of certain circuits or fixtures as indicated on plans. They shall be as manufactured by Tork, Paragon, AMF or approved equivalent.
- B. Mount photocells in locations concealed from sight lines standing on ground unless otherwise noted, in which case the final position shall be as directed by the Architect. Group together (if indicated at one location) and mount on back of parapet wall or otherwise properly support with mounting bracket. Coordinate with roofing installer to ensure that roof penetrations are properly made without violating or reducing the roof warranty in any way. Photocells may be mounted in other locations if it is not practical to install them on roofs or parapets, in which case the Contractor shall request direction for their mounting locations from the Engineer or Architect. Photocells shall always be mounted in a weatherproof, inconspicuous manner.

8. TIMECLOCKS

- A. Provide digital astronomic timeclock(s) to control the indicated loads. The number of poles, their ampacity and voltage withstand shall be to suit the load, but in no case less than 30 amps, 277 volts.
- B. Timeclock coil and motor power shall be 120 volts AC, backed up with seven day memory which is automatically replenished in normal operation. Provide a 120 volt control circuit from the nearest available panelboard.

- C. Order unit for the proper geographical latitude for the project site. Also provide day light savings time option and calibrate for April-October dates. Provide instruction to the Owner's representative in proper setting and operation of each type of timeclock provided.
- D. Enclosures for timeclocks shall be surface type, NEMA 1 or NEMA 3R as needed. Where exposed in finished areas, provide flush-style NEMA 1 enclosures.

END OF SECTION 265113

SECTION 265116 -NETWORK LIGHTING SYSTEMS

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. The lighting control system specified in this section shall provide time-based, sensor-based (occupancy), and manual lighting control.
- B. The system shall be capable of turning lighting loads on/off as well as dimming lights (if lighting load is capable of being dimmed)
- C. The system architecture shall provide stand-alone groups (rooms) of devices to function in a default capacity even if network connectivity to the greater system is lost. The network shall allow for remote troubleshooting and reporting as well as some higher level functionality.
- D. The system shall not require any centrally hardwired switching equipment.
- E. The system shall be capable of wireless, wired, or hybrid wireless/wired architectures.
- F. Graphical floor plan software shall be provided allowing the owner to see devices in specific rooms and by clicking on the symbol with a mouse shall be able to see status, make device adjustments, modify schedules, over-ride, and/or disable devices. The software shall also provide a reporting tool that indicates what savings have been accomplished by use of each technology used in a space over a specified time (Occupancy sensing, daylight harvesting, time of day, etc.)

1.3 SUBMITTALS

A. Product Data: For each type of product.

Specification Conformance Document: Indicate whether the submitted equipment:

Meets specification exactly as stated.

Meets specification via an alternate means and indicate the specific methodology used.

Shop Drawings; include:

Schematic (one-line diagram) of system.

Mounting dimension requirements for each product and mounting condition.

- Product Data: Catalog cut sheets with performance specifications demonstrating compliance with specified requirements.
- Sequence of Operation to describe how each area operates and how any building wide functionality is described.
- Sequence of Operation to describe how each area operates and how any building wide functionality is described.

Provide coordination drawings showing interconnecting control wiring and interface devices.

Quality Control Submittals:

Test Reports: Indicating compliance with specified fabric properties.

Certification: Morton International Laboratory Report for PVC coated fabrics and bacterial and mildew resistance.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Operation and Maintenance Data: For lighting controls to include in emergency, operation, and maintenance manuals.
- B. Software and Firmware Operational Documentation:
 - 1. Software operating and upgrade manuals.
 - 2. Program Software Backup: On magnetic media or compact disk, complete with data files.
 - 3. Device address list.
 - 4. Printout of software application and graphic screens.

1.5 QUALITY ASSURANCE

- A. Retain "Testing Agency Qualifications" Paragraph below if Contractor selects testing agency or if Contractor is required to provide services of a qualified testing agency in "Field Quality Control" Article. Qualification requirements are in addition to those specified in Section 01 40 00 "Quality Requirements," which also defines "NRTL" (nationally recognized testing laboratory).
- B. All steps in sensor manufacturing process shall occur in the USA; including population of all electronic components on circuit boards, soldering, programming, wiring, and housing.
- C. All components and the manufacturing facility where product was manufactured must be ROHS compliant.
- D. In high humidity or cold environments, the sensors shall be conformably coated and rated for condensing humidity and -40 degree Fahrenheit (and Celsius) operation.
- E. All applicable products must be UL/CUL Listed or other acceptable national testing organization.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Handle and prepare panels for installation according to NECA 407.

1.7 COORDINATION

- A. Coordinate lighting control components to form an integrated interconnection of compatible components.
- B. Coordinate lighting controls with BAS (if necessary) either through IP based intercommunication of system or hardwired auxiliary relay outputs.
- C. The installing contractor shall be responsible for a complete and functional system in accordance with all applicable local and national codes.

1.8 WARRANTY

A. All devices in lighting control system shall have a 5 year warranty. Warranty shall start at Final Project Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. This specification is based on the nLight Network Control System from Sensor Switch, by Watt Stopper or Cooper Controls

2.2 SYSTEM REQUIREMENTS

- A. System shall have an architecture that is based upon three main concepts; 1) intelligent lighting control devices 2) standalone lighting control zones 3) network backbone for remote or time based operation.
- B. Intelligent lighting control devices shall consist of one or more basic lighting control components; occupancy sensors, photocell sensors, relays, dimming outputs, manual switch stations, and manual dimming stations. Combining one or more of these components into a single device enclosure should be permissible so as to minimize overall device count of system.
- C. System must interface directly with intelligent LED luminaires such that only CAT-5 cabling is required to interconnect luminaires with control components such as sensors and switches (see Networked LED Luminaire section)
- D. Intelligent lighting control devices shall communicate digitally, require <4 mA of current to function (Graphic wall stations excluded), and posses RJ-45 style connectors.
- E. Lighting control zones shall consist of one or more intelligent lighting control components, be capable of stand-alone operation, and be capable of being connected to a higher level network backbone.
- F. Devices within a lighting control zone shall be connected with CAT-5E low voltage cabling in any order.
- G. Lighting control zone shall be capable of automatically configuring itself for default operation without any start-up labor required.
- H. Individual lighting zones must continue to provide a user defined default level of lighting control in the event of a system communication failure with the backbone network or the management software becoming unavailable.
- I. Power for devices within a lighting control zone shall come from either resident devices already present for switching (relay device) or dimming purposes, or from the network backbone. Standalone "bus power supplies" shall not be required in all cases.
- J. All switching and dimming for a specific lighting zone shall take place within the devices located in the zone itself (i.e. not in a remotely located devices such as panels) to facilitate system robustness and minimize wiring requirements. Specific applications that require centralized or remote switching shall be capable of being accommodated.
- K. System shall have one or more primary wall mounted network control "gateway" devices that are capable of accessing and controlling connected system devices and linking into an Ethernet LAN.
- L. System shall use "bridge" devices that route communication and distribute power for up to 8 directly connected lighting zones together for purposes of decreasing system wiring requirements.
- M. System shall be capable of wirelessly connecting a lighting zone to a WiFi (802.11n) wireless data network for purposes of eliminating the "bridge" devices and all cabling that connects zones to bridge devices.

- N. WiFi enabled devices shall be able to detect when WiFi network is down and revert to a user directed default state.
- O. WiFi-enabled devices shall be capable of current monitoring
- P. WiFi-enabled devices shall utilize WPA2 AES encryption
- Q. WiFi-enabled devices shall be able to connect to 802.11b/g/n WiFi networks
- R. WiFi-enabled devices shall have at least one local RJ-45 port for communicating with nonWiFi- enabled system devices
- S. System shall have a web-based software management program that enables remote system control, status monitoring, and creation of lighting control profiles.
- T. Individual lighting zones shall be capable of being segmented into several "local" channels of occupancy, photocell, and switch functionality for more advanced configurations and sequences of operation.
- U. Devices located in different lighting zones shall be able to communicate occupancy, photocell, and switch information via either the wired or WiFi backbone.
- V. System shall be capable of operating a lighting control zone according to several sequences of operation. System shall be able to change a spaces sequence of operation according to a time schedule so as to enable customized time-of-day, day-of-week utilization of a space. Note operating modes should be utilized only in manners consistent with local energy codes.
- W. A taskbar style desktop application shall be available for personal lighting control.
- X. An application that runs on "smart" handheld devices (such as an Apple® IPhone®) shall be available for personal lighting control.
- Y. Control software shall enable logging of system performance data and presenting useful information in a web-based graphical format and downloadable to .CSV files.
- Z. Control software shall enable integration with a BMS via BACnet IP.
- AA. System shall provide the option of having pre-terminated plenum rated CAT-5 cabling supplied with hardware.

2.3 INDIVIDUAL DEVICE SPECIFICATIONS

- A. Control Module (Gateway)
 - 1. Control module shall be a device that facilitates communication and time-based control of downstream network devices and linking into an Ethernet.
 - 2. Devices shall have a user interface that is capable of wall mounting, powered by low voltage, and have a touch screen.
 - 3. Control device shall have three RJ-45 ports for connection to other backbone devices (bridges) or directly to lighting control devices.
 - 4. Device shall automatically detect all devices downstream of it.

- 5. Device shall have a standard and astronomical internal time clock.
- 6. Device shall have one RJ-45 10/100 BaseT Ethernet connection.
- 7. Device shall have a USB port
- 8. Each control gateway device shall be capable of linking 1500 devices to the management software.
- 9. Device shall be capable of using a dedicated or DHCP assigned IP address.
- B. Networked System Occupancy Sensors
 - 1. Occupancy sensors system shall sense the presence of human activity within the desired space and fully control the on/off function of the lights.
 - 2. Sensors shall utilize passive infrared (PIR) technology, which detects occupant motion, to initially turn lights on from an off state; thus preventing false on conditions. Ultrasonic or Microwave based sensing technologies shall not be accepted.
 - 3. For applications where a second method of sensing is necessary to adequately detect maintained occupancy (such as in rooms with obstructions), a sensor with an additional "dual" technology shall be used.
 - 4. Dual technology sensors shall have one of its two technologies not require motion to detect occupancy. Acceptable dual technology includes PIR/Microphonics (also known as Passive Dual Technology or PDT) which both looks for occupant motion and listens for sounds indicating occupants. Sensors where both technologies detect motion (PIR/Ultrasonic) shall not be acceptable.
 - 5. All sensing technologies shall be acoustically passive meaning they do not transmit sounds waves of any frequency (for example in the Ultrasonic range), as these technologies have the potential for interference with other electronic devices within the space (such as electronic white board readers). Acceptable detection technologies include Passive Infrared (PIR), and/or Microphonics technology. Ultrasonic or Microwave based sensing technologies shall not be accepted.
 - 6. Sensors shall include two integrated Class 1 switching relays, and up to one 0-10 VDC dimming output. Sensors shall be capable of switching 120 / 277 /347 VAC. Load ratings shall be 800 W @ 120 VAC, 1200 W @ 277 VAC, 1500 W @347 VAC, and ¹/₄ HP motor. Relays shall be dry contacts.
 - 7. Sensors shall be available with one or two occupancy "poles", each of which provides a programmable time delay.
 - 8. Sensors shall be available in multiple lens options which are customized for specific applications.
 - 9. Communication and Class 2 low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors.
 - 10. All sensors shall have two RJ-45 ports or capable of utilizing a splitter.
 - 11. All sensors shall have the ability to detect when it is not receiving valid communication (via

CAT-5 connections) and blink its LED in a pattern to visually indicate of a potential wiring issue

- 12. Every sensor parameter shall be available and configurable remotely from the software and locally via the device push-button.
- 13. Sensors shall be able to function together with other sensors in order to provide expanded coverage areas by simply daisy-chain wiring together the units with CAT-5 cabling.
- 14. Sensors shall be equipped with an automatic override for 100 hour burn-in of lamps. This feature must be available at any time for lamp replacements.
- 15. Wall switch sensors shall recess into single-gang switch box and fit a standard GFI opening.
- 16. Wall switch sensors must meet NEC grounding requirements by providing a dedicated ground connection and grounding to mounting strap. Line and load wire connections shall be interchangeable. Sensor shall not allow current to pass to the load when sensor is in the unoccupied (Off) condition.
- 17. Wall switch sensors shall have optional features for photocell/daylight override, vandal resistant lens, and low temperature/high humidity operation.
- 18. Wall switch sensors shall be available in four standard colors (Ivory, White, Light Almond, Gray). Wall plates shall be brushed stainless steel
- 19. Wall switch sensors shall include raise/lower dimming adjustment controls when connected to dimmable fixtures.
- 20. Network system shall have sensors that can be embedded into luminaire such that only the lens shows on luminaire face.
- 21. Embedded sensors shall be capable of both PIR and Dual Technology occupancy detection
- 22. Embedded sensors shall have an optional photocell
- 23. Network system shall also have ceiling, fixture, recessed, & corner mounted sensors available.
- 24. Fixture mount sensors shall be capable of powering themselves via a line power feed.
- 25. Sensors shall have optional features for photocell/daylight override, dimming control, and low temperature/high humidity operation.
- 26. Sensors with dimming can control 0 to 10 VDC dimmable ballasts by sinking up to 20 mA of Class 2 current (typically 40 or more ballasts).
- 27. System shall have WiFi enabled fixture mountable sensors available.
- 28. Embedded sensors shall have an optional photocell and 0-10 VDC dimming output
- C. Networked System Daylight (Photocell and or Dimming) Sensors

- 1. Photocell shall provide for an on/off set-point, and a deadband to prevent the artificial light from cycling. Delay shall be incorporated into the photocell to prevent rapid response to passing clouds.
- 2. Photocell and dimming sensor's set-point and deadband shall be automatically calibrated through the sensor's microprocessor by initiating an "Automatic Set-point Programming" procedure. Min and max dim settings as well as set-point may be manually entered.
- 3. Deadband setting shall be verified and modified by the sensor automatically every time the lights cycle to accommodate physical changes in the space (i.e., furniture layouts, lamp depreciation, or lamp outages).
- 4. Dimming sensors shall control 0 to 10 VDC dimmable ballasts by sinking up to 20 mA of class 2 current (typically 40 or more ballasts).
- 5. Photocell and dimming sensors shall be equipped with an automatic override for 100 hour burn-in of lamps. This feature must be available at any time for lamp replacements. (Note: This function should be performed prior to any dimming of the lamps including the "auto setpoint" setting.)
- 6. Combination units that have all features of on/off photocell and dimming sensors shall also be available.
- 7. A dual zone option shall be available for On/Off Photocell, Automatic Dimming Control Photocell, or Combination units. The second zone shall be capable of being controlled as an "offset" from the primary zone.
- 8. Line voltage versions of the above described photocell and combination photocell/dimming sensors shall be capable of switching both 120 VAC, 277 VAC, and 347 VAC. Load ratings shall be 800 W @ 120 VAC, 1200 W @ 277 VAC, 1500 W @ 347 VAC, and ¼ HP motor load. Relays shall be dry contacts.
- 9. Network system shall have dimming photocells that can be embedded into luminaire such that only the lens shows on luminaire face.
- D. Networked System Metering Power (Relay) Packs
 - 1. Power Pack shall incorporate one or more Class 1 relays and contribute low voltage power to the rest of the system. Secondary Packs shall incorporate the relay(s), shall have an optional 2nd relay, 0-10 VDC dimming output, or line voltage dimming output, but shall not be required to contribute system power. Power Supplies shall provide system power only, but are not required to switch line voltage circuit. Auxiliary Relay Packs shall switch low voltage circuits only.
 - 2. Power Packs shall accept 120 or 277 VAC (or optionally 347 VAC), be plenum rated, and provide Class 2 power to the system and come capable of metering connected load.
 - 3. All devices shall have two RJ-45 ports.
 - 4. Every Power Pack parameter shall be available and configurable remotely from the software and locally via the device push-button.
 - 5. Power Pack shall securely mount to junction location through a threaded ¹/₂ inch chase nipple or be capable of being secured within a luminaire ballast channel. Plastic clips into junction box

shall not be accepted. All Class 1 wiring shall pass through chase nipple into adjacent junction box without any exposure of wire leads. Note: UL Listing under Energy Management or Industrial Control Equipment automatically meets this requirement, whereas Appliance Control Listing does not meet this safety requirement.

- 6. When required by local code, Power Pack must install inside standard electrical enclosure and provide UL recognized support to junction box. All Class 1 wiring is to pass through chase nipple into adjacent junction box without any exposure of wire leads.
- 7. Power Packs and Power Supplies shall be available that are WiFi enabled.
- 8. Power (Secondary) Packs shall be available that provide up to 16 Amp switching of all lighting load types.
- 9. Power (Secondary) Packs shall be available that provide up to 5 Amps switching of all lighting load types as well as 0-10 VDC dimming or fluorescent ballasts/LED drivers.
- 10. Specific Secondary Packs shall be available that provide up to 5 Amps of switching as well as 0-10 VDC dimming of fluorescent ballasts/LED drivers.
- 11. Specific Secondary Packs shall be available that provide up to 5 Amps of switching and can dim 120 VAC incandescent lighting loads or 120/277 VAC line voltage dimmable fluorescent ballasts (2-wire and 3-wire versions).
- 12. Specific Secondary Packs shall be available that provide up to 5 Amps of switching and can dim 120/277 VAC magnetic low voltage transformers.
- 13. Specific Secondary Packs shall be available that provide up to 4 Amps of switching and can dim 120 VAC electronic low voltage transformers.
- 14. Specific Secondary Packs shall be available that provide up to 5 Amps of switching of dual phase (208/240/480 VAC) lighting loads.
- 15. Specific Secondary Packs shall be available that require a manual switch signal (via a networked Wall Station) in order to close its relay.
- 16. Specific Power/Secondary Packs shall be available that are UL924 listed for switching of Emergency Power circuits.
- 17. Specific Secondary Packs shall be available that control louver/damper motors for skylights.
- 18. Specific Secondary Packs shall be available that provide a pulse on/pulse off signal for purposes of controlling shade systems via relay inputs.
- E. Networked System Relay & Dimming Panels
 - 1. Panel shall incorporate up to 4 normally closed latching relays capable of switching 120/277 VAC or up to 2 Dual Phase relays capable of switching 208/240/480 VAC loads.
 - 2. Relays shall be rated to switch up to a 30A ballast load at 277 VAC.
 - 3. Panel shall provide one 0-10VDC dimming output paired with each relay.

- 4. Panel shall power itself from an integrated 120/277 VAC supply.
- 5. Panel shall be capable of operating as either two networked devices or as one.
- 6. Panel shall supply current limited low voltage power to other networked devices connected via CAT-5.
- 7. Panel shall provide auxiliary low voltage device power connected wired directly to a dedicated terminal connection
- F. Networked Auxiliary Input / Output (I/O) Devices
 - 1. Devices shall be plenum rated and be inline wired, screw mountable, or have an extended chase nipple for mounting to a ¹/₂" knockout.
 - 2. Devices shall have two RJ-45 ports
 - 3. Communication and low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors.
 - 4. Specific I/O devices shall have a dimming control output that can control 0-10 VDC dimmable ballasts or LED drivers by sinking up to 20 mA of current (typically 40 or more ballasts).
 - 5. Specific I/O devices shall have an input that read a 0-10 VDC signal from an external device.
 - 6. Specific I/O devices shall have a switch input that can interface with either a maintained or momentary switch and run a switch event, run a local/remote control profile, or raise/lower a dimming output
 - 7. Specific I/O devices shall sense state of low voltage outdoor photocells
 - 8. Specific I/O devices shall enable RS-232 communication between lighting control system and Touch Screen based A/V control systems.
 - 9. Specific I/O devices shall sense .
- G. Networked LED Luminaires
 - 1. Networked LED luminaire shall have a mechanically integrated control device
 - 2. Networked LED luminaire shall have two RJ-45 ports
 - 3. Networked LED luminaire shall be able to digitally network directly to other network control devices (sensors, photocells, switches, dimmers)
 - 4. Networked LED luminaire shall provide low voltage power to other networked control devices
 - 5. System shall be able to turn on/off LED luminaire without using a relay
 - 6. System shall be able to maintain constant lumen output over the specified life of the LED luminarie (also called lumen compensation) by varying the input control power (and thus saving

up to 20% power usage).

