FANNING HOWEY

Project Manual

Dublin Jerome High School – Weight Room Renovation
Dublin City Schools
Dublin, Ohio

Project No. 225079.00

December 15, 2025

PROJECT TITLE PAGE

DUBLIN JEROME HIGH SCHOOL –
WEIGHT ROOM RENOVATION

DUBLIN CITY SCHOOL DISTRICT BOARD OF EDUCATION
DUBLIN, OHIO 43016

Direct Questions Concerning This Project To:

Architects/Engineers

Fanning/Howey Associates, Inc.
5200 Upper Metro Place, Suite 350
Dublin, OH 43017
Phone No. 614/764-4661
FAX No. 614/764-7894

S E T N O. _____ __

END OF PROJECT TITLE PAGE

CERTIFICATIONS PAGE

TITLE AND LOCATION OF THE WORK

Dublin Jerome High School –
Weight Room Renovation
8300 Hyland Croy Road
Dublin, OH 43016

NAME AND ADDRESS OF OWNER

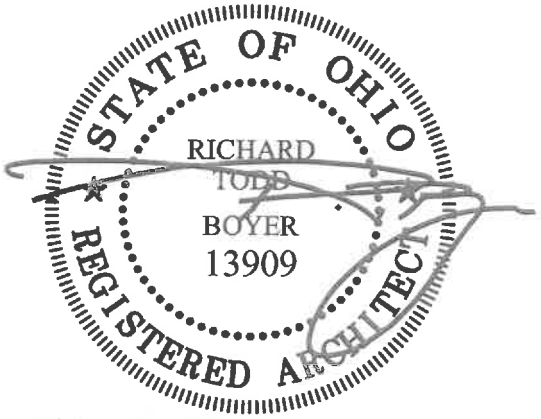
Dublin City School District Board of Education
6371A Shier Rings Road
Dublin, OH 43016

NAME AND ADDRESS OF ARCHITECTS/ENGINEERS

Fanning/Howey Associates, Inc.
5200 Upper Metro Place, Suite 350
Dublin, OH 43017

I hereby certify that the Project Drawings and the Project Manual were prepared by me or under my direct supervision and that I am a duly registered Architect/Engineer under the Laws of the State of Ohio.

FANNING/HOWEY ASSOCIATES, INC.
ARCHITECTS/ENGINEERS



Richard Todd Boyer, License #13909
Expiration Date 12/31/2025

Date: December 15, 2025

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NOTICE TO BIDDERS

Sealed bids will be received by the Board of Education of the Dublin City School District for the Jerome High School Weight Room Renovation.

The bids will be received at:

6371A Shier Rings Road
Dublin, Ohio, 43016
Attention: Jeff Stark, Chief Operating Officer

until 2:00 p.m. local time on January 20, 2026, and will be opened and publicly read and recorded immediately thereafter.

The contract documents, including the notice to bidders, may be obtained at:

https://www.dublinschools.net/departments/operations/bids-and-rfps

Instructions to Bidders

PROJECT:

Dublin City School District, Jerome High School Weight Room Renovation

THE OWNER:

Board of Education of the Dublin City School District
6371A Shier Rings Road
Dublin, Ohio, 43016

THE ARCHITECT:

Fanning Howey Associates, Inc.
5200 Upper Metro Place, Suite 350
Dublin, Ohio 43017

INQUIRIES REGARDING BIDDING DOCUMENTS:

Inquiries regarding the Bidding Documents, including requests for clarifications or interpretations, request for information, or proposal of substitutions shall be submitted by e-mail to the Architect to the attention of:

Michael S. Myers (mmyers@fhai.com)

The subject line of the e-mail should clearly reference the Project as named above.

ESTIMATE:

The estimated Cost of the Work for the Project is as follows:

$325,000.00

PRE-BID MEETING:

There will be Pre-Bid Meetings for all Bidders as follows:

Date/Time: January 6, 2026, at 9:00 a.m.

Location: Dublin Jerome High School
8300 Hyland-Croy Rd.
Dublin, OH 43016
(Meet at the main office door off of Brand Road parking lot).