- 7. System shall indicate (via a blink warning) when the LED luminaire has reached its expected life (in hrs).
- H. Networked System Wall Switches & Dimmers
 - 1. Devices shall recess into single-gang switch box and fit a standard GFI opening.
 - 2. Devices shall be available with one integrated Class 1 switching relay.
 - 3. Communication and low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors.
 - 4. All sensors shall have two RJ-45 ports.
 - 5. All devices shall provide toggle switch control. Dimming control shall be provided when dimmable fixtures are controlled.
 - 6. Devices shall be available in four colors (Ivory, White, Light Almond, Gray).
 - 7. Devices with dimming control outputs can control 0-10 VDC dimmable ballasts by sinking up to 20 mA of current (typically 40 or more ballasts).
 - 8. Devices with mechanical push-buttons shall provide tactile and LED user feedback.
 - 9. Devices with mechanical push-buttons shall be made available with custom button labeling
 - 10. Devices with a single on button shall be capable of selecting all possible lighting combinations for a bi-level lighting zone such that the user confusion as to which of two buttons (as is present in multi-button scenarios) controls which load is eliminated.
- I. Networked System Graphic Wall Station
 - 1. Device shall have a 3.5" full color touch screen for selecting up to 8 programmable lighting control presets or acting as up to 16 on/off/dim control switches.
 - 2. Device shall enable configuration of lighting presets, switched, and dimmers via password protected setup screens.
 - 3. Device shall enable user supplied .jpg screen saver image to be uploaded.
 - 4. Device shall surface mount to single-gang switch box
 - 5. Device shall have a micro-USB style connector for local computer connectivity.
 - 6. Device shall have two RJ-45 ports for communication
- J. Networked System Scene Controllers
 - 1. Device shall have two to four buttons for selecting programmable lighting control profiles or acting as on/off switches.
 - 2. Device shall recess into single-gang switch box and fit a standard GFI opening.

- 3. Devices shall provide LED user feedback.
- 4. Communication and Class 2 low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors.
- 5. All sensors shall have two RJ-45 ports.
- 6. Device shall be capable of reprogramming other devices in its zone so as to implement user selected lighting scene.
- 7. Device shall be capable of selecting a lighting profile be run by the system's upstream Gateway so as to implement selected lighting profile across multiple zones (and not just its local zone).
- 8. Device shall have LEDs indicating current selection.
- K. Communication Bridges
 - 1. Device shall surface mount to a standard 4" x 4" square junction box.
 - 2. Device shall have 8 RJ-45 ports.
 - 3. Device shall be capable of aggregating communication from multiple lighting control zones for purposes of minimizing backbone wiring requirements back to Control Gateway.
 - 4. Device shall be powered with Class 2 low voltage supplied locally via a directly wired power supply or delivered via a CAT-5 cabled connection.
 - 5. Device shall be careful of redistributing power from its local supply and connect lighting control zones with excess power to lighting control zones with insufficient local power. This architecture also enables loss of power to a particular area to be less impactful on network lighting control system.

2.4 LIGHTING CONTROL PROFILES

- A. Changes to the operation of the system shall be capable of being made in real-time or scheduled via lighting control profiles. These profiles are outlines of settings that direct how a collection of devices function for a defined time period.
- B. Lighting control profiles shall be capable of being created and applied to a single device, zone of devices, or customized group of zones.
- C. All relays and dimming outputs shall be capable of being scheduled to track or ignore information regarding occupancy, daylight, and local user switches via lighting control profiles.
- D. Every device parameter (e.g. sensor time delay and photocell set-point) shall be configurable via a lighting control profile.
- E. All lighting control profiles shall be stored on the network control gateway device and on the software's host server.
- F. Lighting control profiles shall be capable of being scheduled to run according to the following calendar options: start date/hour/minute, end date/hour/minute, and sunrise/sunset +/- timed offsets.

- G. Sunrise/sunset times shall be automatically derived from location information using an astronomical clock.
- H. Daylight savings time adjustments shall be capable of being performed automatically, if desired.
- I. Lighting control profile schedules shall be capable of being given the following recurrence settings: daily, weekday, weekend, weekly, monthly, and yearly.
- J. Software shall provide a graphical tool for easily viewing scheduled lighting control profiles.

2.5 MANAGEMENT SOFTWARE

- A. Every device parameter (e.g. sensor time delay and photocell set-point) shall be available and configurable remotely from the software
- B. The following status monitoring information shall be made available from the software for all devices for which it is applicable: current occupancy status, current PIR Status, current Microphonics Status, remaining occupancy time delay(s), current photocell reading, current photocell inhibiting state, photocell transitions time remaining, current dim level, device temperature, and device relay state(s).
- C. The following device identification information shall be made available from the software: model number, model description, serial number, manufacturing date code, custom label(s), and parent network device.
- D. A printable network inventory report shall be available via the software.
- E. A printable report detailing all system profiles shall be available via the software.
- F. Software shall require all users to login with a User Name and Password.
- G. Software shall provide at least three permission levels for users.
- H. All sensitive stored information and privileged communication by the software shall be encrypted.
- I. All device firmware and system software updates must be available for automatic download and installation via the internet.
- J. Software shall be capable of managing systems interconnected via a WAN (wide area network)

2.6 BMS COMPATIBILITY

- A. System shall provide a BACnet IP gateway as a downloadable software plug-in to its management software. No additional hardware shall be required.
- B. BACnet IP gateway software shall communicate information gathered by networked system to other building management systems.
- C. BACnet IP gateway software shall translate and forward lighting relay and other select control commands from BMS system to networked control devices.

2.7 SYSTEM ENERGY ANALYSIS & REPORTING SOFTWARE

- A. System shall be capable of reporting lighting system events and performance data back to the management software for display and analysis.
- B. Intuitive graphical screens shall be displayed in order to facilitate simple viewing of system energy performance.
- C. An "Energy Scorecard" shall be display that shows calculated energy savings in dollars, KWHr, or CO2.
- D. Software shall calculate the allocation of energy savings to different control measures (occupancy sensors, photocells, manual switching, etc).
- E. Energy savings data shall be calculated for the system as a whole or for individual zones.
- F. A time scaled graph showing all relay transitions shall be presented.
- G. A time scaled graph showing a zones occupancy time delay shall be presented
- H. A time scaled graph showing the total light level shall be presented.
- I. User shall be able to customize the baseline run-time hours for a space.
- J. User shall be able to customize up to four time-of-day billing rates and schedules.
- K. Data shall be made available via a .CSV file

2.8 START-UP & SUPPORT FEATURES

- A. To facilitate start-up, all devices daisy-chained together (using CAT-5) shall automatically be grouped together into a functional lighting control zone.
- B. All lighting control zones shall be able to function according to default settings once adequate power is applied and before any system software is installed.
- C. Once software is installed, system shall be able to auto-discover all system devices without requiring any commissioning.
- D. All system devices shall be capable of being given user defined names.
- E. All devices within the network shall be able to have their firmware reprogrammed remotely and without being physically uninstalled for purposes of upgrading functionality at a later date.
- F. All sensor devices shall have the ability to detect improper communication wiring and blink its LED in a specific cadence as to alert installation/startup personnel.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Receive, inspect, handle, and store panels according to NECA 407.
- B. Examine panels before installation. Reject panels that are damaged or rusted or have been subjected to water saturation.

- C. Examine elements and surfaces to receive panels for compliance with installation tolerances and other conditions affecting performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

Install equipment in accordance with manufacturer's installation instructions.

Provide complete installation of system in accordance with Contract Documents.

- Provide equipment at locations and in quantities indicated on Drawings. Provide any additional equipment required to provide control intent.
- Define each dimmer's/relay's load type, assign each load to a zone, and set control functions.

Season lamps at full intensity according to lamp manufacturer's recommendation.

Install equipment in accordance with manufacturer's installation instructions.

Provide complete installation of system in accordance with Contract Documents.

- Provide equipment at locations and in quantities indicated on Drawings. Provide any additional equipment required to provide control intent.
- Define each dimmer's/relay's load type, assign each load to a zone, and set control functions.

Season lamps at full intensity according to lamp manufacturer's recommendation.

Install plenum cable in environmental air spaces, including plenum ceilings.

Comply with requirements for raceways and boxes specified in Section 26 05 33 "Raceways and Boxes for Electrical Systems."

Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

3.3 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals.
- B. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
- C. Create a directory to indicate loads served by each relay; incorporate Owner's final room designations. Obtain approval before installing. Use a PC or typewriter to create directory; handwritten directories are unacceptable.
- D. Lighting Control Panel Nameplates: Label each panel with a nameplate.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect

components, assemblies, and equipment installations, including connections.

- B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- C. Acceptance Testing Preparation:
 - 1. Test continuity of each circuit.
- D. Lighting control panel will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports, including a certified report that identifies lighting control panels and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations made after remedial action.

3.5 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. Confirm correct communications wiring, initiate communications between panels, and program the lighting control system according to approved configuration schedules, time- of-day schedules, and input override assignments.
- B. Required factory-trained personnel site visits:
 - 1. Pre-installation: The system shall be provided with visits from factory trained technician(s) for a pre-installation visit with the contractor prior to system installation.
 - 2. Commissioning and Programming: A second visit shall be included for commissioning and programming of the system including testing of switches and sensors.
 - 3. Owner Training: A third visit shall be provided for owner training after the owner has occupied the building. Minimum four hour training to be video recorded.
 - 4. Owner Re-Training and System Adjustment: A fourth visit 6 months after the owner has occupied the building shall be provided to tweak the system for occupant preferences and for additional training.

3.6 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months from 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.

3.8 SEQUENCE OF OPERATION

A. Classrooms:

1. The classrooms shall be provided with two control stations at the entry door to turn on and dim the zones of lighting in four (4) presets. The first preset shall be labeled "green" and shall turn all lighting on to 30 footcandles. The second preset shall be labeled "AV" and shall turn the lighting

closest to the interactive whiteboard on to 10% output with the rest of the lighting at 30% output. The third preset shall be labeled "Full" with all lighting at 100% output. The fourth preset shall be labeled "Low" and shall be all lighting at 10% output. A vacancy sensor shall be provided to turn lights off when no occupancy has been detected for 30 minutes. It shall include auxillary relay contacts to provide occupancy status to the temperature control system. The second control station shall include on/off and up/down buttons for each zone.

B. Offices

- 1. The offices shall be provided with a dimmer at the entry door to turn on and dim all lighting in one zone. A vacancy sensor shall be provided to turn lights off when no occupancy has been detected for 30 minutes.
- C. Corridor/Lobbies/Vestibules:
 - 1. The common areas shall be controlled via time of day scheduling. These areas shall be placed in occupied mode at 6:00AM and unoccupied mode at 5:00PM. At 5:00PM the lighting will be swept off after a blink warning to provide occupants time to hit the switch and receive 90 minutes of additional lighting. Switches shall be placed in locations indicated on drawings to provide 90 minute over-ride to on when necessary. During school hours the switches will be programmed as on only.

D. Restrooms:

- 1. The restrooms shall be controlled via occupancy sensors. Switches in restrooms will be used for over-ride to on only. The occupancy sensor shall maintain the lights on for a period of 30 minutes.
- E. Storage Rooms:
 - 1. The storage rooms shall be provided with a low voltage switch at the entry door allowing the occupant to turn lighting on if needed. The vacancy sensor shall turn the lighting off when no occupancy has been detected for 5 minutes.
- F. Gym:
 - 1. The lighting shall be controlled via low voltage switches at entry doors and where indicated on the drawings. Time of day scheduling will put the Gym into occupied mode at 6:00AM and into unoccupied mode at 10:00PM. The occupant will be required to turn the lighting on when they enter the space. If the lighting is not switched off then the time of day scheduling will sweep it off after a blink warning.
- G. Media Center:
 - 1. The media center shall be provided with a switch at the entry doors to turn on all lighting in one zone. A graphic wall station shall be provided at the media desk to switch and dim four (4) separate zones. Time of day scheduling shall place the room into occupied mode at 6:00AM and shall sweep lighting off after a blink warning at 5:00PM.
- H. Cafeteria:
 - The cafeteria shall be provided with a switch at the entry doors to turn on all lighting in one zone. A three zone control station shall be provided at one entry door adjacent to Custodial Receiving to dim three (3) separate zones. Time of day scheduling shall place the room into occupied mode at 6:00AM and shall sweep lighting off after a blink warning at 5:00PM.
- I. Kitchen:

- The kitchen shall be controlled via time of day scheduling. It shall be placed in occupied mode at 4:00AM and unoccupied mode at 3:00PM. At 3:00PM the lighting will be swept off after a blink warning to provide occupants time to hit the switch and receive 90 minutes of additional lighting. Switches shall be placed in locations indicated on drawings to provide 90 minute over-ride to on when necessary. During school hours the switches will be programmed as on only.
- J. Mechanical/Electrical Rooms:
 - 1. The mechanical/electrical rooms shall be provided with a low voltage switch at the entry door allowing the occupant to turn lighting on if needed. The vacancy sensor shall turn the lighting off when no occupancy has been detected for 30 minutes.

3.9 SERVICE AND SUPPORT

- Provide factory certified field service engineer to make minimum of three site visits to ensure proper system installation and operation under following parameters
 - Qualifications for factory certified field service engineer:
 - Minimum experience of 2 years training in the electrical/electronic field.
 - Certified by the equipment manufacturer on the system installed.
 - Make first visit prior to installation of wiring. Contractor must schedule meeting Electrical Engineer and Manufacturer representative to review system and functionality prior to installation of wire and equipment.
 - Make second visit upon completion of installation of Network Lighting Control System for system start up. Schedule start up with owner and engineer with 2 weeks prior notice.
 - A total two (2) Owner training session with the electrical contractor, the lighting controls contractor, the factory authorized representative, engineer of record, and the owner (and staff) shall be conducted at the project site. The training session shall be scheduled a minimum of 2 weeks prior. The training session shall not be conducted until the lighting controls system has been programmed and is fully operational.
 - A total of two (2) walk thrus shall be conducted after completion of construction to assure that the system is fully operational. The walk thrus shall be schedule a minimum of 2 weeks prior and shall be conducted at the request of the owner or engineer of record. In lieu of a formal request from the owner or engineer of record the walk thrus shall be conducted 3 months and 9 months after completion of construction. Reports shall be issued at each walk-thru.

END OF SECTION 265116

SECTION 275100 - PAGING/INTERCOM SYSTEM

1. GENERAL REQUIREMENTS

A. Scope of the Work

- (1) The work to be provided herein consists of furnishing and installing all equipment, cabling and labor required for modifications to existing system.
- (2) The equipment specified herein is based on equipment manufactured by DUKANE CORPORATION. Rauland and Simplex are acceptable manufacturers.
- (3) The electronic systems contractor shall be the manufacturer's authorized representative for the equipment proposed and have adequate experience with the proposed manufacturer's equipment and submit proof of having been a factory authorized distributor for the proposed product for at least five years.
- (4) The electronic systems contractor shall have a factory trained service department on call 24 hours a day, 365 days a year, to service the specified product.
- (5) The electronics systems contractor shall provide a reference list of five similar sized projects installed by the contractor including contacts and telephone numbers.
- (6) Intentional or unintentional painting of exposed low voltage or line voltage cabling is prohibited. The contractor shall ensure that exposed cabling is adequately protected from direct painting or overspray whether painting is required within the electrical specifications or required by other disciplines/trades. The contractor shall review the painting requirements for all disciplines and shall provide cabling protection as required. Where exposed cabling is being installed in exposed ceiling or wall spaces that are required to be painted, the contractor shall provide alternate options for cable colors and shall provide submittals for such cabling to engineer for approval.

2. SYSTEM COMPONENTS

- A. Field Equipment
 - (1) Ceiling speakers: provide an 8" speaker with a 5 oz. magnet complete with line matching transformer. Program rating shall be 15 watts continuous.
 - (2) Provide a square recessed baffle with each unit. The speaker assembly shall be a DUKANE 5A606 speaker with a 6A328 grille. The backbox shall be a DUKANE 145-222.
 - (3) Wall speaker: provide an 8" speaker with a 5 oz. magnet complete with line matching transformer. Program rating shall be 15 watts continuous. The speaker assembly shall be a DUKANE model 6A551.
 - (4) Outside speaker (recessed mount): Provide a DUKANE outdoor recessed speaker. Provide speaker with a multitap line matching transformer. A swivel mount bracket will be provided to allow ease of adjustment. Units shall be weather resistant.

3. WIRING

Size and quantity of conductors shall be in accordance with manufacturer's requirement for cabling. Cables may be run in conduit or in return air plenums provided the cable is UL listed for plenum use.

4. WARRANTY AND TRAINING

- A. The system contractor shall warrant any equipment installed under this specification to be free from defect for a period of one year from date of final acceptance.
- B. The system contractor shall provide a minimum of four hours training for school district personnel on proper operating procedures for the system.

END OF SECTION 275100

SECTION 283100 - FIRE ALARM SYSTEM

1. GENERAL

A. SCOPE AND RELATED DOCUMENTS

- (1) The work covered by and the intent of this section of the specifications includes the furnishing of all labor, equipment, materials, testing, programming and performance of all operations in connection with the modifications of the existing Fire Alarm System as shown on the drawings, as herein specified and as required by the applicable codes.
- (2) The requirements of all other applicable conditions of the Contract, Supplementary Conditions and General Requirements, apply to the work specified in this section.
- (3) The complete installation shall conform to the applicable sections of NFPA-71, NFPA-72A, B, C, D, Local Code Requirements and National Electrical Code (Article 760). The requirements of any local fire department and the Authority Having Jurisdiction shall also be observed in the system installation and device layout.
- (4) The work included in this section shall be coordinated with related work specified elsewhere in these specifications.

B. QUALITY ASSURANCE

- (1) Every component, device, transmitter, software, etc., that are included in the work, to make up a complete Fire Alarm System shall be listed as a product by the manufacturer under the appropriate category by the Underwriters' Laboratories, Inc. (UL), and shall bear the "U.L." label.
- (2) The system power, signal and controls wiring shall be UL listed for Power Limited Applications per NEC 760. All circuits shall be marked in accordance with NEC Article 760.

C. GENERAL

- (1) Equipment submissions for shop drawing review must include a minimum of the following:
 - a. Complete descriptive data indicating UL listing for all system components.
 - b. Complete system wiring diagrams for components capable of being connected to the system and interfaces to equipment supplied by others.
 - c. A copy of any state or local Fire Alarm System equipment approvals.
 - d. An Autocad (latest version) produced wiring diagram illustrating the basic floor plan of the building, showing all system wiring and equipment, as well as zoning boundaries and schedule of zone legends as intended to appear on annunciators. Provide three CD-Rom copies of as-built drawings and all system operational software at close of project, to be included in operation and maintenance manuals.
- (2) No work shall be done until the drawings are approved by the Kentucky Department of Housing, Buildings and Construction.
- D. POWER REQUIREMENTS

- (1) The control panel shall receive 120 VAC power via a dedicated circuit. The incoming circuit shall have suitable overcurrent protection within the control panel, as well as at the circuit source. If additional circuits are required for this or other control units, they shall be provided by the Contractor.
- (2) If the facility is equipped with an emergency standby power generator, the fire alarm equipment shall be connected to this system, per N.E.C.
- (3) The system control panel and auxiliary equipment, such as power supplies shall be provided with sufficient battery capacity to operate the entire system upon loss of normal 120 VAC power in a normal supervisory mode for a period of time as required by codes for the building occupancy. There shall be reserve battery capacity to drive all alarm appliances for five minute indication at the end of this period. The system shall automatically transfer to the standby batteries upon power failure. All battery charging and recharging operating shall be automatic. Batteries, once discharged, shall recharge at a rate that will provide a minimum of 70% capacity in 12 hours, or sooner if required by codes.
- (4) All circuits requiring system operating power shall be 24 VDC and shall be individually fused at the control panel.
- (5) Power supplies for Notification signals, whether in the main panel or within remote power supply cabinets, shall be designed to provide a minimum of 20% spare capacity for future signals.

E. SYSTEM SOFTWARE AND PROGRAMMING

(1) Provide all programming and software necessary to place annunciators and controls in full operation. System set-up shall allow for changes in annunciator legends without rewiring or addition of programming or electronics. Furnish initial programming and reprogramming as needed to accommodate changes in the system up to the time of system acceptance by the engineer without extra charge.

F. PERIPHERAL DEVICES

<u>Note</u>: On fully digital multiplex systems, provide addressable devices, bases or modules for devices listed herein. Each device shall be an individual address on the system. Addressable bases or modules shall be U.L. listed for the device served.

(1) MANUAL PULL STATION

a. Manual stations shall be double action and shall be constructed of high impact, red lexan or cast metal with raised white lettering and a smooth high gloss finish. The manual pull station shall have a hinged front with key lock. Stations shall be keyed alike with the fire alarm control panel. When the station is operated, the handle shall lock open in a protruding manner. Furnish one key for each manual station to owner at close of project, during instruction period. Install within 60" of each exit, per code, whether indicated on the drawings or not.

(2) CEILING-MOUNTED SMOKE DETECTORS, PHOTOELECTRIC TYPE

- a. Furnish and install where indicated on the plans or required, ceiling-mounted smoke detectors. Provide separate outlet-box mounted base with auxiliary relay, or standard base, as required.
- b. Smoke Detectors shall be listed to U.L. Standard 268 and shall be compatible with their control equipment. Detectors shall be listed for this purpose by Underwriters' Laboratories, Inc. The

detectors shall obtain their operating power from the fire alarm panel supervised detection loop. Loss of the operating voltage shall interrupt the supervisory circuit of the fire alarm detection loop and cause a trouble signal to be generated at the control panel. Detectors shall be capable of being reset at the main control panel.

- c. No radioactive materials shall be used. Detector construction shall provide mounting base with twist-lock detector head. Contacts between the base and head shall be of the bifurcated type using spring-type, self-cleaning contacts. Removal of the detector head shall interrupt the supervisory circuit of the fire alarm detection loop and cause a trouble signal at the control panel. Detector design shall provide full solid state construction, and compatibility with other normally open fire alarm detection loop devices such as heat detectors, pull stations, etc.
- d. To minimize nuisance alarms, voltage and RF transient problems, suppression techniques shall be employed as well as a smoke verification circuit and an insect screen. The detector head shall be easily disassembled to facilitate cleaning.
- e. Remote LED alarm indicators shall be installed where required.
- f. Smoke detectors (and all other system electronics) shall be shielded to protect circuitry from EMI problems generated by power fields, cellular phones, etc.
- g. <u>Special Note:</u> The Contractor installing smoke detectors shall use care in the final positioning of all devices. They shall not be installed closer than 36" from an air diffuser or return grille, closer than 24" from a ceiling/wall intersection, or similar location that would diminish detector performance. Refer to and comply with NFPA 72E, "Standard On Automatic Fire Detectors".
- h. Provide smoke detector at each fire alarm system control component, as required by code.

(3) AUTOMATIC HEAT DETECTORS (RATE-OF-RISE TYPE)

a. Automatic heat detectors shall be combination rate-of-rise and fixed-temperature type. When the fixed-temperature portion is activated, the units shall be non-restorable and give visual evidence of such operation. Heat detectors shall be 135, 165 or 195NF, as indicated on plan. Where not indicated, provide 165° F units. Provide as indicated or required.

(4) AUTOMATIC HEAT DETECTORS (FIXED TEMPERATURE TYPE)

a. Where indicated on the plans, provide automatic heat detectors of the non-restorable type, of the temperature rating as indicated or required. Detector heads shall be mounted to an outlet-box mounted base. Provide auxiliary contacts as needed. Provide as indicated or required.

(5) AUDIBLE AND VISUAL UNITS

a. Audible signals shall be polarized and shall be operated by 24 VDC. Each audible assembly shall include separate wire leads for in/out wiring for each leg of the associated signal circuit. T-tapping of signal device conductors to signal circuit conductors will not be accepted. The audible visual units shall be equipped with a xenon-type strobe which shall be semi-flush mounted on 4" square outlet box. Each audible device shall produce a minimum sound pressure level of 92db at 36" on axis. Provide units as manufactured by Wheelock, Inc., or approved equivalent. Locate as indicated or required. All audible tones for same function shall be identical, per NFPA. Provide sufficient audible units to comply with code for required coverage. Provide temporal coded signals.

- b. The output intensity of all visual units, their locations and mountings shall be in compliance with the latest version of the Americans with Disabilities Act requirements.
- c. Audible units and visual units shall be wired to separate Notification circuits, allowing for silencing of audibles with alarm acknowledgment, continuing operation of strobes until system reset. Addressable devices may be used to fulfill this requirement.
- d. Provide system-wide synchronization of all visual devices, so that all strobes flash at the same rate and at the same time, complying with A.D.A.

(6) VISUAL UNITS

a. Stand-alone visual indicating units shall be xenon type strobe matching audio-visual units. These devices shall be UL listed and be or wall mounted. A high-impact clear lens shall project out from backplate. Lettering, if any, shall be oriented upright to the standing viewer. Candela output values of all visual units shall be selected for the covered spaces geometry and size, complying with A.D.A. and NFPA.

(7) DOOR HOLDERS

a. Magnetic door holders shall be 24 volt A.C., and shall have an approximate holding force of 25 lbs or greater, if required to restrain door. The door-mounted portion shall have a plated steel pivot mounted armature with shock absorbing bearing. Unit shall be capable of being either surface, flush, semi-flush or floor mounted as required. Door holders shall be UL listed for their intended purpose. Where door mounted, locate armature 6" down from top and 6" in from strike side of leaf. Where door swing prevents direct contact between armature and holder pole piece, provide non-removable plated chain to close gap as tightly as possible. Verify holder positioning with Architect prior to mounting any devices. Unless otherwise indicated, provide semi-flush mounted holders 6" below top of door leaf as noted above, with blocking in wall to support force of door impact against holder and outlet box. Provide at all needed locations as indicated or required. Coordinate with architectural hardware schedule, as applicable to project.

(8) DUCT SMOKE DETECTORS

- a. Duct smoke detectors shall be of the solid state photoelectric type, operating on the light scattering photodiode principle. The detectors shall ignore invisible airborne particles or smoke densities that are below the set alarm point. No radioactive materials shall be used. The basic construction of duct smoke detectors shall be the same as that previously described for ceiling-mounted smoke detectors. Duct housing couplings shall be slotted to insure proper alignment of the sampling and exhaust tubes. Detector shall have an alarm status LED visible through a transparent cover, panel or in housing.
- b. The Contractor shall furnish air duct smoke detectors with template to the sheetmetal or air handling unit installer for installation. Coordinate length of sampling probe required and furnish appropriate length. Probe tube shall be located in accord with manufacturer's recommendations, to give maximum sampling rate of airflow. Provide multiple detectors, as required, if a single device will not provide adequate sensing due to duct size or air velocity. Wire multiple detectors on a single air handling system as a single zone or address unless otherwise required by prevailing codes. Field verify quantity of detectors needed to provide NFPA-compliant coverage of the air handling unit and provide as required.

- c. Detector supervised power and alarm wiring (from F.A. control panel) is to be provided by the Contractor. Interlock wiring from auxiliary contacts to stop or otherwise control air handling unit fan motor(s) is to be provided by the Contractor. Provide auxiliary contacts as required. Zone wiring and indication for air duct smoke detectors shall be maintained separate from area detection devices. Detector shall be capable of being reset at the main control panel, and at a local test/reset station.
- d. Where air duct smoke detectors are located in other than Mechanical Rooms or in spaces not easily visible, a remote alarm/power indicating LED key reset station shall be installed. These remotes shall be ganged together, if required, and labeled accurately as to which unit is reporting an alarm condition.
- e. Where air duct smoke detectors are indicated to be furnished at concealed air handling units above ceilings or smoke damper locations, furnish as outlined above. Also provide remote indicating alarm LED flush in corridor wall at 7'-0" A.F.F. immediately below installation, or as close as practical to installation. The Contractor is to provide control wiring, E.P. switches, etc., as required to operate smoke dampers, as well as the required operating circuit. Coordinate all requirements with the installer of smoke dampers.
- f. Ionization type detectors shall not be utilized for air duct smoke detection.
- g. All air duct smoke detector installations and materials shall be in accord with U.L., NFPA, and any other applicable codes.

(9) WEATHERPROOF DEVICES AND EXPLOSION-PROOF DEVICES

a. Where the anticipated atmosphere or installation conditions require weather-proof, explosion-proof or other specially housed devices, they shall be U.L.-listed and NFPA-compliant and provided as indicated or required. Verify installation conditions and indicate type of device on shop drawing submission.

(10) END OF LINE RESISTOR

a. End-of-line devices (if required) shall be flush-mounted, located at 7'-0" A.F.F. in corridor walls or as indicated.

(11) GUARDS FOR DEVICES

a. Where detectors, manual stations, signals, etc., require or are indicated to be furnished with a guard, utilize a U.L. listed unit, compactly covering and compatible with the device. Provide as indicated or required. Guards shall not diminish the performance of any device.

(12) REMOTE POWER SUPPLY UNITS FOR PERIPHERAL

- a. Provide remote power supply(ies) as required for proper system operation.
- b. Remote power supplies shall be provided with local intelligence compatible with the digital multiplex network, so they have a unique address, providing the ability to monitor the supply for loss of power, shorts, grounds and other supervisory functions.
- c. Where required by the fire alarm system manufacturer, remote power supplies shall be provided that will provide sufficient current to drive audio/visual or other required devices.

- d. These units shall be located in electrical closets, mechanical rooms or similar spaces. They shall not be installed in finished areas, storage rooms, etc., without the permission of the Engineer. All locations shall be indicated on the shop drawing submissions.
- e. Provide dedicated 120 volt power circuit(s) from nearby panelboards as required, whether indicated on the plans or not.

G. INSTALLATION

- (1) Provide and install the system in accordance with the plans and specifications, all applicable codes and the manufacturer's recommendations. All wiring shall be in a completely separate conduit system from power wiring or other raceway systems. Minimum conduit size shall be 3/4" trade size. Maximum wire fill shall be 40%, for any raceway system. All conduit shall be red, except where exposed in public spaces.
- (2) All junction boxes shall have coverplates painted red and labeled "Fire Alarm". A consistent wiring color code shall be maintained throughout the installation. The number of wiring splices shall be minimized throughout. Excessive wire splicing (as determined by the Engineer), shall be cause for rejection of the work.
- (3) All circuit breakers and disconnects serving fire alarm equipment shall be marked in red and clearly labeled as Fire Alarm Circuits.
- (4) Installation of equipment and devices that pertain to other work in the contract shall be closely coordinated with the appropriate tradesmen or other contractors.
- (5) The Contractor shall clean all dirt and debris from the inside and the outside of the fire alarm equipment after completion of installation.
- (6) The manufacturer's authorized representative shall provide on-site supervision of installation, and shall perform the initial "power-up" of the system after he has thoroughly checked the installation.
- (7) Operation and maintenance manuals submitted for this project shall list names, license numbers, and telephone numbers of at least two installers that are employed full time by the supplier/manufacturer to install and test fire alarm systems in the installation location.

A floor plan drawing indicating fire alarm devices and wiring only, shall be provided by the manufacturing company for job site use. These drawings shall be approved by the State Fire Marshal's Office or Local Authority Having Jurisdiction, as appropriate and in accord with code requirements. A copy of this drawing shall be submitted to the Engineer for his review, approval and project records.

H. TESTING

(1) The completed fire alarm system shall be fully tested in accordance with NFPA-72H by the contractor in the presence of the Owner's representative and the Local Fire Marshal. Upon completion of a successful test, the Contractor shall certify the test results in writing to the Fire Marshal, Owner, General Contractor, Architect and Engineer. Provide one week's written advance notice of the test to all concerned parties.

- (2) All auxiliary devices the fire alarm system is connected to, including tamper switches, flow switches, elevator controls, remote receiving stations, etc., shall be fully tested for proper operation where interfacing with the fire alarm system.
- (3) The Contractor shall provide a minimum of three hours of instructional time to the Owner in the operation and maintenance of all equipment and components. A receipt shall be obtained from the Owner that this has been accomplished, and a copy forwarded to the Engineer. Provide additional training time if required by the Owner at no charge to the contract or as direct charge to the Owner.

I. WARRANTY

- (1) The Contractor shall unconditionally guarantee (except for vandalism or misuse) the completed fire alarm system wiring and equipment to be free from inherent mechanical, software and electrical defects for a period of one year from the date of substantial completion.
- (2) The equipment manufacturer shall make available to the Owner a maintenance contract proposal to provide a minimum of two inspections and tests per year in compliance with NFPA-72H guidelines.

END OF SECTION 283100

SECTION 311000 - SITE CLEARING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Clearing and protection of vegetation.
- B. Removal of existing debris.
- C. Removal of existing site improvements including pavements, utilities and utility structures, foundations or other site improvements.

1.02 RELATED REQUIREMENTS

- A. Section 011000 Summary: Limitations on Contractor's use of site and premises.
- B. Section 013329 Sustainable Design Reporting
- C. Section 015000 Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.
- D. Section 015713 Temporary Erosion and Sediment Control.
- E. Section 017000 Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products.
- F. Section 312200 Grading: Topsoil removal.
- G. Section 312323 Fill: Filling holes, pits, and excavations generated as a result of removal operations.
- H. Section 312513 Permanent Erosion Controls
- I. Section 311500- Protection of Existing Trees

PART 2 PRODUCTS

2.01 MATERIALS

A. Fill Material: As specified in Section 312323 - Fill and Backfill

PART 3 EXECUTION

3.01 SITE CLEARING

- A. Comply with other requirements specified in Section 017000.
- B. Minimize production of dust due to clearing operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.

3.02 EXISTING UTILITIES AND BUILT ELEMENTS

- A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.
- B. Protect existing utilities to remain from damage.
- C. Do not disrupt public utilities without permit from authority having jurisdiction.
- D. Protect existing structures and other elements that are not to be removed.
- E. Pavements and slabs are to be saw cut to provide a clean edge. Concrete pavements are to be cut at the nearest control joint to the required demolition area.

3.03 VEGETATION

- A. Scope: Remove trees, shrubs, brush, and stumps in areas to be covered by building structure, paving, playing fields, lawns, planting beds, borrow areas (when applicable) and disposal areas (when applicable).
- B. Install substantial, highly visible fences at least 3 feet high to prevent inadvertent damage to vegetation to remain:
 - 1. At vegetation removal limits.
 - 2. Around trees to remain within vegetation removal limits; locate no closer to tree than at the drip line.
 - 3. Around other vegetation to remain within vegetation removal limits.
- C. Vegetation Removed: Do not burn, bury, landfill, or leave on site, except as indicated.
 - 1. Chip, grind, crush, or shred vegetation for mulching, composting, or other purposes; preference should be given to on-site uses.
 - 2. Trees: Sell if marketable; if not, treat as specified for other vegetation removed; remove stumps and roots to depth of 18 inches.
 - 3. Sod: Re-use on site if possible; otherwise sell if marketable, and if not, treat as specified for other vegetation removed.
- D. Restoration: If vegetation outside removal limits or within specified protective fences is damaged or destroyed due to subsequent construction operations, replace at no cost to Owner.

3.04 DEBRIS

- A. Remove debris, junk, and trash from site.
- B. Leave site in clean condition, ready for subsequent work.
- C. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

SECTION 311500 - PROTECTION OF EXISTING TREES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Protection of existing and newly planted trees is to be performed on the project site and at any areas adjacent to or near the site where construction activities impact the Tree Protection Zone (TPZ). Tree protection will function as follows:
 - 1. The foliage canopy and branching structure are to be kept clear from contact with equipment, vehicles, materials and activities
 - 2. The roots and soil conditions are to be preserved in an intact and non-compacted state
 - 3. No Soil disturbance is permitted within the identified Tree Protection Zone (TPZ) unless otherwise approved.
- B. Work included: Furnish all labor, materials, equipment and services necessary to protect existing trees on site and on adjacent road right-of-way and sites, including but not limited to:
 - 1. Survey and layout, installation, maintenance, adjustment during construction, and final removal of protective barriers and signs.
 - 2. Pruning as required, including hand excavation and root pruning if required and approved by the landscape architect and/or arborist.
 - 3. Excavation, soil stabilizing

1.02 RELATED REQUIREMENTS

- A. Section 011000 Summary: Contract descriptions, description of alterations work, work by others, future work, occupancy conditions, use of site and premises, work sequence.
- B. Section 013000 Administrative Requirements: Submittal procedures, project meetings, progress schedules and documentation, reports, coordination.
- C. Section 015713 Temporary Erosion and Sedimentation Control.
- D. Section 024100 Demolition: Selective demolition, site demolition, structure removal.
- E. Section 323113: Chain Link Fences and Gates.

1.03 DEFINITIONS AND PROCEDURES

- A. Tree Protection Zone (TPZ) (May be interchanged with Critical Root Zone (CPZ) and Drip-Line below): An area around the base of a tree with a radius of 10 times the diameter of the tree's trunk or twenty feet, whichever is greater.
- B. Tree Protection Barrier: any fencing or other barrier material, including supports and bracing for such, to be used to surround and enclose the TPZ.
- C. Critical Root Zone Area (CRZ): The area of undisturbed natural soil around a tree defined by a horizontal circle drawn at grade with the trunk at the center and extending for a radial distance equal to the distance from the center of the trunk to the outermost portion of the drip line.
- D. Drip Line: the area surrounding a tree directly below the outermost portions of the tree canopy, or a circular area with a radius of one-half of the height of the tree extending outward from the center point of the tree.
- E. Warning Sign: A warning sign is to be prominently displayed on each fence at 25- foot intervals.
- F. Root Protection: Materials or devices installed at ground level to protect the root system of trees from compaction during construction.
- G. Root Boring for utility installation: Directional micro-tunneling and boring may be permitted within the limits of the TPZ subject to approval by the Landscape Architect.

- H. Tree Topping: Practice of removing a substantial portion or all of the upper canopy of a tree. Tree Topping will not be allowed in this project.
- I. Root Boring: Boring beneath protected trees to provide a tunnel for the installation of utilities.

PART 2 PRODUCTS

2.01 TREE PROTECTION PRODUCTS

- A. Fencing: 4'-0" high orange plastic 'snow' or barrier fence. Provide steel posts spaced at 6 ft. minimum.
- B. Tree Protection Area Signs: minimum size 12" x 18", may be lettered vertically or horizontally.
 - 1. Size: minimum 12" x 18", vertical or horizontal placement.
 - 2. Text: CAUTION TREE PROTECTION ZONE DO NOT REMOVE. NO DUMPING, BURNING, STORAGE, CUTTING, MACHINERY OR VEHICLES.
 - 3. Material to be painted plywood or other weather resistant material.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Prior to the beginning of demolition or construction work, field verify the TPZ for each existing tree to be preserved. Perform any root exploratory excavation necessary to determine root location and condition and/or other existing conditions.
- B. Instruct all construction workers to observe the TPZ limits.

3.02 INSTALLATION

- A. No construction activity including grade changes, surface treatments or excavations of any kind is permitted within the TPZ of any existing tree to remain unless otherwise indicated on the project plan drawings. The area within the TPZ must remain undisturbed at all times.
- B. No root cutting is permitted unless done with the approval of the landscape architect and requiring the services of a qualified arborist or approved tree professional. An exploratory excavation by hand or using a low water pressure hydro vac method must be completed prior to commending with open face cuts outside the TPZ.
- C. Do not store materials or fill within the TPZ.
- D. Do not allow movement, parking or storage of vehicles or equipment within the TPZ.
- E. Do not discharge exhaust into foliage or allow fires under and adjacent to trees.
- F. Do not allow run off of spillage of damaging materials into the TPZ, including but not limited to concrete overflow or sleuth, gas, oil, paint, etc.
- G. Protection Barrier Fencing Layout:
 - 1. Typical Layout: Fencing is to enclose the entire area under the canopy drip line or TPZ (whichever is greater) of each tree or group of trees to be protected throughout the demolition and construction period.
 - 2. Special Layout:
 - a. For trees located within a planting strip or island, and where existing vehicular and/or pedestrian pathways must be kept open for use, only the planting strip or island and landscaped side of the TPZ is to be enclosed with the required fencing type.
 - b. For trees located in a tree well or sidewalk planter pit, the tree is to be wrapped with 2 inches of orange plastic fencing from the ground to the height of the first branch and overlaid with 2 inch thick wooden slats bound securely. Protect the tree bark

from direct contact with the slats. Use caution during installation to avoid damage to branches and tree stem.

- H. Install Tree Protection Barrier Fencing
 - 1. Chain Link: Fencing to be mounted on two-inch diameter galvanized steel posts, driven into the ground to a depth of at least 30 inches at no more than 10 foot spacing. Stanchions, concrete or blocks may be substituted for embedded posts at existing paved areas to be maintained open during the demolition/construction period.
 - 2. Orange safety fence: Embed posts a minimum 18 inches at no more than 5 (five) foot spacing. Fencing is to be tied closed completely surrounding the TPZ.
- I. Install Tree Protection Area and Enclosure Signage.
- J. Water retained trees thoroughly and deeply as necessary to supplement rainfall to maintain plant turbidity without prolonged saturation of the root zone. The method, amount and frequency of watering is to be per the recommendation of the arborist. Monitor soil moisture on a continual basis.
- K. Retained trees may require fertilizing and other measures to stimulate regeneration of lost roots and foliage. Fertilization and other measures are to be per the recommendation of the arborist.
- L. Tree Topping: No Tree Topping will be allowed.
- M. Tree Pruning: Branches which are found to be a barrier to construction or a health and safety hazard may be removed subject to the approval of the landscape architect/arborist.
 - 1. When removing a branch, cut outside the branch bard ridge and collar. Do not make a flush cut adjacent to the trunk of the tree or branch being pruned.
 - 2. Make a partial cut from beneath at a point several inches away from the trunk.
 - 3. Make a second cut from above several inches out from the first cut to allow the limb to fall safely.
 - 4. Complete the removal with a final cut just outside the branch collar (the raised area that surrounds the branch where it joins the trunk).
 - 5. Make all cuts clean and remove any jagged edges carefully.