BID OPENING:
In addition to attending the public bid opening, Bidders may observe the public Bid opening live at the following link:

https://www.youtube.com/@DublinCitySchoolsOH/streams

ARTICLE 1. DEFINITIONS

1.1 Bidding Documents include the Bidding Requirements and the Contract Documents plus any other item designated as a Bidding Document. The Bidding Requirements consist of the Notice to Bidders, Instructions to Bidders, the Bid Form, Bid Guaranty, bond (as required under Section 4.2.1), and other sample bidding and contract forms. The Contract Documents, which are inclusive of the Bidding Requirements, are enumerated and defined in the Agreement between the Owner and Contractor. Definitions set forth in the Agreement between Owner and Contractor or in other Contract Documents are applicable to the Bidding Documents.

1.2 Addendum or Addenda are written or graphic instruments issued by the Architect prior to the opening of Bids which modify or interpret the Bidding Documents by additions, deletions, clarifications or corrections.

1.3 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.

1.4 The Base Bid is the sum stated in the Bid 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.

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

1.6 A Bidder is a person or entity who submits a Bid.

1.7 The Bid Form is the form furnished in the Bidding Documents that is to be completed, signed, and submitted containing the Bidder's Bid.

1.8 Bid Guaranty means a bond or other instrument of security authorized by Ohio Revised Code Section 153.54 submitted with the Bid in accordance with Section 4.2 to provide assurance that the Bidder will execute the Agreement.

1.9 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.

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, 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 and surrounding area, become familiar with the conditions under which the Work is to be performed (including but not limited to the condition, layout and nature of the site and surrounding area; the availability and cost of labor; the availability and cost of materials, supplies and equipment; the costs of temporary utilities required in the Bid; the cost of any required permit or license; the usual weather conditions of the Project location; conditions bearing upon transportation, disposal, handling and storage of equipment, materials and waste; and subsurface and concealed physical conditions and related information provided in the Bidding Documents) and has correlated the Bidder's personal observations with the requirements of Bidding Documents.

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

2.2 By submitting its Bid, the Bidder understands and agrees that the Contract Sum, based on its Bid and as amended by Change Orders, shall cover all amounts due from the Owner resulting from interference, disruption, hindrance or delay caused by or between Separate Contractors or their agents and employees.

2.3 The Bidder agrees that the Bidder will make no request for additional compensation or mitigation of Liquidated Damages for any such interference, disruption, hindrance or delay, and will accept as full satisfaction an extension of the Contract Time which may be provided by the Owner in accordance with the Bidding Documents.

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 Notice to Bidders in the number and for the dollar amount, if any, stated therein.

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

3.1.3 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 errors, inconsistencies or ambiguities discovered.

3.2.2 Bidders requiring clarification or interpretation of the Bidding Documents shall submit a written request for information to the Architect at least seven (7) days prior to the date for receipt of Bids. By submitting its Bid, each Bidder represents and agrees, based upon its careful and diligent review of the Bidding Documents, that it is not aware of any conflicts, inconsistencies, errors or omissions in the Bidding Documents for which it has not timely notified the Architect. Bidders who fail to timely provide notification and to request clarification will be expected to overcome such conditions without additional compensation.

3.2.3 Interpretations, corrections and changes of the Bidding Documents if determined by the Architect to be warranted 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.

3.2.4 In interpreting the Bidding Documents, words describing materials that have a well-known technical or trade meaning, unless otherwise defined in the Bidding Documents, shall be construed in accordance with the well-known meaning recognized by the trade.

3.2.5 When the Bidding Documents refer to a period of time by a number of days, it excludes the first day and includes the last day of the period. If the last day of the period falls on a Saturday, Sunday, or a legal holiday, that day shall be omitted, and the period shall end on the next day which is not a Saturday, Sunday, or legal holiday. The term "day" as used in the Instructions to Bidders shall mean a calendar day unless otherwise noted.

3.2.6 Bidder is required to comply with all requirements of the Bidding Documents, regardless of whether the Bidder has actual knowledge of the requirements and regardless of any statement or omission made by the Bidder that might indicate a contrary intention.