3.03 INTERFACE WITH OTHER WORK:

A. Coordinate tree protection with all demolition, excavation and utility work in the area..

3.04 FIELD QUALITY CONTROL

- A. See Division 1 for Quality Requirements.
- B. Inspect for existing soil conditions which may be detrimental to tree health and survival; existing utilities within or adjacent to the TPZ; and extent of root system beyond the visible drip line.
- C. Any trees which are found to be in poor or damaged condition are to be evaluated by the landscape architect or arborist. Trees that are deemed to have a minimal chance of survival or which pose a health or safety risk may be removed or pruned by more than one-third subject to approval of the landscape architect/arborist and Owner.

3.05 MAINTENANCE

- A. See Division 1 for additional requirements relating to maintenance service.
- B. Trees are to be watered, aerated and maintained as necessary to ensure survival.
- C. Repair or replace any fencing, ground protection or signage that has been removed or damaged. Inspect installations on a continuous basis.
- D. Tree protection devices are to be removed at the end of the project (after final completion) and the area beneath the TPZ returned to original condition.

END OF SECTION

SECTION 312200 - GRADING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Removal of topsoil.
- B. Rough grading the site for site structures.
- C. Finish grading.

1.02 RELATED REQUIREMENTS

- A. Section 015713 Temporary Erosion and Sediment Control.
- B. Section 013329 Sustainable Design Reporting
- C. Section 311000 Site Clearing.
- D. Section 312316 Excavation.
- E. Section 312316.13 Trenching: Trenching and backfilling for utilities.
- F. Section 312323 Fill: Filling and compaction.
- G. Section 312513 Permanent Erosion Controls
- H. Section 329219 Seeding: Finish ground cover.
- I. Section 329223 Sodding: Finish ground cover.
- J. Section 329300 Plants: Topsoil in beds and pits.

1.03 SUBMITTALS

A. Project Record Documents: Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.

1.04 QUALITY ASSURANCE

A. Perform Work in accordance with State of Kentucky, Highway Department standards.

1.05 PROJECT CONDITIONS

- A. It is recommended that earthwork be done during the warm and dry months. If earthwork is to be done during cold or wet months, the use of DGA in lieu of general soil fill should be considered for structural and pavement areas. Time extensions will not be considered for any delays due to the Contractor choosing to not use DGA in lieu of general soil fill during cold or wet months.
- B. The soils found on this site are very sensitive to changes in the moisture content and will quickly degrade in such conditions and when subjected to construction traffic. The Contractor should carefully evaluate equipment to be used on the site so as to minimize degradation of the soils. In addition, the Contractor is to include in their bid the stabilization or repair of soils that will be affected by construction activities.
- C. The new vehicular pavement and stone base areas are not designed for construction traffic and should not be used for construction activities unless they are stabilized using #2 crushed stone and geogrid. Stabilization should include any undercutting and material handling, borrow or disposal necessary to maintain the design subgrade elevations after stabilization has been done. Any areas of subgrade, road base or pavement damage are to be repaired.
PART 2 PRODUCTS

2.01 MATERIALS

A. Topsoil: Excavated from site and free of weeds. Supplement as needed with imported fertile agricultural soil, typical for locality, capable of sustaining vigorous plant growth, taken from drained site; free of subsoil, clay or impurities, plants, weeds and roots; pH value of minimum 5.4 and maximum 7.0. Topsoil to be amended as needed.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that survey bench mark and intended elevations for the Work are as indicated.
- B. Verify the absence of standing or ponding water.

3.02 PREPARATION

- A. All site grading is unclassified.
- B. Identify required lines, levels, contours, and datum.
- C. Stake and flag locations of known utilities.
- D. Locate, identify, and protect from damage above- and below-grade utilities to remain.
- E. Provide temporary means and methods to remove all standing or ponding water from areas prior to grading.
- F. Protect site features to remain, including but not limited to bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs, from damage by grading equipment and vehicular traffic.
- G. Protect trees to remain by providing substantial fencing around entire tree at the outer tips of its branches; no grading is to be performed inside this line.
- H. Protect plants, lawns, rock outcroppings, and other features to remain as a portion of final landscaping.

3.03 ROUGH GRADING

- A. Remove topsoil from areas to be further excavated, re-landscaped, or re-graded, without mixing with foreign materials.
- B. Do not remove topsoil when wet.
- C. Remove subsoil from areas to be further excavated, re-landscaped, or re-graded.
- D. Do not remove wet subsoil, unless it is subsequently processed to obtain optimum moisture content.
- E. See Section 312323 for filling procedures.
- F. Benching Slopes: Horizontally bench existing slopes greater than 1:4 to key fill material to slope for firm bearing.
- G. Stability: Replace damaged or displaced subsoil to same requirements as for specified fill.
- H. Remove and replace soils deemed unsuitable by classification and which are excessively moist due to lack surface water control.

3.04 SOIL REMOVAL and STOCKPILING

A. Stockpile excavated topsoil on site. No topsoil is to be removed from the site. Topsoil stockpile is to be covered or seeded and mulched to protect the pile from erosion.

- B. Stockpile subsoil that is to be re-used on site; remove remainder from site. Cover stockpile to prevent erosion and saturation of the material.
- C. Stockpiles: Use areas designated on site; pile depth not to exceed 8 feet; protect from erosion.

3.05 FINISH GRADING

- A. Before Finish Grading:
 - 1. Verify building and trench backfilling have been inspected.
 - 2. Verify subgrade has been contoured and compacted.
- B. Remove debris, roots, branches, stones, in excess of 1/2 inch in size. Remove soil contaminated with petroleum products and legally dispose of it off-site.
- C. Where topsoil is to be placed, scarify surface to depth of 3 inches.
- D. In areas where vehicles or equipment have compacted soil, scarify surface to depth of 3 inches.
- E. Place topsoil to the following compacted thicknesses:
 - 1. Areas to be Seeded with Grass: 6 inches.
 - 2. Areas to be Sodded: 5 inches.
- F. Place topsoil during dry weather.
- G. Remove roots, weeds, rocks, and foreign material while spreading.
- H. Near plants, buildings, and other improvements spread topsoil manually to prevent damage.
- I. Fine grade topsoil to eliminate uneven areas and low spots. Maintain profiles and contour of subgrade.
- J. Maintain stability of topsoil during inclement weather. Replace topsoil in areas where surface water has eroded thickness below specifications.

3.06 TOLERANCES

- A. Top Surface of Subgrade: Plus or minus 0.10 foot (1-3/16 inches) from required elevation.
- B. Top Surface of Finish Grade: Plus or minus 0.04 foot (1/2 inch).

3.07 REPAIR AND RESTORATION

- A. Existing Facilities, Utilities, and Site Features to Remain: If damaged due to this work, repair or replace to original condition.
- B. Other Existing Vegetation to Remain: If damaged due to this work, replace with vegetation of equivalent species and size.

3.08 FIELD QUALITY CONTROL

A. See Section 312323 for compaction density testing.

3.09 CLEANING

- A. Sediment Control/Silt Fencing: Provide fabric silt fencing and other erosion control devices as required and shown on plans to control erosion and allow lawn crew to establish grass uniformly across slope areas.
- B. Remove unused stockpiled topsoil and subsoil. Grade stockpile area to prevent standing water.
- C. Leave site clean and raked, ready to receive landscaping.

END OF SECTION

SECTION 312316 - EXCAVATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Excavating for building volume below grade, footings, slabs-on-grade, paving, site structures, and non-utility excavations in the building pad.

1.02 RELATED REQUIREMENTS

- A. Section 015713 Temporary Erosion and Sediment Control: Slope protection and erosion control.
- B. Section 017000 Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring. General requirements for dewatering of excavations and water control.
- C. Section 312200 Grading: Soil removal from surface of site.
- D. Section 312200 Grading: Grading.
- E. Section 312316.13 Trenching: Excavating for utility trenches outside the building to utility main connections.
- F. Section 312319 Dewatering
- G. Section 312323 Fill: Fill materials, backfilling, and compacting.
- H. 312323.13 Flowable Fill

1.03 PROJECT CONDITIONS

- A. All excavation is unclassified including bedrock excavation.
- B. Verify that survey bench mark and intended elevations for the Work are as indicated.

PART 2 PRODUCTS

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that survey bench mark and intended elevations for the work are as indicated.

3.02 EXCAVATING

- A. Excavate to accommodate new structures and construction operations.
- B. If a footing/foundation trench or other excavation inside the building footprint is to be left open for more than 48-hours or when a rain event occurs, the excavation is to be over-excavated an additional 4-inches and a lean concrete mud mat or layer of flowable fill should be placed 4-inches thick over the bottom of the excavation. This mud mat can extend no more than 4-inches into the minimum soil cushion between the footing and bedrock.
- C. Fill areas that do not pass proof-roll are to be undercut and/or stabilized as necessary to provide a stable platform for fill placement.
- D. Notify Architect of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.
- E. Slope banks of excavations deeper than 4 feet to angle of repose or less until shored.
- F. Do not interfere with 45 degree bearing splay (zone of influence) of foundations without approval from the Architect and approved specific backfill requirements.

- G. Cut utility trenches wide enough to allow inspection of installed utilities.
- H. Hand trim excavations. Remove loose matter.
- I. Correct areas that are over-excavated and load-bearing surfaces that are disturbed; see Section 312323.
- J. Provide temporary means and methods, as required, to remove all water from excavations until directed by Architect. Remove and replace soils deemed suitable by classification and which are excessively moist due to lack of dewatering or surface water control.
- K. Determine the prevailing groundwater level prior to excavation. If the proposed excavation extends less than 1 foot into the prevailing groundwater, control groundwater intrusion with perimeter drains routed to sump pumps, or as directed by the Architect. If the proposed excavation extends more than 1 foot into the excavation, control groundwater intrusion with a comprehensive dewatering procedures, or as directed by the Geotechnical Engineer.
- L. Remove excavated material that is unsuitable for re-use from site.
- M. Stockpile excavated material to be re-used in area designated on site 312200.
- N. Remove excess excavated material from site.

3.03 FIELD QUALITY CONTROL

- A. See Division 1 for general requirements for field inspection and testing.
- B. Provide for visual inspection of load-bearing excavated surfaces by Architect before placement of foundations.

3.04 PROTECTION

- A. Divert surface flow from rains or water discharges from the excavation.
- B. Prevent displacement of banks and keep loose soil from falling into excavation; maintain soil stability.
- C. Protect open excavations from rainfall, runoff, freezing groundwater, or excessive drying so as to maintain foundation subgrade in satisfactory, undisturbed condition.
- D. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.

E. Keep excavations free of standing water and completely free of water during concrete placement. **END OF SECTION**

SECTION 312316.13 - TRENCHING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Excavation, backfilling and compacting for utilities outside the building to utility main connections.

1.02 RELATED REQUIREMENTS

- A. Section 013329 Sustainable Design Reporting
- B. Section 015713 Temporary Erosion and Sediment Control.
- C. Section 312200 Grading: Site grading.
- D. Section 312316 Excavation: Building and foundation excavating.
- E. Section 312323 Fill: Backfilling at building and foundations.
- F. Section 312323.13 Flowable Fill: Backfill of utilities and excavations in the zone of influence of a foundation, footing or structural element inducing a load to the subgrade materials.
- G. Section 334100 Subdrainage: Filter aggregate and filter fabric for foundation drainage systems.

1.03 DEFINITIONS

- A. Finish Grade Elevations: Indicated on drawings.
- B. Zone of Influence: Area beneath a footing or foundation that extends out from the bottom edge of the footing/foundation at a 45-degree angle down to a depth equal to 3 times the footing width.

1.04 REFERENCE STANDARDS

- A. AASHTO T 180 Standard Specification for Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 in.) Drop; 2010.
- B. ASTM D698 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)); 2012.
- C. ASTM D1556 Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method; 2007.
- D. ASTM D1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN m/m3)); 2012.
- E. ASTM D2167 Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method; 2008.
- F. ASTM D2487 Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2011.
- G. ASTM D3017 Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth); 2005.
- H. ASTM D4318 Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils; 2010.

1.05 SUBMITTALS

- A. See Division 1 for submittal procedures.
- B. Materials Sources: Submit name of imported materials source.
- C. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used.

D. Compaction Density Test Reports.

1.06 DELIVERY, STORAGE, AND HANDLING

A. When necessary, store materials on site in advance of need.

PART 2 PRODUCTS

2.01 FILL MATERIALS

- A. General Fill Fill Type Lean Clay (CL): Subsoil excavated on-site.
 - 1. Graded.
 - 2. Free of lumps larger than 3 inches, rocks larger than 2 inches, and debris.
 - 3. Conforming to ASTM D2487 Group Symbol CL.
 - 4. Having no more than 5-percent rock/gravel in the top 24-inches in landscape areas, and no more than 15-percent rock/gravel in any location.
- B. Structural Fill Fill Type DGA: Conforming to State of Kentucky Highway Department standard.
- C. Flowable Fill: A controlled low-strength material made of cement, water, sand, and an air-entraining admixture that it can be excavated by hand or use of a backhoe. See Section 312323.13.
- D. Concrete for Surge Block Fill and structure/pipe encasement: Lean concrete with a compressive strenght of 1000 psi.
- E. Graded Granular Fill Fill Type #57: Graded aggregate, conforming to State of Kentucky Highway Department standard.
- F. Pipe Bedding Granular Fill Fill Type #8 crushed limestone: Fine aggregate, conforming to State of Kentucky Highway Department standard.

2.02 ACCESSORIES

A. Geotextile Fabric: Non-biodegradable, non-woven, needle punched, 6-oz/sy(minimum weight).

2.03 SOURCE QUALITY CONTROL

- A. See Division 1 for general requirements for testing and analysis of soil material.
- B. Where fill materials are specified by reference to a specific standard, test and analyze samples for compliance before delivery to site.
- C. If tests indicate materials do not meet specified requirements, change material and retest.
- D. Provide materials of each type from same source throughout the Work.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that survey bench marks and intended elevations for the work are as indicated.

3.02 PREPARATION

- A. All trenching is unclassified, including trenching in bedrock.
- B. Identify required lines, levels, contours, and datum locations.
- C. See Section 312200 for additional requirements.
- D. Locate, identify, and protect utilities that remain and protect from damage.
- E. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

F. Grade top perimeter of trenching area to prevent surface water from draining into trench. Provide temporary means and methods, as required, to maintain surface water diversion until no longer needed, or as directed by the Architect.

3.03 TRENCHING

- A. Notify Architect of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.
- B. Slope banks of excavations deeper than 4 feet to angle of repose or less until shored.
- C. Do not interfere with 45 degree bearing splay of foundations (Zone of Influence) without approval from the Architect and Structural Engineer and approved specific backfill procedures.
- D. Cut trenches wide enough to allow inspection of installed utilities, but no more than twice the pipe diameter or 12-inches, whichever is greater for the total trench width.
- E. Hand trim excavations. Remove loose matter.
- F. Remove large stones and other hard matter that could damage piping or impede consistent backfilling or compaction.
- G. Remove excavated material that is unsuitable for re-use from site.
- H. Stockpile excavated material to be re-used in area designated in Section 312200.
- I. Provide temporary means and methods, as required, to remove all water from trenching until directed by the Architect. Remove and replace soils deemed unsuitable by classification and which are excessively moist due to lack of dewatering or surface water control.
- J. Determine the prevailing groundwater level prior to trenching. If the proposed trench extends less than 1 foot into the prevailing groundwater, control groundwater intrusion with perimeter drains routed to sump pumps, or as directed by the Architect.
- K. If a trench is to be left open for more than 48-hours or when a rain event occurs, the trench is to be excavated an additional 4-inches and a lean concrete mud mat or layer of flowable fill should be placed 4-inches thick over the bottom of the excavation.

3.04 PREPARATION FOR UTILITY PLACEMENT

- A. Cut out soft areas of subgrade not capable of compaction in place. Backfill with:
 - 1. Flowable Fill in areas located in the zone of influence of any footing or foundation.
 - 2. Structural Fill in areas within the building footprint or under pavements that are not located in the zone of influence.
 - 3. General Fill in landscape areas
- B. Remove loose soil and any debris from the excavation prior to installing the utility and backfill.
- C. Compact subgrade to density equal to or greater than requirements for subsequent fill material.
- D. Until ready to backfill, maintain excavations and prevent loose soil from falling into excavation.

3.05 BACKFILLING

- A. Backfill to contours and elevations indicated using unfrozen materials.
- B. Employ a placement method that does not disturb or damage other work.
- C. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.
- D. Maintain optimum moisture content of fill materials to attain required compaction density.

- E. Granular/Crushed Stone Fill: Place and compact materials in equal continuous layers not exceeding 6 inches loose depth when using heavy compaction equipment (sheepsfoot rollers, smooth drums, etc.) and not exceeding 4 inches loose depth when using hand operated or remote controlled equipment.
- F. Soil Fill: Place and compact material in equal continuous layers not exceeding 8 inches loose depth when using heavy compaction equipment (sheepsfoot rollers, smooth drums, etc.) and not exceeding 4 inches loose depth when using hand operated or remote controlled equipment.
- G. Slope grade away from building minimum 2 inches in 10 ft, unless noted otherwise. Make gradual grade changes. Blend slope into level areas.
- H. Correct areas that are over-excavated.
 - 1. Thrust bearing surfaces: Fill with concrete.
 - 2. Other areas: Use general fill, flush to required elevation, compacted to minimum 98 percent of maximum dry density.
- I. Compaction Density Unless Otherwise Specified or Indicated:
 - 1. Under slabs-on-grade and similar construction: 98 percent of maximum dry density.
 - 2. At paving: 95 percent of maximum dry density.
 - 3. At landscape locations: 85 percent of maximum dry density.
- J. Reshape and re-compact fills subjected to vehicular traffic.

3.06 BEDDING AND FILL AT SPECIFIC LOCATIONS

- A. Utility Piping, Conduits, and Duct Bank:
 - 1. Bedding: Use Fill Type Pipe bedding granular fill for the initial 4-inch thick utility setting/leveling bed.
 - 2. If pipe is larger than 12-inches or if there are multiple pipes of any size utilizing the same trench (hoizontally or vertically), then the leveling bed and pipe bedding backfill is to be wrapped in filter fabric.
 - 3. Cover with pipe bedding granular fill to 6-inches above the utility and finish with general fill in non-structural locations, and structural fill in building and pavement locations. If the utility is located within the zone of influence of a foundation, the trench is to be backfilled with flowable fill from the top of the initial utility setting/leveling bed and encompassing the utility until it is at least 1-foot above the zone of influence. When using flowable fill as a utility trench backfill, care should be taken to prevent the utility from floating by using deadman anchors or another anchoring system.
 - 4. Fill up to subgrade elevation.
 - 5. Compact to 98 percent of maximum dry density.
 - 6. Compact in maximum 6 inch loose lifts to 98 percent of maximum dry density.
- B. At Sanitary Pipes:
 - 1. Bedding: Use Fill Type Pipe bedding granular fill for the initial utility setting/leveling bed.
 - 2. If pipe is larger than 12-inches or if there are multiple pipes of any size utilizing the same trench (hoizontally or vertically), then the leveling bed and pipe bedding backfill is to be wrapped in filter fabric.
 - 3. Cover with pipe bedding granular fill to 6-inches above the utility pipe and finish with general fill in non-structural locations, and structural fill in building and pavement locations. If the sanitary pipe is located within the zone of influence of a foundation, the trench is to be backfilled with flowable fill from the top of the 6-inch cover until it is at least 1-foot above the zone of influence. Felt paper (15 lb) is to be installed around any sanitary standpipes as necessary to prevent the pipe from being in direct contact with the flowable fill. When using flowable fill as a utility trench backfill, care should be taken to prevent the utility from floating by using deadman anchors or another anchoring system.
 - 4. Fill up to subgrade elevation.
 - 5. Compact to 98 percent of maximum dry density.

6. Compact in maximum 6 inch lifts to 98 percent of maximum dry density.

3.07 TOLERANCES

A. Top Surface of General Backfilling: Plus or minus 1 inch from required elevations.

3.08 FIELD QUALITY CONTROL

- A. See Division 1 for general requirements for field inspection and testing.
- B. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D1557 ("modified Proctor"), AASHTO T 180, or ASTM D698 ("standard Proctor").
- C. If tests indicate work does not meet specified requirements, remove work, replace and retest.
- D. Frequency of Tests: One (1) test for each 150 feet or less of trench length, but no fewer than two (2) tests..

3.09 CLEANING

A. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

END OF SECTION

SECTION 312319 - DEWATERING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Dewatering of site during construction.