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 submitted to the Architect at least seven (7) 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, the reason for the requested substitution, a complete description of the proposed substitution including the name of the material or equipment proposed as the substitute, drawings, performance and test data, any other information necessary for an evaluation, and a certification from the Bidder that the proposed item is equal in quality and all aspects of performance and appearance, to the item specified. A statement setting forth changes in other materials, equipment or other portions of the Work, including changes in the work of Separate Contractors 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. Approvals made in any other manner will not be binding, and Bidders shall not rely upon them. The Architect's decision will be final.

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 by e-mail or facsimile, posted to the Owner's website set forth in the Notice to Bidders, posted to an FTP site, or otherwise furnished to each firm's contact person of record. It is essential that Bidders provide full and accurate contact information to the Owner, including e-mail addresses.

3.4.2 All Bidders will be presumed to have actual knowledge of all Addenda distributed in the manner set forth in Section 3.4.1, and Bidders shall not avail themselves of incomplete knowledge and/or lack of familiarity of the Bidding Documents and any Addenda thereto resulting from the Bidder's failure to provide accurate contact information to the Owner, a Bidder's failure to check the Owner's website, or a Bidder's failure to otherwise ascertain delivery of an Addendum

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

3.5 If an Addendum is issued within 72 hours prior to the published time for the opening of Bids (excluding Saturdays, Sundays, and legal holidays), then the time for opening of Bids shall be extended one week with no further advertising of Bids required.

3.5.1 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 Form. If the Bidder fails to acknowledge receipt of each Addendum, the Bid may be deemed non-responsive, unless the Bid amount clearly and unambiguously reflects receipt of the Addendum, or the Addendum involves only a matter of form and does not affect the price, quantity or quality of the Work to be performed in any material manner.

3.6 BASIS OF DESIGN AND ACCEPTABLE COMPONENTS

3.6.1 The Bidding Documents may list components produced by specific manufacturers to denote kind, quality, or performance requirements. The component listed first is the basis of design component, and other listed components are acceptable components. If the Bidder includes an acceptable component in its Bid, the Bidder is responsible for the costs of coordination and modification required.

ARTICLE 4. BIDDING PROCEDURES

4.1 PREPARATION OF BIDS

4.1.1 The Bidder is strongly encouraged to attend any pre-bid meetings where questions will be received regarding the Bidding Documents. Each Bidder will be determined to have actual knowledge of all information provided or discussed at the pre-bid meeting, and additional compensation shall not be based upon the Bidder's failure to attend the pre-bid meeting which results in the Bidder's incomplete knowledge and familiarity of the Project requirements.

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

4.1.3 The Owner may solicit Bids which combine two or more bid packages. The individual Base Bid amounts of each separate bid package need not total the combination Base Bid amount. The Owner reserves the right to accept or reject any or all separate Bids or combination Bids, in whole or in part, and in any order.

4.1.4 All blanks on the Bid Form shall be legibly filled in using a non-erasable medium, and interlineations, alterations and erasures must be initialed in ink by the signer of the Bid.

4.1.5 Sums shall be expressed in both words and figures. In case of discrepancy between the amount in words versus the amounts in figures, the lowest amount shall control, whether expressed in numbers or words.

4.1.6 The wording on the Bid Form shall be used without change, alteration or addition. Any change in the wording or omission of specifying accompanying documents may cause the Bid to be rejected.

4.1.7 When an Alternate is listed on the Bid Form, the Bidder shall fill in the blank with an amount to add to or deduct from the Base Bid. Voluntary Alternates are prohibited from becoming the basis of the Contract award.

4.1.7.1 If no change in the Bid amount is required, indicate "No Change" or "$0 dollars."

4.1.7.2 When the Bid Form provides for quoting either an addition or deduction for an Alternate, indicate whether the amount is an addition or deduction. If it is not indicated, it will be conclusively presumed that the amount is a deduction.