1.02 RELATED SECTIONS

- A. Section 312316 Excavation: Excavating for subdrainage system piping and surrounding filter aggregate.
- B. Section 312323 Fill: Filter aggregate, up to subgrade elevation.
- C. Section 312316.13 Trenching: Excavating and backfilling for site subdrainage systems.
- D. Section 334600 Subdrainage

1.03 REFERENCES

A. ASTM D 2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2003.

1.04 PROJECT CONDITIONS

- A. The Contractor is to provide any temporary piping required to reroute downspout and roof drains away from the work areas until the permanent drainage system is installed and in working order.
- B. Damage or destabilization/degradation of the on-site soils due to failure to dewater or otherwise prepare the site will be repaired at the Contractors expense.

1.05 PERFORMANCE REQUIREMENTS

- A. Dewatering Performance:
 - 1. Design, furnish, install, test, operate, monitor and maintain dewatering system of sufficient scope, size and capacity to control surface and ground water flow into excavations and permit construction to proceed on dry stable subgrades.
 - 2. Prevent water from ponding inside foundation walls, including after the floor slabs have been installed, and causing the foundation soils to become saturated.

PART 2 - NOT USED

PART 3 EXECUTION

3.01 INSTALLATION

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades and from flooding the Project site and surrounding areas.
- B. Reroute surface water away from excavated areas. Do not allow water to accumulate in excavations or on footings that have already been installed but not backfilled. Do not use utility, foundation or other trenches as temporary drainage ditches unless specifically designed for only that purpose.
- C. Prevent water from ponding inside the foundation walls, within the building footprint and in pavement areas.
- D. The Contractor is to provide and maintain pumps, well points, sumps, suction and discharge lines and other dewatering system components necessary to convey water away from excavations and control the groundwater to a level at least 3'-0" below the lowest point of the excavation.
- E. Do not use open-sump pumping that leads to loss of fines, soil piping, subgrade softening and slope instability.

- F. Dispose of water removed by dewatering in a manner that avoids endangering public health, property and portions of work under construction or completed. Avoid creating an inconvenience to others, and maintain sedimentation controls as required by authorities having jurisdiction.
- G. All dewatering discharge is to be routed to a sediment pond or sediment bags so that the sediment can settle prior to the discharge water leaving the site or entering any waterway or storm sewer.

3.02 FIELD QUALITY CONTROL

- A. Dewatering systems are to be inspected at least weekly and any and all repairs or refinements performed to maintain a fully operational system that achieves the intended purpose.
- B. Standby equipment is to be maintained on site so that it can be immediately installed if failure of primary equipment occurs.

3.03 **PROTECTION**

- A. Protect pipe and dewatering system from other construction activities.
- B. Remove dewatering system at the completion of construction or when determined by the Architect that it is no longer needed. Any holes in interior slabs and voids under the slabs are to be repaired using lean concrete for the voids and an non-shrink concrete repair grout for the slabs.

END OF SECTION

SECTION 312323 - FILL

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Filling, backfilling, and compacting for building volume below grade, footings, paving, and non-utility excavations located within the building and future building footprints.
- B. Filling holes, pits, and excavations generated as a result of removal (demolition) operations.

1.02 RELATED REQUIREMENTS

- A. Section 015713 Temporary Erosion and Sediment Control: Slope protection and erosion control.
- B. Section 312200 Grading: Site grading.
- C. Section 312316 Excavation: Removal and handling of soil to be re-used.
- D. Section 312316.13 Trenching: Excavating and backfilling for utility trenches outside the building to utility main connections.
- E. Section 312323.13 Flowable Fill
- F. Section 334100 Subdrainage: Filter aggregate and filter fabric for foundation drainage systems.

1.03 DEFINITIONS

- A. Finish Grade Elevations: Indicated on drawings.
- B. Zone of Influence: Area beneath a footing or foundation that extends out from the bottom edge of the footing/foundation at a 45-degree angle down to a depth equal to 3 times the footing width.

1.04 REFERENCE STANDARDS

- A. ASTM D1556 Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method; 2007.
- B. ASTM D2167 Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method; 2008.
- C. ASTM D2487 Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2011.
- D. ASTM D3017 Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth); 2005.
- E. ASTM D4318 Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils; 2010.

1.05 SUBMITTALS

- A. See Division 1 Sections for submittal procedures.
- B. Materials Sources: Submit name of imported materials source.
- C. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used, including manufactured fill.

1.06 DELIVERY, STORAGE, AND HANDLING

A. When necessary, store materials on site in advance of need.

PART 2 PRODUCTS

2.01 FILL MATERIALS

- A. General Fill Fill Type Lean Clay: Subsoil excavated on-site and imported as necessary for new work..
 - 1. Graded.
 - 2. Free of lumps larger than 3 inches, rocks larger than 2 inches, and debris.
 - 3. Conforming to ASTM D2487 Group Symbol CL.
 - 4. Having no more than 5-percent rock/gravel in the top 24-inches in landscape areas, and no more than 15-percent rock/gravel in any location.
- B. Structural Fill Fill Type DGA: Conforming to State of Kentucky Highway Department standard.
- C. Flowable Fill: A controlled low-strength material made of cement, water, sand, and an air-entraining admixture that it can be excavated by hand or use of a backhoe. See Section 312323.13.
- D. Graded Granular Fill Fill Type #57: Crushed aggregate, conforming to State of Kentucky Highway Department Standard.
- E. Coarse Granular Fill Fill Type #2: Coarse aggregate, conforming to State of Kentucky Highway Department standard.

2.02 SOURCE QUALITY CONTROL

- A. See Section 014000 Quality Requirements, for general requirements for testing and analysis of soil material.
- B. Where fill materials are specified by reference to a specific standard, test and analyze samples for compliance before delivery to site.
- C. If tests indicate materials do not meet specified requirements, change material and retest.
- D. Provide materials of each type from same source throughout the Work.

PART 3 EXECUTION

3.01 EXAMINATION

- A. All fill material is unclassified.
- B. Verify that survey bench marks and intended elevations for the Work are as indicated.
- C. Identify required lines, levels, contours, and datum locations.
- D. Verify subdrainage, dampproofing, or waterproofing installation has been inspected.
- E. Verify structural ability of unsupported walls to support imposed loads by the fill.
- F. Proof roll all areas to receive fill prior to placing fill as required in the geotechnical report. Proof rolls should only be done when the soils are are near optimum moisture content. Any areas that do not pass proof roll are to be stabilized and approved in accordance with the Geotechnical Report. Any suitable soils removed as part of the stabilization process due to moisture content issues are to be moisture conditioned and used as fill in other locations.
- G. Confirm that fat clay (CH) material has been removed under all floor slab and pavement areas so that no fat clay is located within 24-inches of the top of subgrade.
- H. Verify areas to be filled are not compromised with surface or ground water.

3.02 PREPARATION

A. Scarify and proof roll subgrade surface to a depth of 6 inches to identify soft spots.

- B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill or as outlined per over-excavation below.
- C. Compact subgrade to density equal to or greater than requirements for subsequent fill material.
- D. Until ready to fill, maintain excavations and prevent loose soil from falling into excavation.

3.03 FILLING

- A. Fill to contours and elevations indicated using unfrozen materials.
- B. Soils are not to be "over-compacted" or worked in a manner that will cause them to break down and lose strength.
- C. Employ a placement method that does not disturb or damage other work.
- D. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.
- E. Maintain optimum moisture content of fill materials to attain required compaction density.
- F. Granular Fill: Place and compact materials in equal continuous layers not exceeding 6 inches compacted depth for heavy equipment compaction, and layers not exceeding 4 inches for small or hand operated compaction equipment..
- G. Soil Fill: Place and compact material in equal continuous layers not exceeding 8 inches compacted depth for heavy equipment compaction, and layers not exceeding 4 inches for small or hand operated compaction equipment.
- H. Slope grade away from building minimum 2 inches in 10 feet, unless noted otherwise. Make gradual grade changes. Blend slope into level areas.
- I. Correct areas that are over-excavated.
 - 1. Load-bearing foundation surfaces and floor slab areas: Use structural fill, compacted to 98 percent of maximum dry density, to slab subgrade elevation in areas outside of the zone of influence of any footings or foundations. All excavations in the zone of influence of any footings or foundations are to be backfilled with flowable fill. If the backfill of the over-excavated areas encroaches into the minimum of 12-inches of soil cushion between the bottom of the footing and the top of bedrock, the Architect and Structural Engineer are to be notified immediately to determine if an alternate backfill method is necessary.
 - 2. Drives and vehicular pavement areas: Use DGA over a layer of Tensar BX1200 geogrid up to the required bottom of pavement crushed stone base elevation.
 - 3. Other areas: Use general fill, flush to required elevation, compacted to minimum 97 percent of maximum dry density.
- J. Compaction Density Unless Otherwise Specified or Indicated:
 - 1. Under paving, slabs-on-grade, and similar construction: 98 percent of maximum dry density.
 - 2. At paving/paver areas: 95 percent of maximum dry density.
- K. Reshape and re-compact fills subjected to vehicular traffic.
- L. Maintain temporary means and methods, as required, to remove all water while fill is being placed as required, or until directed by the Architect. Remove and replace soils deemed unsuitable by classification and which are excessively moist due to lack of dewatering or surface water control.

3.04 FILL AT SPECIFIC LOCATIONS

- A. Use general fill unless otherwise specified or indicated.
- B. Building Pad Mass Fill :
 - 1. Use general fill.

- 2. Fill up to subgrade elevations.
- 3. Maximum depth per lift: 6 inches, compacted.
- 4. Compact to minimum 98 percent of maximum dry density.
- C. Excavations within the zone of influence (ZOI) of any footing or foundation:
 - 1. Use Flowable Fill. See MEP and Structural Engineer drawings and specifications for utility excavation backfill requirements inside the building footprint.
- D. At Foundation Walls and Footings where excavation was done after the building pad was constructed and within the Zone of Influence:
 - 1. Use flowable fill where excavation was done within the Zone of Influence. Flowable fill is to extend to a minimum of 1-foot above the Zone of Influence.
 - 2. Use structural fill where excavation was done outside of the Zone of Influence.
- E. Against Foundation Walls and Footings where foundation drainage is not required:
 - 1. Use structural fill as backfill against the foundations/stem walls above the top of footing inside the building footprint, and general fill outside of the building footprint above the top of footing. Compact per above requirements.
 - 2. Fill up to subgrade elevation.
 - 3. Do not backfill against unsupported foundation walls.
 - 4. Backfill simultaneously on each side of unsupported foundation walls until supports are in place.
- F. At Lawn Areas:
 - 1. Use general fill.
 - 2. Compact to 85 percent of maximum dry density.
 - 3. See Section 312200 for topsoil placement.
- G. At French Drains:
 - 1. Use granular fill.
 - 2. Fill up to 8 inches below finish grade.
 - 3. Compact to 95 percent of maximum dry density.
- H. Landscape Area Backfill:
 - 1. Do not backfill landscape planting beds, landscape islands, or tree pits with construction or other debris. These areas are to be free of debris and particles 1/2 inch or larger in size, down to a depth of 24 inches minimum.
 - 2. Gravel, rock or concrete particles of no more than 1/2 inch in any dimension, shall constitute no more than 10% of the backfill content of planting beds, planting islands, and tree pits.

3.05 TOLERANCES

A. Top Surface of General Filling: Plus or minus 1 inch from required elevations.

3.06 CLEANING

- A. See Section 017419 Construction Waste Management and Disposal, for additional requirements.
- B. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

END OF SECTION

SECTION 312323.13 - FLOWABLE FILL

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Flowable Fill or Controlled Low Strength Materials (CLSM)
- B. Backfill for site utilities within the zone-of-influence of any footing/foundation.

1.02 RELATED REQUIREMENTS

- A. Section 312316.13 Trenching: Excavation and backfilling for foundations and utilities outside the building footprint.
- B. Section 312323 Fill: Filling and Compaction.

1.03 REFERENCE STANDARDS

- A. ACI 301 Specifications for Structural Concrete for Buildings; American Concrete Institute International; 2010.
- B. ACI 304R Guide for Measuring, Mixing, Transporting, and Placing Concrete; American Concrete Institute International; 2000.
- C. ACI 305R Hot Weather Concreting; American Concrete Institute International; 2010.
- D. ACI 306R Cold Weather Concreting; American Concrete Institute International; 2010.
- E. ASTM C33/C33M Standard Specification for Concrete Aggregates; 2011a.
- F. ASTM C39/C39M Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2012.
- G. ASTM C150/C150M Standard Specification for Portland Cement; 2012.
- H. ASTM C173/C173M Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; 2010b.
- I. ASTM C260 Standard Specification for Air-Entraining Admixtures for Concrete; 2010a.
- J. ASTM C494/C494M Standard Specification for Chemical Admixtures for Concrete; 2011.
- K. ASTM C685/C685M Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing; 2011.
- L. ASTM D4832 Preparation and Testing of Controlled Low Strength Material Test Cylinders
- M. ASTM D5971 Sampling Freshly Mixed Controlled Low Strength Material
- N. ASTM D6103 Flow Consistency of Controlled Low Strength Material
- O. ASTM D6023 Unit Weight, Yield, Cement Content and Air Content (Gravimetric) of Controlled Low Strength Material

1.04 SUBMITTALS

- A. See Division 1 Sections for submittal procedures.
- B. Product Data: Provide data on mix materials and admixtures.
- C. Design Data: Mix design and test results showing that the mix design meets the mix and performance requirements.

PART 2 PRODUCTS

2.01 CONCRETE MATERIALS

- A. Obtain cementitious materials from same source throughout.
- B. Cement: ASTM C150/C150M Air Entraining Type IA portland type, grey color.
- C. Fine Mix Aggregates: ASTM C33.
- D. Fly Ash: ASTM C 618, Class F Optional for Non-Excavatable flowable fill.
- E. Water: Clean, and not detrimental to concrete.
- F. Air Entrainment Admixture: ASTM C260.
- G. Chemical Admixtures: ASTM C494/C494M, Type A Water Reducing.
 - Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.

2.02 ACCESSORIES

1.

2.03 FLOWABLE FILL/CLSM MIX DESIGN

- A. The Flowable Fill/CLSM material is to be a self-leveling and self-compacting, cementitious material with low compressive strength (see below).
- B. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended by manufacturer.
- C. If flowable fill is to be pumped, a modified mixture shall be submitted along with test results that indicate that the mix will meet the strength restrictions. In addition, the supplier is to ensure that the air content at the point of discharge from the pump meets the below requirements.
- D. Excavatable Flowable Fill Properties (not-pumped):
 - 1. Compressive Strength, when tested in accordance with ASTM D4832 at 28 days: 30 to 80 psi maximum. Strength shall not exceed 130 psi at 180-days.
 - 2. Fly Ash Content: None
 - 3. Cement Content: 50 to 100 lb per cubic yard.
 - 4. Water: Content to provide self-leveling mix with flowability per below and without excess bleed water.
 - 5. Total Air Content: 20-30 percent, determined in accordance with ASTM D6023.
 - 6. Flowability: 6 to 8 inches in accordance with ASTM D6103.
 - 7. Unit Weight (wet): 90-115 pcf
 - 8. Aggregate Size: Concrete Sand

2.04 MIXING

- A. Transit Mixers: Comply with ASTM C94/C94M.
- B. Do not add water to the mix once the truck has left the concrete plant.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify trench subgrade is acceptable and ready to support fill and future loads.
- B. Verify gradients and elevations of base are correct.
- C. Verify that utilities have been properly anchored to eliminate vertical and horizontal movement.

3.02 PREPARATION

- A. Wrap utilities with protective felt paper or other protective wrap as approved by the governing body for the utility.
- B. Notify Testing Agent minimum 24 hours prior to filling operations.

3.03 FORMING

A. Place and secure forms as necessary at the ends of each pour.

3.04 COLD AND HOT WEATHER INSTALLATION

- A. Follow recommendations of ACI 305R when installing during hot weather.
- B. Follow recommendations of ACI 306R when installing during cold weather.
- C. Do not place concrete when base surface temperature is less than 40 degrees F, or surface is wet or frozen.
- D. Protect from freezing for a minimum of 36-hours after placement.

3.05 PLACING FLOWABLE FILL/CLSM

- A. Place fill in accordance with ACI 304R.
- B. Place fill material continuously over the full width of the trench/excavation.

3.06 TOLERANCES

- A. The contractor should anticipate a 1/8-inch per foot of depth shrinkage of the Flowable Fill/CLSM material during the initial 7-day curing period.
- B. Maximum Variation From True Position Post-Cure: Plus 1/4 inch (no minus).

3.07 FIELD QUALITY CONTROL

- A. The Owner will employ an independent testing agency to perform field quality control tests, as specified in Division 1 Sections.
 - 1. Provide free access to Flowable Fill/CLSM operations at project site and cooperate with appointed firm.
 - 2. Submit proposed mix design of each class of Flowable Fill/CLSM to inspection and testing firm for review prior to commencement of installation operations.
 - 3. Tests of concrete and concrete materials may be performed at any time to ensure conformance with specified requirements.
- B. Compressive Strength Tests: ASTM D4832. For each test, mold and cure five Flowable Fill/CLSM test cylinders. Obtain test samples for every truck delivered.
 - 1. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as material it represents.
 - 2. Perform one flowability test and one air content test for each set of test cylinders taken.
 - 3. Perform compression tests at 7-days, 14-days, 28-days, 56-days and 180-days
- C. Maintain records of placed Flowable Fill/CLSM items. Record date, pour time, batch time, location of pour, quantity, air temperature, and test samples taken. All test reports are to by typed.
- D. Any tests or time limits that do not meet the specified requirements are to be reported to the Contractor and that material shall be considered unacceptable. Any material placed that is deemed unacceptable shall be removed and replaced with acceptable material.

3.08 **PROTECTION**

A. Immediately after placement, protect from premature drying, excessive hot or cold temperatures, and mechanical injury for a minimum of 36-hours.

B. Do not subject the fill material to foundation or other loads that may exceed the material strength. **END OF SECTION**

SECTION 312513 - PERMANENT EROSION CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Erosion blankets and netting.
- B. Slope protection
- C. protection (non-rip rap)

1.02 RELATED SECTIONS

- A. Section 015713 Temporary Erosion Controls
- B. Section 312200 Grading
- C. Section 311000 Site Clearing.
- D. Section 312316 Excavation.
- E. Section 312323 Fill: Filling and compaction.
- F. Section 313413 Flexible Concrete Erosion Control
- G. Section 329219 Seeding: Finish ground cover.
- H. Section 329223 Sodding: Finish ground cover.
- I. Section 329300 Plants: Topsoil in beds and pits.

1.03 REFERENCES

- A. Kentucky Erosion Prevention and Sediment Control Field Guide by Kentucky Division of Conservation. Refer to these guidelines for construction and maintenance of erosion control items.
- B. Kentucky Division of Water (www.water.ky.gov)

1.04 SUBMITTALS

A. Erosion Control Material Data: Include manufacturer, product and design calculations for each product used.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with State of Kentucky, Highway Department standards.

1.06 PROJECT CONDITIONS

- A. Protect above- and below-grade utilities that remain.
- B. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from installation equipment and vehicular traffic.

PART 2 PRODUCTS

2.01 MATERIALS

- A. High Velocity Erosion-Control Blankets: Coconut-fiber mat enclosed in a double-net, UV stabilized polypropylene mesh with a minimum 36-month design life. Include manufacturer's recommended biodegradable stakes, 6 inches (150 mm) long. Acceptable products are:
 - 1. Curlex III by American Excelsior Company
 - 2. C125 by North American Green
 - 3. ECC-2 by East Coast Erosion Blankets

- B. Long-Term Erosion-Control Blankets: Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a double-net, photo-degradable woven mesh with a minimum 1-year design life. Include manufacturer's recommended biodegradable stakes, 6 inches long. Acceptable products are:
 - 1. Curlex II by American Excelsior Company
 - 2. S150 by North American Green
 - 3. ECS-2 and ECX-2 by East Coast Erosion Blankets
- C. Short-Term Erosion-Control Blankets: Biodegradable twisted jute or spun-coir mesh in a single-net product with straw or coconut-fiber fill. Include manufacturer's recommended steel wire staples, 6 inches long. Acceptable products are:
 - 1. Curlex I by American Excelsior Company
 - 2. S75 by North American Green
 - 3. ECS-1 by East Coast Erosion Blankets
- D. Other Materials: See Section 312323.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that finish grading and intended elevations for the Work are as indicated and that all debris and rock fragments larger than 1/2-inch have been removed from the area to be covered.

3.02 PREPARATION

- A. Identify required lines, levels, contours, and datum.
- B. Identify and mark areas to receive erosion controls.

3.03 INSTALLATION

- A. Protect areas to be seeded as follows:
 - 1. Ditches and drainage swales are to receive high-velocity erosion-control blankets.
 - 2. Slopes 4:1 (H:V) or greater are to receive long-term erosion-control blankets.
 - 3. Slopes between 4:1 and 6:1 are to receive short-term erosion-control blankets.
 - 4. If drawings indicate installation of flexible concrete erosion controls, the flexible concrete erosion controls are to be installed over the erosion control blankets and not as a substitute.
- B. Roll out erosion controls beginning at the bottom of the slope or the lowest end of the ditch line.
- C. Overlap ends of the controls a minimum of 24-inches or per the manufacturers recommendation, whichever is larger.
- D. Overlap the edges of the controls a minimum of 12-inches or per the manufacturers recommendation, whichever is larger.
- E. Install biodegradable anchors per the manufacturers recommendation. If erosion controls begin to pull up, slide or otherwise come loose, install additional anchors as needed for proper installation.
- F. Sod can be used for all slopes identified above (not drainage swales or ditches) as a substitute for the listed erosion controls. Sod is to be laid perpendicular to the slope and staked to prevent slipping.

3.04 CLEANING AND PROTECTION

A. Leave site clean and raked, ready to receive landscaping. **END OF SECTION**

SECTION 313116 - TERMITE CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Chemical soil treatment.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

A. Title 7, United States Code, 136 through 136y - Federal Insecticide, Fungicide and Rodenticide Act; 1947 (Revised 2001).

1.04 SUBMITTALS

- A. See Division 1 Sections for submittal procedures.
- B. Product Data: Indicate toxicants to be used, composition by percentage, dilution schedule, intended application rate.
- C. Test Reports: Indicate regulatory agency approval reports when required.
- D. Manufacturer's Instructions: Indicate caution requirement.
- E. Manufacturer's Certificate: Certify that toxicants meet or exceed specified requirements.
- F. Record and document moisture content of soil before application.
- G. Maintenance Data: Indicate re-treatment schedule .
- H. Warranty: Submit warranty and ensure that forms have been completed in Owner's name.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing this type of work and:
 - 1. Having minimum of three (3) years documented experience.
 - 2. Approved by manufacturer of treatment materials.
 - 3. Licensed in the State in which the Project is located.

1.06 REGULATORY REQUIREMENTS

- A. Conform to applicable code for requirements for application, and comply with EPA regulations.
- B. Provide certificate of compliance from authority having jurisdiction indicating approval of toxicants.

1.07 SEQUENCING

A. Apply toxicant 12 hours prior to installation of vapor barrier under slabs-on-grade.

1.08 WARRANTY

- A. See Section 017800 Closeout Submittals, for additional warranty requirements.
- B. Provide five year installer's warranty against damage to building caused by termites.
 - 1. Inspect annually and report in writing to Owner. Provide inspection service for twelve months from Date of Substantial Completion.

PART 2 PRODUCTS

2.01 CHEMICAL SOIL TREATMENT

A. Toxicant Chemical: EPA (Title 7, United States Code, 136 through 136y) approved; synthetically color dyed to permit visual identification of treated soil.

- B. Manufacturers: Subject to compliance with requirements, manufacturers offering the following products that may be incorporated into the work include;
 - 1. BASF: Product: Termidor 80 WG: www.basf.com
 - 2. Bayer Environmental Science Corp; ____: www.backedbybayer.com/pest-management/#sle.
 - 3. FMC Professional Solutions; Product Baseline: www.fmcprosolutions.com.
 - 4. Syngenta Professional Products; ____: www.syngentaprofessionalproducts.com/#sle.
- C. Toxicant Chemical: EPA (1) approved; synthetically color dyed to permit visual identification of treated soil.
- D. Diluent: Recommended by toxicant manufacturer.

2.02 MIXES

A. Mix toxicant to manufacturer's instructions.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that soil surfaces are unfrozen, sufficiently dry to absorb toxicant, and ready to receive treatment.
- B. Verify final grading is complete.

3.02 APPLICATION - CHEMICAL TREATMENT

- A. Comply with requirements of U.S. EPA and applicable state and local codes.
- B. Spray apply toxicant in accordance with manufacturer's instructions.
- C. Apply toxicant at following locations:
 - 1. Under Slabs-on-Grade.
 - 2. At Both Sides of Foundation Surface.
 - 3. Soil Within 10 feet of Building Perimeter For a Depth of 1' foot.
- D. Under slabs, apply toxicant immediately prior to installation of vapor barrier.
- E. At foundation walls, apply toxicant immediately prior to finish grading work outside foundations.
- F. Apply extra treatment to structure penetration surfaces such as pipe or ducts, and soil penetrations such as grounding rods or posts.
- G. Re-treat disturbed treated soil with same toxicant as original treatment.
- H. If inspection or testing identifies the presence of termites, re-treat soil and re-test.

3.03 PROTECTION

A. Do not permit soil grading over treated work. **END OF SECTION**

SECTION 321123 - AGGREGATE BASE COURSES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Aggregate base course.
- B. Paving aggregates.

1.02 RELATED REQUIREMENTS

- A. Section 312200 Grading: Preparation of site for base course.
- B. Section 312323 Fill: Compacted fill under base course.
- C. Section 321216 Asphalt Paving: Finish and binder asphalt courses.
- D. Section 321313 Concrete Paving: Finish concrete surface course.
- E. Section 334913 Storm Drainage Manholes, Frames and Covers: Manholes and frames.

1.03 REFERENCE STANDARDS

- A. AASHTO M 147 Standard Specification for Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses; 1965 (2004).
- B. AASHTO T 180 Standard Specification for Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 in.) Drop; 2010.
- C. ASTM C136/C136M Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates; 2014.
- D. ASTM D698 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)); 2012.
- E. ASTM D1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN m/m3)); 2012.
- F. ASTM D2487 Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2011.
- G. ASTM D3017 Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth); 2005.
- H. ASTM D4318 Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils; 2010.
- I. ASTM D6938 Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth); 2010.

1.04 SUBMITTALS

- A. See Division 1 Sections for submittal procedures.
- B. Materials Sources: Submit name of imported materials source.
- C. Aggregate Composition Test Reports: Results of laboratory tests on proposed and actual materials used.
- D. Compaction Density Test Reports.

1.05 DELIVERY, STORAGE, AND HANDLING

A. When necessary, store materials on site in advance of need.

- B. Aggregate Storage, General:
 - 1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
 - 2. Prevent contamination.
 - 3. Protect stockpiles from erosion and deterioration of materials.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Coarse Aggregate Type #2: Coarse aggregate, conforming to State of Kentucky Highway Department standard.
- B. Blended Aggregate Type DGA: Pug DGA conforming to State of Kentucky Highway Department standard.
- C. Medium Aggregate Type #57 crushed stone: Medium aggregate conforming to State of Kentucky Highway Department Standards
- D. Herbicide: In accordance with State of Kentucky Highway Department Standards .

2.02 SOURCE QUALITY CONTROL

- A. See Division 1 for Quality Requirements for testing and analysis of aggregate materials.
- B. Where aggregate materials are specified using ASTM D2487 classification, test and analyze samples for compliance before delivery to site.
- C. If tests indicate materials do not meet specified requirements, change material and retest.
- D. Provide materials of each type from same source throughout the Work.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that survey bench marks and intended elevations for the work are as indicated.
- B. Verify substrate has been inspected, gradients and elevations are correct, and is dry.
- C. Proof-roll areas to receive aggregate base course material and have proof-roll approved by the soils testing agent.
- D. Due to the type of soils encountered on the site, proof-rolling during wet periods or when the existing soils are above optimum moisture content will not be acceptable. All proof-rolling will need to be done during dry conditions.

3.02 PREPARATION

- A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.
- B. Do not place aggregate on soft, muddy, or frozen surfaces.

3.03 INSTALLATION

- A. Place aggregate in maximum 4 inch layers and roller compact to specified density.
- B. Level and contour surfaces to elevations and gradients indicated.
- C. Add small quantities of fine aggregate to coarse aggregate as appropriate to assist compaction.
- D. Add water to assist compaction. If excess water is apparent, remove aggregate and aerate to reduce moisture content.
- E. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

F. Apply herbicide to finished surface.

3.04 TOLERANCES

- A. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.
- B. Scheduled Compacted Thickness: Within 1/4 inch.

3.05 FIELD QUALITY CONTROL

- A. See Division 1 Sections for general requirements for field inspection and testing.
- B. Compaction density testing will be performed on compacted aggregate base course in accordance with ASTM D1556, ASTM D2167, or ASTM D6938.
- C. Results will be evaluated in relation to compaction curve determined by testing uncompacted material in accordance with AASHTO T 180, ASTM D698 ("standard Proctor"), or ASTM D1557 ("modified Proctor").
- D. If tests indicate work does not meet specified requirements, remove work, replace and retest.
- E. Frequency of Tests: One (1) test for every 2000 sq. ft. or less of paved area per lift, but in no case fewer than two (2) tests per lift.
- F. Proof roll compacted aggregate at surfaces that will be under slabs-on-grade.

3.06 CLEANING

A. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

END OF SECTION

SECTION 321216 - ASPHALT PAVING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Single course bituminous concrete paving.
- B. Double course bituminous concrete paving.

1.02 RELATED REQUIREMENTS

- A. Section 312200 Grading: Preparation of site for paving and base.
- B. Section 312323 Fill: Compacted subgrade for paving.
- C. Section 321123 Aggregate Base Courses: Aggregate base course.
- D. Section 321613 Concrete Curbs and Gutters: Concrete curbs.
- E. Section 330513 Manholes and Structures: Manholes, including frames; gutter drainage grilles, covers, and frames for placement by this section.

1.03 REFERENCE STANDARDS

- A. AI MS-2 Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types; 1997.
- B. ASTM D946 Standard Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction; 2009a.

1.04 QUALITY ASSURANCE

- A. Perform Work in accordance with State of Kentucky Highways standard.
- B. Mixing Plant: Conform to State of Kentucky Highways standard.
- C. Obtain materials from same source throughout.

1.05 FIELD CONDITIONS

- A. Do not place asphalt when ambient air or base surface temperature is less than 40 degrees F, or surface is wet or frozen.
- B. Place bitumen mixture when temperature is not more than 15 F degrees below bitumen supplier's bill of lading and not more than maximum specified temperature.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Asphalt Cement: ASTM D946.
- B. Aggregate for Base Course: In accordance with State of Kentucky Highways standards.
- C. Aggregate for Binder Course: In accordance with State of Kentucky Highways standards.
- D. Aggregate for Wearing Course: In accordance with State of Kentucky Highways standards.
- E. Fine Aggregate: In accordance with State of Kentucky Highways standards.
- F. Tack Coat: Homogeneous, medium curing, liquid asphalt in accordance with Kentucky Transportation Cabinet Standard Specifications Section 406.

2.02 ASPHALT PAVING MIXES AND MIX DESIGN

A. Use dry material to avoid foaming. Mix uniformly.

- B. Asphalt Pavement:
 - 1. Binder Course: State of Kentucky Highways standards for CL2 BASE 0.75 D PG 64-22.
 - 2. Wearing Course: State of Kentucky Highways standards for CL2 SURF 0.38 D PG 64-22.
- C. Recycled Asphalt Pavement (RAP): In accordance with State of Kentucky Highway Department Section 409 with a maximum of 15 percent RAP for PG 64-22.
- D. Submit proposed mix design of each class of mix for review prior to beginning of work.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that compacted subgrade is dry and ready to support paving and imposed loads.
- B. Verify gradients and elevations of base are correct.
- C. Asphalt Pavement may be placed between November 15th and April 1st if the ambient temperature requirements are met or if approved by the architect/engineer.

3.02 BASE COURSE

A. Place and compact base course.

3.03 PREPARATION - TACK COAT

- A. Apply tack coat in accordance with manufacturer's instructions.
- B. Comply with provisions in KTC Standard Specifications Section 406
- C. Apply tack coat on asphalt or concrete surfaces over subgrade surface at uniform rate of 1/3 gal/sq yd.
- D. Coat surfaces of storm and sanitary sewer structure frames with oil to prevent bond with asphalt pavement. Do not tack coat these surfaces.

3.04 PLACING ASPHALT PAVEMENT - DOUBLE COURSE

- A. Place asphalt binder course within 24 hours of applying primer or tack coat.
- B. Place binder course to compacted thickness identified on the contract drawings.
- C. Place wearing course within 72 hours of placing and compacting binder course. If the wearing course is placed more than 72 hours after the binder course, the binder course is to be cleaned and a tack coat installed prior to the wearing course installation.
- D. Place wearing course to compacted thickness identified on the contract drawings.
- E. Compact pavement by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.
- F. Perform rolling with consecutive passes to achieve even and smooth finish, without roller marks.
- G. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent.

3.05 TOLERANCES

- A. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.
- B. Compacted Thickness: Within 1/4 inch of specified or indicated thickness.
- C. Variation from True Elevation: Within 1/2 inch.

D. Texture: Surface is to have a tight, smooth, uniform finish. Areas that have an abundance of exposed aggregate or porous texture, as determined by the Architect, shall be re-compacted or replaced as required by the Architect.

3.06 FIELD QUALITY CONTROL

- A. See Division 1 Sections for general requirements for testing and inspections.
- B. Provide field inspection and testing. Take samples and perform tests in accordance with AI MS-2.

3.07 PROTECTION

- A. Immediately after placement, protect pavement from mechanical injury for 2 days or until surface temperature is less than 140 degrees F.
- B. All pavements that are soiled or otherwise dirty are to be pressure washed and rinsed upon completion of the construction and landscaping work.

END OF SECTION

SECTION 321313 - CONCRETE PAVING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete sidewalks and stair steps.

1.02 RELATED REQUIREMENTS

- A. Section 031000 Concrete Forming and Accessories.
- B. Section 312200 Grading: Preparation of site for paving and base and preparation of subsoil at pavement perimeter for planting.
- C. Section 312323 Fill: Compacted subbase for paving.
- D. Section 321123 Aggregate Base Courses: Stone base course.
- E. Section 321373 Joint Sealers: Sealant for joints.
- F. Section 321613 Concrete Curb and Gutters

1.03 REFERENCE STANDARDS

- A. ACI 211.1 Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; 1991 (Reapproved 2009).
- B. ACI 301 Specifications for Structural Concrete; 2010 (Errata 2012).
- C. ACI 304R Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000.
- D. ACI 305R Hot Weather Concreting; 2010.
- E. ACI 306R Cold Weather Concreting; 2010.
- F. ASTM A36 Steel plate for plate dowel systems.
- G. ASTM A185/A185M Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete; 2007.
- H. ASTM A615/A615M Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement; 2015.
- I. ASTM A1064/A1064M Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2015.
- J. ASTM B633 Type II Electroplated zinc for plat dowel systems
- K. ASTM C33/C33M Standard Specification for Concrete Aggregates; 2013.
- L. ASTM C39/C39M Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2015a.
- M. ASTM C94/C94M Standard Specification for Ready-Mixed Concrete; 2015.
- N. ASTM C150/C150M Standard Specification for Portland Cement; 2015.
- O. ASTM C173/C173M Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; 2014.
- P. ASTM C260/C260M Standard Specification for Air-Entraining Admixtures for Concrete; 2010a.
- Q. ASTM C309 Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 2011.

- R. ASTM C494/C494M Standard Specification for Chemical Admixtures for Concrete; 2013.
- S. ASTM C685/C685M Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing; 2014.
- T. ASTM D1751 Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types); 2004 (Reapproved 2013).
- U. ASTM D1752 Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction; 2004a (Reapproved 2013).

1.04 SUBMITTALS

- A. See Division 1 Sections for submittal procedures.
- B. Product Data: Provide data on joint filler, admixtures, curing compound, and fiber reinforcement.
- C. Design Data: Indicate pavement thickness, designed concrete strength, reinforcement, and typical details.

PART 2 PRODUCTS

2.01 FORM MATERIALS

- A. Form Materials: As specified in Section 031000, conform to ACI 301.
- B. Joint Filler: Preformed; non-extruding bituminous type (ASTM D1751) or sponge rubber or cork (ASTM D1752).
 - 1. Thickness: 3/8 inch.

2.02 REINFORCEMENT

- A. Reinforcing Steel: ASTM A615/A615M, Grade 80 (80,000 psi) yield strength; deformed billet steel bars; unfinished.
- B. Steel Welded Wire Reinforcement: Plain type, ASTM A1064/A1064M; in flat sheets; unfinished.
- C. Bar Dowels: Heavy Duty Concrete ASTM A615/A615M Grade 40 (280); deformed billet steel bars; unfinished finish.
- D. Plate Dowels: Light and Medium Duty Concrete ASTM A36 steel plates with electroplated zinc coating meeting ASTM B633 Type II. Plate sizes and spacing to meet specified concrete thickness.

2.03 CONCRETE MATERIALS

- A. Obtain cementitious materials from same source throughout.
- B. Concrete Materials: Provide in accordance with State of Kentucky Highways standards.
- C. Cement: ASTM C150/C150M, Normal Type I Portland cement, gray color.
- D. Fine and Coarse Mix Aggregates: ASTM C33/C33M.
- E. Fly Ash: ASTM C 618, Class F Optional for mixes used for slip forming of curb and gutter, or slip forming of concrete pavements. Fly ash is not to be used in concrete that is not slip formed or extruded except for summer installations where temperatures are 85 degrees or higher.
- F. Water: Clean, and not detrimental to concrete.
- G. Fiber Reinforcement: Shrinkage crack control, micro synthetic, fibrilated, polypropylene fibers shown to have long-term resistance to deterioration when in contact with alkalis and moisture; 3/4 to 1 inch length and designed to reduce shrinkage cracking of concrete.
 - 1. Acceptable Products:

- a. PSI FIBERSTRAND F by Euclid Chemical
- b. Procon F-E by Nycon Corporation
- c. Fibermesh 300 by Propex Operating Company
- d. Econo-Net by Forta Corporation
- H. Air-Entraining Admixtures: ASTM C260/C260M.
- I. Chemical Admixtures: ASTM C494/C494M, Type A Water Reducing.
 - 1. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.

2.04 ACCESSORIES

- A. Curing Compound: ASTM C309, Type 1, Class A.
- B. Curing Compound:
 - 1. Sonneborn's Sonosil
 - 2. L&M's L&M Cure
 - 3. Dayton Superior's Day Chem Sil-Cure (J-13)
- C. Joint Sealer: Type as specified in Section 321373.

2.05 CONCRETE MIX DESIGN

- A. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended by manufacturer.
- B. Micro Fiber Reinforcement: Add to mix at rate of 1.5 pounds per cubic yard, or as recommended by manufacturer for specific project conditions. Fiber is to be added at the plant after all other materials have been added, and have a minimum mix time of 5-minutes..
- C. Concrete Properties:
 - 1. Compressive strength (prior to fiber), when tested in accordance with ASTM C39/C39M at 28 days; 4500 psi. Testing of the concrete mix prior to adding fiber and again after fiber has been added is required to set the compressive strength requirement for fiber reinforced concrete. This should be done for the first pour of each mix design and the results used to confirm future pours.
 - 2. Fly Ash Content: Maximum 15 percent of cementitious materials by weight.
 - 3. Cement Content: Minimum 600 lb per cubic yard.
 - 4. Water-Cement Ratio: Maximum 0.44 percent by weight.
 - 5. Total Air Content: 6 percent +/- 1%, determined in accordance with ASTM C 173/C 173M.
 - 6. Maximum Slump: 4 inches using base design, 5 inches when using fiber and mid-range water reducer, 6 inches when using a mid-range water reducer, +/- 1-inch.
 - 7. Maximum Aggregate Size: 1 inch.

2.06 MIXING

- A. Transit Mixers: Comply with ASTM C94/C94M.
- B. Do not add water to the mix once the truck has left the concrete plant.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify compacted subgrade is acceptable and ready to support paving and imposed loads.
- B. Verify gradients and elevations of base are correct.

3.02 SUBBASE

A. See Section 321123 for construction of base course for work of this Section.

3.03 PREPARATION

- A. Moisten base to minimize absorption of water from fresh concrete.
- B. Coat surfaces of manhole frames with oil to prevent bond with concrete pavement.

3.04 FORMING

- A. Place and secure forms to correct location, dimension, profile, and gradient.
- B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.
- C. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.

3.05 REINFORCEMENT

- A. Place reinforcement as indicated and per the manufacturers recommendations.
- B. Provide doweled joints at all isolation joints with one end of dowel set in capped sleeve to allow longitudinal movement.

3.06 COLD AND HOT WEATHER CONCRETING

- A. Follow recommendations of ACI 305R when concreting during hot weather.
- B. Follow recommendations of ACI 306R when concreting during cold weather.
- C. Do not place concrete when base surface temperature is less than 40 degrees F, or surface is wet or frozen.

3.07 PLACING CONCRETE

- A. Place concrete in accordance with ACI 304R.
- B. Do not add water to concrete.
- C. Ensure reinforcement, inserts, embedded parts, formed joints are not disturbed during concrete placement.
- D. Place concrete continuously over the full width of the panel and between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.
- E. Place concrete to indicated pattern.

3.08 JOINTS

- A. Align curb, gutter, and sidewalk joints.
- B. Place 3/8 inch wide isolation joints at 20 foot intervals and to separate paving from vertical surfaces and other components and in pattern indicated.
 - 1. Form joints with joint filler extending from bottom of pavement to within 1/2 inch of finished surface.
 - 2. Secure to resist movement by wet concrete.
- C. Provide tooled contraction control joints:
 - In pattern shown on drawings.

3.09 FINISHING

1.

- A. Area Paving: Light broom, texture perpendicular to pavement direction.
- B. Sidewalk Paving: Light broom, texture perpendicular to direction of travel with troweled and radiused edge 1/4 inch radius. Remove tooling marks to prevent a picture frame effect.
- C. Remove "slop" created by the concrete finishing from all joints and edges.

D. Place curing compound on exposed concrete surfaces immediately after finishing. Apply in accordance with manufacturer's instructions.

3.10 JOINT SEALING

A. See Section 321373 for joint sealer requirements.

3.11 TOLERANCES

- A. Maximum Variation of Surface Flatness: 1/4 inch in 10 ft.
- B. Maximum Variation From True Position: 1/4 inch.

3.12 FIELD QUALITY CONTROL

- A. Allow the independent testing agency to perform field quality control tests, as specified in Division 1.
 - 1. Provide free access to concrete operations at project site and cooperate with appointed firm.
 - 2. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.
 - 3. Tests of concrete and concrete materials may be performed at any time to ensure conformance with specified requirements.
- B. Compressive Strength Tests: ASTM C39/C39M; for each test, mold and cure three concrete test cylinders. Obtain test samples for every 100 cu yd or less of each class of concrete placed.
 - 1. Test fiber reinforced concrete prior to the addition of fiber and again after fiber has been added to set the baseline for the fiber reinforced compressive strength, slump and air content. This is to be done for the first pour of each mix design, and the results used for later pour strength requirements.
 - 2. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.
 - 3. Perform one slump test and one air content test for each set of test cylinders taken.
- C. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken. All test reports are to by typed.
- D. Any tests or time limits that do not meet the specified requirements are to be reported to the Contractor and that concrete shall be considered unacceptable.

3.13 PROTECTION

- A. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures, and mechanical injury.
- B. Do not permit pedestrian traffic over pavement for 2 days minimum after finishing.
- C. Do not permit vehicular traffic over pavement until 75 percent design strength of concrete has been achieved.
- D. All pavements that are soiled or otherwise dirty are to be pressure washed and rinsed upon completion of the construction and landscaping work.

END OF SECTION

SECTION 321373 - PAVEMENT JOINT SEALANTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Special Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Expansion and contraction joints within cement concrete pavement.
 - 2. Joints between cement concrete and asphalt pavement.
 - 3. Joints between cement concrete or asphalt pavement and adjacent structures.

B. Related Sections include the following:

- 1. Section 321216 Asphalt Paving
- 2. Section 321313 Concrete Paving: constructing joints in concrete pavement.
- 3. Section 321613 Concrete Curbs and Gutters

1.03 SUBMITTALS

- A. Product Data: For each joint sealant product indicated.
- B. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.
- C. Qualification Data: For Installer.
- D. Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:
 1. Materials forming joint substrates and joint sealant backings have been tested for
 - compatibility and adhesion with joint sealants.
 - 2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
- E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for sealants.

1.04 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.
- B. Preconstruction Compatibility and Adhesion Testing: Submit to joint sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
 - 1. Use ASTM C 1087 or manufacturer's standard test methods to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
 - 2. Submit not fewer than eight pieces of each type of material, including joint substrates, shims, joint sealant backings, secondary seals, and miscellaneous materials.
 - 3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 - 4. For materials failing tests, obtain joint sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
 - 5. Testing will not be required if joint sealant manufacturers submit joint preparation data that are based on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.
- C. Product Testing: Obtain test results for "Product Test Reports" Paragraph in "Submittals" Article from a qualified testing agency based on testing of current sealant products within a 36-month period preceding the Notice to Proceed with the Work.
 - 1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 for testing indicated, as documented according to ASTM E 548.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials to comply with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.06 PROJECT CONDITIONS

- A. All expansion, isolation and cold joints, including those in concrete curbs, are to receive joint sealant.
- B. 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.
 - 2. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 40 deg F (4.4 deg C), whichever is higher.
 - 3. When joint substrates are wet or covered with frost.
 - 4. Where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.
 - 5. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

2.02 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backing materials, 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. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.03 COLD-APPLIED JOINT SEALANTS

- A. Type NS Silicone Sealant for Concrete: Single-component, low-modulus, neutral-curing, nonsag silicone sealant complying with ASTM D 5893 for Type NS.
 - 1. Available Products:
 - a. Crafco Inc.; RoadSaver Silicone.
 - b. Dow Corning Corporation; 888.

2.04 JOINT SEALANT BACKER MATERIALS

- A. General: Provide joint sealant backer materials that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint sealant manufacturer based on field experience and laboratory testing.
- B. Backer Strips for Cold- and Hot-Applied Sealants: ASTM D 5249; Type 2; of thickness and width required to control sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.
2.05 PRIMERS

A. Primers: Product 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.

PART 3- EXECUTION

3.01 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.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint sealant manufacturer's written instructions.
- B. Joint Priming: Prime joint substrates where indicated or where recommended by joint sealant manufacturer, based on 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.

3.03 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 backer materials of type 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 backer materials.
 - 2. Do not stretch, twist, puncture, or tear backer materials.
 - 3. Remove absorbent backer materials that have become wet before sealant application and replace them with dry materials.
- D. 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 provided for each joint configuration.
 - 3. Produce uniform, cross sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified 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 sealants from surfaces adjacent to joint.
 - 2. Use tooling agents that are approved in writing by joint sealant manufacturer and that do not discolor sealants or adjacent surfaces.
- F. Provide joint configuration to comply with joint sealant manufacturer's written instructions, unless otherwise indicated.
- G. Provide recessed joint configuration for silicone sealants of recess depth and at locations indicated.

3.04 CLEANING

A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3.05 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 and replace with joint sealant so installations with repaired areas are indistinguishable from the original work.
- B. Apply clean, white, silica sand dusting to the finished tooled surface of the joint sealant to help prevent tracking of the material.

END OF SECTION

SECTION 321613 - CONCRETE CURBS AND GUTTERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete curbs and gutters.

1.02 RELATED REQUIREMENTS

- A. Section 312200 Grading: Preparation of site for paving and base and preparation of subsoil at pavement perimeter for planting.
- B. Section 312323 Fill: Compacted subbase for paving.
- C. Section 321123 Aggregate Base Courses: base course.
- D. Section 321216 Asphalt Paving: Asphalt wearing course.
- E. Section 321313 Concrete Paving.
- F. Section 321373 Joint Sealers: Sealant for joints.

1.03 REFERENCE STANDARDS

- A. ACI 211.1 Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; American Concrete Institute International; 1991 (Reapproved 2002).
- B. ACI 301 Specifications for Structural Concrete for Buildings; American Concrete Institute International; 2005.
- C. ACI 304R Guide for Measuring, Mixing, Transporting, and Placing Concrete; American Concrete Institute International; 2000.
- D. ACI 305R Hot Weather Concreting; American Concrete Institute International; 1999.
- E. ACI 306R Cold Weather Concreting; American Concrete Institute International; 1988 (Reapproved 2002).
- F. ASTM A 615/A 615M Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement; 2007.
- G. ASTM C 33 Standard Specification for Concrete Aggregates; 2007.
- H. ASTM C 39/C 39M Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2005.
- I. ASTM C 94/C 94M Standard Specification for Ready-Mixed Concrete; 2007.
- J. ASTM C 150 Standard Specification for Portland Cement; 2007.
- K. ASTM C 173/C 173M Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; 2008a.
- L. ASTM C 260 Standard Specification for Air-Entraining Admixtures for Concrete; 2006.
- M. ASTM C 309 Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 2007.
- N. ASTM C 494/C 494M Standard Specification for Chemical Admixtures for Concrete; 2008a.
- O. ASTM C 618 Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2008a.

- P. ASTM C 685/C 685M Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing; 2007.
- Q. ASTM D 1751 Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (nonextruding and Resilient Bituminous Types); 2004 (Reapproved 2008).
- R. ASTM D 1752 Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction; 2004a (Reapproved 2008).

1.04 SUBMITTALS

- A. See Division 1 Sections for submittal procedures.
- B. Product Data: Provide data on joint filler, admixtures, curing compound, and fiber reinforcement.
- C. Installer qualifications using Macro Fiber reinforcement in finished, exterior concrete.
- D. Design Data: Indicate curb/gutter thickness, designed concrete strength, reinforcement, and typical details. Separate mix designs are required for conventionally formed concrete and machine placed or slip-formed concrete.

PART 2 PRODUCTS

2.01 FORM MATERIALS

- A. Form Materials: Conform to ACI 301 and as follows.
- B. Steel forms with self-aligning joints designed to withstand the lateral and vertical loads associated with the concrete placement. Form sections are to be a minimum of 10-feet in length for runs that are 10-feet or longer in length.
- C. Joint Filler: Preformed; non-extruding bituminous type (ASTM D 1751) or sponge rubber or cork (ASTM D 1752).
 - 1. Thickness: 3/8 inch.

2.02 REINFORCEMENT

- A. Reinforcing Steel: ASTM A 615/A 615M Grade 40 (280); deformed billet steel bars; unfinished finish.
- B. Steel Welded Wire Reinforcement: Plain type, ASTM A 185/A 185M; in flat sheets; unfinished.
- C. Dowels: ASTM A 615/A 615M Grade 40 (280); deformed billet steel bars; unfinished finish.

2.03 CONCRETE MATERIALS

- A. Obtain cementitious materials from same source throughout.
- B. Concrete Materials: Provide in accordance with State of Kentucky Highways standards.
- C. Cement: ASTM C 150 Air Entraining Type IA portland type, grey color.
- D. Fine and Coarse Mix Aggregates: ASTM C 33.
- E. Fly Ash: ASTM C 618, Class F Optional for mixes used for slip forming of curb and gutter, or slip forming of concrete pavements. Fly ash is not to be used in concrete that is not slip formed or extruded..
- F. Water: Clean, and not detrimental to concrete.
- G. Fiber Reinforcement: Structural, macro synthetic, fibrilated, polypropylene fibers shown to have long-term resistance to deterioration when in contact with alkalis and moisture; 1.5 to 2 inch length and manufactured to provide post-cure concrete strength and increase freeze/thaw resistance.

- 1. Acceptable Products:
 - a. TUF-STRAND SF by Euclid Chemical
 - b. Nycon-XL200 by Nycon Corporation
 - c. Fibermesh 650 by Propex Operating Company
 - d. Forta-Ferro by Forta Corporation
- H. Air Entrainment Admixture: ASTM C 260.
- I. Chemical Admixtures: ASTM C 494/C 494M, Type A Water Reducing.
 - 1. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.

2.04 ACCESSORIES

- A. Curing Compound: ASTM C 309, Type 1, Class A.
- B. Joint Sealer: Type as specified in Section 321373.

2.05 CONCRETE MIX DESIGN

- A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.
- B. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended by manufacturer.
- C. Macro Fiber Reinforcement: Add to mix at rate of 5 pounds per cubic yard, or as recommended by manufacturer for specific project conditions. Fiber is to be added at the plant after all other materials have been added, and have a minimum mix time of 5-minutes. Fiber reinforcement is only to be used when slip forming of concrete is performed.
- D. Concrete Properties:
 - Compressive Strength (prior to adding fiber), when tested in accordance with ASTM C 39/C 39M at 28 days: 4500 psi. Testing of the concrete mix prior to adding fiber and again after fiber has been added is required to set the compressive strength requirement for fiber reinforced concrete. This should be done for the first pour of each mix design and the results used to confirm future pours.
 - 2. Fly Ash Content: Maximum 15 percent of cementitious materials by weight.
 - 3. Cement Content: Minimum 639 lb per cubic yard.
 - 4. Water-Cement Ratio: Maximum 0.44 percent by weight.
 - 5. Total Air Content: 6 percent +/- 1%, determined in accordance with ASTM C 173/C 173M.
 - 6. Maximum Slump: 4 inches using base design, 5 inches when using fiber and mid-range water reducer, 6 inches when using a mid-range water reducer, +/- 1-inch.
 - 7. Maximum Aggregate Size: 1 inch.

2.06 MIXING

- A. Transit Mixers: Comply with ASTM C 94/C 94M.
- B. Do not add water to the mix once the truck has left the concrete plant.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify compacted subgrade is acceptable and ready to support imposed loads.
- B. Verify gradients and elevations of base are correct.

3.02 SUBBASE

A. See Section 321123 for construction of base course for work of this Section.

3.03 PREPARATION

- A. Moisten base to minimize absorption of water from fresh concrete.
- B. Coat surfaces of storm structure frames with oil to prevent bond with concrete curb/gutter.
- C. Notify Architect minimum 24 hours prior to commencement of concreting operations. Architect is to review and approve sample pours prior to installation of permanent concrete.

3.04 FORMING

- A. Place and secure forms to correct location, dimension, profile, and gradient.
- B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.
- C. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.
- D. Slip forming can be used for curb and gutter combinations. The slip form machine shall be self-propelled and designed to place, consolidate and finish the concrete in one pass, and be adjustable to install gutter lines that slope away from the curb where required.

3.05 REINFORCEMENT

- A. Place reinforcement as indicated.
- B. Use fiber reinforcement for all concrete.
- C. Provide doweled joints as indicated with one end of dowel set in capped sleeve to allow longitudinal movement.

3.06 COLD AND HOT WEATHER CONCRETING

- A. Follow recommendations of ACI 305R when concreting during hot weather.
- B. Follow recommendations of ACI 306R when concreting during cold weather.
- C. Do not place concrete when base surface temperature is less than 40 degrees F, or surface is wet or frozen.

3.07 PLACING CONCRETE

- A. Place concrete in accordance with ACI 304R.
- B. Do not place concrete when base surface is wet.
- C. Concrete can be placed using the slip form technique. If slip forming is used, fiber-reinforced concrete shall be used.
- D. Ensure reinforcement, inserts, embedded parts, formed joints are not disturbed during concrete placement.
- E. Place concrete continuously over the full length of the run and between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.
- F. Place expansion joints at the beginning and ending of each pour.
- G. Place expansion joints at the beginning and ending of each pour. Place control joints concrete to indicated pattern.

3.08 JOINTS

- A. Align curb, gutter, and sidewalk joints.
- B. Place 3/8 inch wide expansion joints at 40 foot intervals and to separate curb and gutter from adjacent sidewalks, vertical surfaces and other components.

- 1. Form joints with joint filler extending from bottom of pavement to within 1/2 inch of finished surface.
- 2. Secure to resist movement by wet concrete.
- C. Provide sawcut contraction control joints every 8-feet. Where the curb is adjacent to a sidewalk, install contraction joints that align with the sidewalk joints with spacing between 8-feet and 10-feet.
- D. Provide tooled contraction joints between curbs/gutters and adjacent traffic duty pavements.
- E. At 90-degree curb corners, the contraction joint is to be cut parallel to the traffic lane. Diagonal cuts at 90-degree corners are not acceptable.

3.09 FINISHING

- A. Curbs and Gutters: Uniform float finish and round edges. Correct all honeycombed areas by filling with mortar. Do not plaster. Finish the top and face while the concrete is plastic by wetting and rubbing with a carborundum brick. Finish the face of header curbs to 4-inches below the finished ground line. Provide uniform texture and color.
- B. Remove "slop" created by the concrete finishing from all joints and edges.
- C. Place curing compound on exposed concrete surfaces immediately after finishing. Apply in accordance with manufacturer's instructions.
- D. Exposed macro fibers are to be removed using a propane torch and stiff brush after a minimum of 56-days curing of the concrete. Care should be taken to not overheat the concrete and cause it to be discolored, damaged or lose strength.

3.10 JOINT SEALING

A. All expansion joints are to be sealed. See Section 321373 for joint sealer requirements.

3.11 TOLERANCES

- A. Maximum Variation of Surface Flatness and Face Alignment: 1/4 inch in 10 ft.
- B. Maximum Variation From True Position: 1/4 inch.

3.12 FIELD QUALITY CONTROL

- A. Allow an independent testing agency to perform field quality control tests, as specified in Division 1.
 Provide free access to concrete operations at project site and cooperate with appointed firm.
 - 2. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.
 - 3. Tests of concrete and concrete materials may be performed at any time to ensure conformance with specified requirements.
- B. Compressive Strength Tests: ASTM C 39/C 39M. For each test, mold and cure four concrete test cylinders. Obtain test samples for every 25 cu yd or less of each class of concrete placed.
 - 1. Test fiber reinforced concrete prior to the addition of fiber and again after fiber has been added to set the baseline for the fiber reinforced compressive strength, slump and air content. This is to be done for the first pour of each mix design, and the results used for later pour strength requirements.
 - 2. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.
 - 3. Perform one slump test and one air content test for each set of test cylinders taken.
- C. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken. All test reports are to by typed.
- D. Any tests or time limits that do not meet the specified requirements are to be reported to the Contractor and that concrete shall be considered unacceptable.

3.13 PROTECTION

- A. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures, and mechanical injury.
- B. Do not permit pedestrian traffic into curb/gutter area for 2 days minimum after finishing.
- C. Do not permit vehicular traffic into curb/gutter area until 75 percent design strength of concrete has been achieved.
- D. All concrete curb/gutter that is soiled or otherwise dirty are to be pressure washed and rinsed upon completion of the construction and landscaping work.

END OF SECTION

SECTION 329219 - SEEDING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Preparation of subsoil.
- B. Placing topsoil.
- C. Seeding, mulching and fertilizer.
- D. Maintenance.

1.02 RELATED REQUIREMENTS

- A. Section 015713- Temporary Erosion and Sediment Control
- B. Section 312200 Grading: Topsoil material.
- C. Section 31 2200 Grading: Preparation of subsoil and placement of topsoil in preparation for the work of this section.
- D. Section 312323 Fill: Topsoil material.
- E. Section 312513 Permanent Erosion Controls:

1.03 DEFINITIONS

 Weeds: Include Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

1.04 SUBMITTALS

- A. Maintenance Data: Include maintenance instructions, cutting method and maximum grass height; types, application frequency, and recommended coverage of fertilizer; and watering instructions.
- B. Hydroseed product and maintenance data including a hydroseed physical sample. Submit dry hydroseed material in one gallon bag.
- C. If hydroseeding is to be used in combination with other seeding methods, the contractor is to submit plan for areas to receive each type of seeding method.

1.05 REGULATORY REQUIREMENTS

A. Comply with regulatory agencies for fertilizer and herbicide composition.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable. Deliver seed mixture in containers showing percentage of seed mix, year of production, net weight, date of packaging, and location of packaging.
- B. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.
- A. Furnish maintenance of seeded areas for three months after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 SEED MIXTURE

A. Seed Mixture:

- 1. Tall Fescue Grass Type: 40 percent. (Firecracker LS, Aggressor, Falcon IV, Col-M, 3rd Millenium or similar to be approved by the Landscape Architect).
- 2. Fine Fescue Grass Type: 30 percent. (Reliant IV, Firefly, Epic, Fortitude, Finelawn Petite or similar to be approved by the Landscape Architect)
- 3. Kentucky Blue Grass Type: 20 percent. (Freedom III, Blue Velvet, Midnight, Barrister, Nu Destiny, Quantum Lelap, Brilliant, Everglade or similar to be approved by the Landscape Architect).
- 4. Perennial Rye: 10 percent.
 - a. Approved Varieties:
 - 1) Manhattan 5
 - 2) Divine
 - 3) Secretariat II

2.02 SOIL MATERIALS

A. Topsoil: Type as specified in Section 312200.

2.03 ACCESSORIES

- A. Mulching Material: Wheat straw, free from seeds and weeds, foreign matter detrimental to plant life, and dry. Hay or chopped cornstalks are not acceptable.
- B. Hydraulic Mulch: Fully biodegradable hydraulic mulch composed of 100% recycled wood fibers, cellulose fibers and wetting agents (including high-viscosity colloidal polysaccharides). The hydraulic mulch is to be sanitized, free from plastic netting, and upon application forms an intimate bond with the soil subsurface to create a porous, absorbent and flexible erosion resistant blanket that allows for rapid germination and accelerated plant growth.
 - 1. Basis of design: SoilCover Blend with Tack by Profile Products, 750 Lake Cook Road, Suite 440, Buffalo Grove, IL 60089. p:800-508-8681, www.profileproducts.com.
- C. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
 1. Composition: Recommendations per the soil test.
- D. Water: Clean, fresh and free of substances or matter that could inhibit vigorous growth of grass.

2.04 **TESTS**

- A. Analyze to ascertain percentage of nitrogen, phosphorus, potash, percentage inorganic matter soluble salt content, organic matter content, and pH value.
- B. Submit minimum 10 oz sample of topsoil proposed. Forward sample to approved testing laboratory in sealed containers to prevent contamination.
- C. Testing is not required if recent tests are available for imported topsoil. Submit these test results to the testing laboratory for approval. Indicate, by test results, information necessary to determine suitability.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that prepared soil base is ready to receive the work of this Section.
- B. For areas that are graded with slopes less than 6:1, hydroseeding may be used in lieu of seed and mulch.

3.02 PREPARATION

- A. Prepare subgrade in accordance with Section 312200.
- B. Place topsoil in accordance with Section 312200.

3.03 FERTILIZING

- A. Apply fertilizer as recommended in the soil testing results.
- B. Apply after smooth raking of topsoil and prior to roller compaction.
- C. Do not apply fertilizer at same time or with same machine as will be used to apply seed.
- D. Mix thoroughly into upper 3 inches of topsoil.
- E. Lightly water to aid the dissipation of fertilizer.

3.04 SEEDING

- A. Apply seed at a rate of 7 lbs per 1000 sq ft or as recommended by the seed producer and/or soil testing, evenly in two intersecting directions. Rake in lightly.
- B. Do not seed areas in excess of that which can be mulched on same day.
- C. Planting Season: Timeframe for seeding is to be determined by the landscape architect in accordance with weather and project site conditions.
- D. Do not sow immediately following rain, when ground is too dry, or during windy periods.
- E. Immediately following seeding and compacting, apply mulch to a thickness of 1/2 inches. Maintain clear of shrubs and trees.
- F. Apply water with a fine spray immediately after each area has been mulched. Saturate to 4 inches of soil.
- G. Following germination, immediately re-seed areas without germinated seeds that are larger than 4 by 4 inches.

3.05 HYDROSEEDING

- A. Apply seed at a rate of 4 lbs per 1000 sq ft or as recommended by the seed producer and/or soil testing, evenly in two directions. Rake in lightly.
- B. Do not seed areas in excess of that which can be mulched on same day.
- C. Apply 2000 lbs of hydraulic mulch with tack per acre or as recommended by the hydroseed manufacturer. Maintain clear of shrubs and trees. Contractor is to submit bill of materials to architect for quantity of materials delivered to site. Contractor is to have a manufacturer representative present on site during the first day of installation of hydraulic mulch.
- D. Contractor is to water hydroseeded area once every 7-days after hydroseeding for that area is complete or as recommended by the manufacturer.
- E. Following germination, immediately re-seed areas without germinated seeds that are larger than 4 by 4 inches.

3.06 PROTECTION

- A. Identify seeded areas with stakes and string around area periphery. Set string height to 18 inches. Space stakes at 30 inches.
- B. Protect seeded areas in accordance with Section 312513 Permanent Erosion Controls

3.07 MAINTENANCE

- A. Provide maintenance at no extra cost to Owner; Owner will pay for water.
- B. See Division 1 Sections for additional requirements relating to maintenance service.

- C. Provide maintenance of seeded areas for three months from Date of Substantial Completion.
- D. Mow grass at regular intervals to maintain at a maximum height of 4 inches. Do not cut more than 1/3 of grass blade at any one mowing.
- E. Neatly trim edges and hand clip where necessary.
- F. Immediately remove clippings after mowing and trimming.
- G. Water to prevent grass and soil from drying out.
- H. Roll surface to remove minor depressions or irregularities.
- I. Control growth of weeds. Apply herbicides in accordance with manufacturer's instructions. Remedy damage resulting from improper use of herbicides.
- J. Immediately reseed areas that show bare spots.
- K. Protect seeded areas with warning signs during maintenance period.

END OF SECTION

SECTION 334101 - SITE STORM DRAINAGE PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Storm drainage piping, fittings, and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 312316.13 Trenching: Excavating, bedding, and backfilling.
- B. Section 334413.23 Cleanouts and Drains
- C. Section 334413.13 Catch Basin and Curb Inlets
- D. Section 334416 Trench Drains
- E. Section 334419.13 Storm Water Quality Structures
- F. Section 334903 Storm Drainage Inlets and Outlets
- G. Section 334913 Storm Drainage Manholes

1.03 DEFINITIONS

A. Bedding: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations.

1.04 REFERENCE STANDARDS

- A. ASTM C 76 Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe; 2008.
- B. ASTM C 76M Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe [Metric]; 2008.
- C. ASTM C 443 Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets; 2005a.
- D. AASHTO M 252M AND M 294M Standard Specification for Corrugated Polyethylene (PE) Drainage Pipe.
- E. ASTM F 667 Standard Specification for Large Diameter Corrugated Polyethylene (PE) Pipe and Fittings.
- F. ASTM F 447 Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
- G. ASTM D 3212 Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.

1.05 SUBMITTALS

- A. See Section 013000 Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data indicating pipe, pipe accessories, and fittings.
- C. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Project Record Documents:
 - 1. Record location of pipe runs, connections, catch basins, cleanouts, and invert elevations.

PART 2 PRODUCTS

2.01 SEWER PIPE MATERIALS

- A. Concrete Pipe: Reinforced, ASTM C 76 (ASTM C 76M), Class III with Wall type B; mesh reinforcement; inside nominal diameter as identified on the drawings, bell and spigot end joints. Approved manufacturers include:
 - 1. Cloud Concrete Products
 - 2. Forterra (formerly Sherman Dixie)
- B. Reinforced Concrete Pipe Joint Device: ASTM C 443 (ASTM C 443M) rubber compression gasket joint.
- C. Corrugated PE Drainage Pipe and Fittings: Type S, dual wall with smooth waterway for coupling joints and PE sleeve with gasket material that mates with pipe and fittings to make them <u>watertight</u>. Approved manufacturers are:
 - 1. Advanced Drainage Systems, Inc., N-12 Pipe (www.ads-pipe.com)
 - 2. Timewell, Dual Wall Pipe(www.timewelltile.com)
 - 3. Baughman Tile Company, Dual Wall Pipe (www.baughmantile.com)
 - 4. Hancor, Blue Seal Pipe (www.hancor.com)
 - 5. Prinsco, Goldflow WT (www.prinsco.com)
 - 6. J.M. Eagle- product Eagle Corr Dual Wall Watertight Pipe. (www.jmeagled.com)
 - 7. Substitutions: As submitted for review and approved by architect by addendum during the bidding process.

2.02 PIPE ACCESSORIES

- A. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required wye, bends, elbows, cleanouts, reducers, traps and other configurations required.
- B. Trace Tape: Magnetic detectable conductor, clear plastic covering, imprinted with "Storm Sewer Service " in large letters.

2.03 BEDDING AND COVER MATERIALS

- A. Bedding: As specified in Section 312316.13.
- B. Cover: As specified in Section 312316.13.

PART 3 EXECUTION

3.01 TRENCHING

- A. See Section 312316.13 for additional requirements.
- B. Hand trim excavation for accurate placement of pipe to elevations indicated.
- C. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.

3.02 INSTALLATION - PIPE

- A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on layout drawings.
- B. Install pipe, fittings, and accessories in accordance with manufacturer's instructions. Seal watertight.
- C. Lay pipe to slope gradients noted on layout drawings; with maximum variation from true slope of 1/8 inch in 10 feet.
- D. Connect to building storm drainage system, foundation drainage system, and utility/municipal sewer system.

E. Install continuous trace wire 6 to 12 inches below finish grade, above pipe line; coordinate with Section 312316.13.

3.03 FIELD QUALITY CONTROL

- A. See Division 1 Sections for general requirements for testing and inspections.
- B. Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.
- C. Alignment: Piping where less than the full diameter of the inside of the pipe is not visible between structures will require replacement.
- D. Deflection Test: Piping with deflection that prevents passage of a ball or cylinder of size not less than 92.5 percent of piping diameter will require replacement.
- E. Piping that is crushed, cracked, broken or otherwise damaged will require repair or replacement as determined by the Architect.
- F. The contractor is to provide someone to remove and replace all grates or covers on storm water structures for any punch list visits that involve the storm water system.

3.04 PROTECTION

A. Protect pipe and bedding cover from damage or displacement until backfilling operation is in progress. **END OF SECTION**

SECTION 334413.13 - CATCH BASINS AND CURB INLETS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Area Drains.
- B. Monolithic FRP catch basins and inlets, frames, covers, anchorage, and accessories.

1.02 RELATED REQUIREMENTS

A. Section 015713 - Temporary Erosion and Sediment Controls for temporary inlet protection

1.03 REFERENCE STANDARDS

- A. ASTM A 48/A 48M Standard Specification for Gray Iron Castings; 2003.
- B. ASTM A 123/A 123M Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2002.
- C. ASTM D 3753 Standard Specification for Glass-Fiber-Reinforced Polyester Manholes and Wetwells; 2005.
- D. ASTM D3753 05e1 Standard Specification for Glass-Fiber-Reinforced Polyester Manholes and Wetwells

1.04 SUBMITTALS

- A. See Section 013000 Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate structure identification designations, locations, elevations, piping sizes and elevations of penetrations.
- C. Product Data: Provide structure data including configuration, grates, frames, steps and other components .

1.05 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Polyester Structure Sections: ASTM D 3753, glass-fiber reinforced polyester .
- B. Approved Polyester Structure Manufacturers include:
 - 1. Advanced Drainage Systems (ADS)
 - 2. HARCO
 - 3. Substitutions: As submitted for review and approved by architect by addendum during the bidding process.

2.02 CATCH BASIN AND CURB INLET COMPONENTS

- A. Polyester Structure Inlets:
 - 1. Area Drains (Landscaped Areas):
 - a. Grate Design: Per the storm drainage structure schedule on the drawings. All grates must meet or exceed H-20 loading.
 - b. Approved Manufacturers include:
 - 1) Harco PVC Drain Basins and In-Line Drains
 - 2) ADS Nyloplast Drain Basins and In-Line Drains

3) Substitutions: As submitted for review and approved by architect by addendum during the bidding process.

2.03 OTHER COMPONENTS

- A. Grate and Frame: ASTM A 48/A 48M, Class 30B Cast iron construction, machined flat bearing surface, removable grate, designed for H-20 loading; . Frames in pavement areas to allow for full asphalt pavement section to be located above the top of the concrete structure. Frames in landscape areas to be a minimum of 6-inches tall to allow for topsoil cover over top of concrete structure. Approved manufacturers include:
 - 1. J.R. Hoe and Sons
 - 2. Neenah Foundry Co.
 - 3. Substitutions: As submitted for review and approved by architect by addendum during the bidding process.

2.04 CONFIGURATION

- A. Shape: As identified in the storm structure schedule on the drawings.
- B. Clear Inside Dimensions: as required for piping layout shown with 48 inch minimum diameter for circular structures.
- C. Design Depth: As indicated.
- D. Clear Lid Opening: 18 inches diameter.
- E. Pipe Entry: Provide openings as required.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify items provided by other sections of Work are properly sized and located.
- B. Verify that built-in items are in proper location, and ready for roughing into Work.
- C. Verify excavation for structure is correct.

3.02 PREPARATION

A. Coordinate placement of inlet and outlet pipe or duct sleeves required by other sections.

3.03 INSTALLATION - CATCH BASINS

- A. Form bottom of excavation clean and smooth to correct elevation.
- B. Establish elevations and pipe inverts for inlets and outlets as indicated.
- C. Grout base of shaft sections to achieve slope to exit piping. Trowel smooth. Contour as required.
- D. Mount grate and frame level in grout, secured to top slab to elevation indicated. Grate elevations shown on the drawings are for the highest point on the grate for combination inlets, and are the elevation where water will enter the structure for catch basins.
- E. All lift hook holes are to be grouted flush with the face of the structure using a hydraulic, non-shrink grout that will provide a finish to match that of the structure.
- F. Coordinate with other sections of work to provide correct size, shape, and location.

3.04 FIELD QUALITY CONTROL

A. See Division 1 sections for field inspection and testing requirements.

- B. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.
- C. Structures and castings that are cracked, broken or otherwise damaged will require repair or replacement as determined by the Architect.
- D. The contractor is to provide someone to remove and replace all grates or covers on storm water structures for any punch list visits that involve the storm water system.

3.05 SCHEDULES

A. Storm Sewer Structures: See contract drawings for the storm structure schedule. **END OF SECTION**

SECTION 334903 - STORM DRAINAGE OUTLETS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Precast concrete headwalls with grates and accessories .

1.02 REFERENCE STANDARDS

- A. ASTM A 48/A 48M Standard Specification for Gray Iron Castings; 2003.
- B. ASTM C 478 Standard Specification for Precast Reinforced Concrete Manhole Sections; 2007.
- C. ASTM C 478M Standard Specification for Precast Reinforced Concrete Manhole Sections [Metric]; 2007.
- D. ASTM C 923 Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals; 2007.
- E. ASTM C 923M Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals [Metric]; 2007.

1.03 SUBMITTALS

- A. See Division 1 Sections for submittal procedures.
- B. Shop Drawings: Indicate structure identification designations, locations, elevations, piping sizes and elevations of penetrations.
- C. Product Data: Provide structure data including configuration, grates, frames, steps and other components .

1.04 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Pre-Cast Headwalls: Reinforced precast concrete in accordance with Kentucky Transportation Cabinet requirements.
- B. All headwalls are to be in compliance with Kentucky Transportation Cabinet requirements.
- C. Approved Pre-Cast Concrete Manufacturers include:
 - 1. Oldcastle Precast
 - 2. Sherman-Dixie
 - 3. Substitutions: As submitted for review and approved by architect by addendum during the bidding process.

2.02 HEADWALL COMPONENTS

- A. Grates: Rectangular steel bars, hot-dipped galvanized per Kentucky Transportation Cabinet standard drawings. Grates are to have security chains attaching them to the structure.
- B. Screens: Perforated pipe headwalls are to have stainless steel or galvanized rodent screens installed.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify items provided by other sections of Work are properly sized and located.

- B. Verify that built-in items are in proper location, and ready for roughing into Work.
- C. Verify excavation for structure is correct.

3.02 PREPARATION

A. Coordinate placement of pipe required by other sections.

3.03 INSTALLATION - HEADWALLS

- A. Form bottom of excavation clean and smooth to correct elevation.
- B. Establish elevations and pipe inverts for outlets as indicated.
- C. Set grate in recessed notches formed into the headwall wing walls, secure to top headwall with galvanized chain of a length that will allow removal for inspection.
- D. All lift hook holes are to be grouted flush with the face of the structure using a hydraulic, non-shrink grout that will provide a finish to match that of the structure.
- E. Coordinate with other sections of work to provide correct size, shape, and location.

3.04 FIELD QUALITY CONTROL

- A. See Division 1 Sections for general requirements for testing and inspections.
- B. Structures that are cracked, broken or otherwise damaged will require repair or replacement as determined by the Architect.
- C. The contractor is to provide someone to remove and replace all grates for any punch list visits that involve the storm water system.

3.05 SCHEDULES

A. Storm Sewer Headwalls: Refer to the storm structure schedule shown on the Contract Drawings. END OF SECTION

SECTION 334993 - DOWNSPOUT BOOTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Cast iron and Cast aluminum downspout boots.
 - 1. Contractors to provide aluminum downspout boots at all canopy locations and wherever they will be located in walks/pavements, and cast iron downspout boots where they will be located in grass or landscape areas.
- B. Precast concrete splash blocks.

1.02 RELATED REQUIREMENTS

A. Section 334101 - Site Storm Utility Drainage Piping.

1.03 DESIGN REQUIREMENTS

A. Conform to applicable code for size and method of rain water discharge.

1.04 SUBMITTALS

- A. See Section 013000 Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate locations, configurations, jointing methods, fastening methods, locations, and installation details.
- C. Product Data: Provide data on prefabricated components.
- D. Coordination Data: Provide table of downspout boots and their corresponding downspout size. Table shoud show boot top opening dimensions, downspout dimensions, boot length, boot outlet size and subsurface drainage pipe/fitting size.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Prevent contact with materials that could cause discoloration, staining, or damage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Extruded Aluminum Downspout Boots: Subject to compliance with requirements, manufacturers offering the following products that may be incorporated into the work include:
 - 1. Basis of Design: Design concept and the drawings indicate the size, profiles, dimensional requirements and aesthetics of the following:
 - a. Extruded Aluminum: McKinley Iron Works Type DS4 for connection to underground piping.
 - b. Extruded Aluminum: McKinley Iron Works Type DS8 for splash block application.
 - 2. Products by other manufacturers (listed below) may be considered, provided deviations in dimensions and profiles are minor and do not change the design concept as judged by the Architect:
 - a. Or equal approved through addendum prior to bidding.
- B. Cast Aluminum Downspout Boots: Subject to compliance with requirements, manufacturers offering the following products that may be incorporated into the work include:
 - 1. Basis of Design: Design concept and the drawings indicate the size, profiles, dimensional requirements and aesthetics of the following:
 - a. Cast Aluminum: Barry Pattern and Foundry Type B25A for connection to underground piping.

- b. Cast Aluminum: Barry Pattern and Foundry Type B25D for splash block application.
- 2. Products by other manufacturers (listed below) may be considered, provided deviations in dimensions and profiles are minor and do not change the design concept as judged by the Architect:
 - a. McKinley Iron Works Type DS4 for connection to underground piping, Type DS8 for splash block application.
 - b. Or equal approved through addendum prior to bidding.
- C. Cast Iron Downspout Boots: Subject to compliance with requirements, manufacturers offering the following products that may be incorporated into the work include:
 - 1. Basis of Design: Design concept and the drawings indicate the size, profiles, dimensional requirements and aesthetics of the following:
 - a. Cast Iron: J.R. Hoe O Series Type Boot for connection to underground piping.
 - b. Cast Iron: J.R. Hoe A Series Type Boot for splash block application.
 - 2. Products by other manufacturers (listed below) may be considered, provided deviations in dimensions and profiles are minor and do not change the design concept as judged by the Architect:
 - a. Neenah Foundry Company Angled type boot
 - b. Zurn Industries, Inc.
 - c. Barry Pattern and Foundry Type B25A for connection to underground piping, Type B25D for splash block application.
 - d. McKinley Iron Works Type DS4 for connection to underground piping, Type DS8 for splash block application.
 - e. Or equal approved through addendum prior to bidding.

2.02 MATERIALS

- A. Extruded Aluminum Heavy duty extruded aluminum with integral fastening system.
 - 1. Length:
 - 2. Size: Coordinate with downspout sizes on Architectural plans
 - 3. Finish: Powder coat
 - 4. Color: Manufactor's standard color choices
- B. Cast Aluminum Heavy duty cast aluminum with integral fastening system.
 - 1. Length: 18 inches
 - 2. Size: Coordinate with downspout sizes on Architectural plans
 - 3. Finish: Satin finish, ready for paint
 - 4. Color: Manufactor's standard color choices
- C. Cast Iron- Heavy duty cast iron body with strap construction.
 - 1. Length: 18 inches
 - 2. Size: Coordinate with downspout sizes on Architectural plans
 - 3. Finish: Shop primed and field painted
 - 4. Color: Manufactor's standard color choices

2.03 ACCESSORIES

- A. Splash Blocks: Precast concrete type, size and profiles indicated; minimum 3000 psi at 28 days, with minimum 5 percent air entrainment.
 - 1. Size: 12" wide, 30" long, 2-7/8" (min) thick.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that surfaces are ready to receive work.

3.02 PREPARATION

- A. Paint concealed metal surfaces and surfaces in contact with dissimilar metals with protective backing paint to a minimum dry film thickness of 15 mil. Paint color is to match downspouts.
- B. All non-factory painted downspout boots are to receive one coat of primer and two coats of finish color paint prior to installation. A minimum of one additional coat of finish color paint is to be applied after installation. Any damage to paint or boot is to be repaired to like new condition. Paint color is to match downspouts as selected by Architect.

3.03 INSTALLATION

- A. Install downspouts and accessories in accordance with manufacturer's instructions.
- B. Connect downspouts to downspout boots at a minimum of 24" above grade. Seal connection watertight.
- C. Connect downspouts to storm sewer system with the pipe connection and sleeve being completely below grade . Seal connection watertight.
- D. Set splash pans under downspouts where identified.
- E. Where downspout boots extend through concrete pavement, protect boot from concrete using plastic or other protective material for the entire height of the boot. If concrete materials come into contact with the downspout boot, removal and replacement of the boot may be required. Remove plastic protection after concrete work has been completed.
- F. Where downspout boots extend through concrete pavement, provide isolation joint material around the boot. After concrete installation, remove top 1/2-inch of isolation joint material and install joint sealant in accordance with Section 321373- Pavement Joint Sealants.

END OF SECTION