4.1.7.3 Failure to indicate a negative number will indicate the Bidder's intent to increase the Base Bid by the amount entered in the applicable blank. Methods for indicating a negative number may include preceding the number by a minus sign, enclosing the number in parenthesis, or, when provided on the Bid Form, by circling "DEDUCT" or similar words.

4.1.8 Each copy of the Bid shall state the legal name of the Bidder and the nature of legal form of the Bidder. 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. For a Bid submitted by an agent, the Owner may require submission of a current power of attorney certifying the agent's authority to bind the Bidder. The Bidder may be required to provide evidence of legal authority to perform within the jurisdiction of the Work.

4.1.9 In determining which Bid is the lowest, the Owner shall consider the Base Bid and any Alternate or Alternates which the Owner decides to accept in the Owner's sole and absolute discretion. The Owner shall have the right to accept Alternates in any order or combination as desired by the Owner and to determine the low Bidder on the basis of the sum of the Base Bid and Alternates accepted. The Bidder further understands and acknowledges that use of Alternates is a long held customary practice in the construction industry in the State of Ohio. The Bidder understands that based on Alternates selected by the Owner, the Contract award to the lowest responsible Bidder may result in an award to a Bidder other than the Bidder that submitted the lowest Base Bid.

4.1.10 When two or more Bids are equal, in the whole, or in any part thereof, and are lower than any others, and the Owner has determined the Bidders to be responsive and responsible, the Owner may do either of the following in the Owner's sole discretion: (1) accept either of such equal bids, but in no case shall the Work be divided between such Bidders, or (2) select one Bidder by lot in the presence of all Bidders in such manner as the Owner shall determine and such selection shall be final, and if one of the Bidders refuses to participate in or fails to be present, the selection shall be made among the participating Bidders.

4.1.11 UNIT PRICES.

4.1.11.1 If Unit Prices are requested on the Bid Form, the amount of the scheduled quantities shall be included in the Base Bid amount. Unit prices shall be used solely for the purpose of determining the adjustment to the Contract Sum for the difference between the estimated quantities on the Bid Form and the actual quantities provided. If Unit Prices are stated to be sought only for informational purposes, they shall not be included in the Bid amount.

4.1.11.2 Unit Prices shall include all materials, equipment, labor, delivery, installation, and any other cost or expense, in connection with, or incidental to, the performance of that portion of the Work. Unit Prices shall not include the Contractor's fee on account of the associated Unit Price Work. The Bidder shall submit Unit Prices for all items listed.

4.1.11.3 Where there is a conflict between a Unit Price and the extension thereof made by the Bidder, the Unit Price shall govern, and a corrected extension of such Unit Price shall be made.

4.1.11.4 The Bidder agrees that the Owner may increase, decrease or delete entirely the scheduled quantities of Work to be done and materials to be furnished after execution of the Contract.

4.1.12 ALLOWANCES

4.1.12.1 If allowances are provided in the Bidding Documents, including the Bid Form, the amount of each applicable allowance shall be included in the Base Bid amount. Allowances shall be used solely for the purpose of determining the adjustment to the Contract Sum for the difference between the amount of the allowance and the actual cost of the related Work provided.

4.2 BID GUARANTY/BOND

4.2.1 A Bid Guaranty payable to the Owner and meeting the requirements of Ohio Revised Code Section 153.54 shall be submitted with the Bidders Bid in the form of either (i) a bid guaranty and contract bond meeting the requirements of Ohio Revised Code Sections 153.54(A)(1), 153.54(B) and 153.571 or (ii) a certified check, cashier's check or letter of credit meeting the requirements of Ohio Revised Code Sections 153.54(A)(2) and 153.54(C). The Bid Guaranty shall serve as an assurance that the Bidder will, upon acceptance of the Bid by the Owner, comply with all conditions for the execution of the Contract within the time specified.

4.2.1.1 The amount of the bid guaranty and contract bond under Section 4.2.1(i) herein should be the full amount of the Bidder's Base Bid plus all add Alternates with no deduction for any deduct Alternates; a percentage is not acceptable. If the blank line on the bid guaranty and contract bond is not filled in, the penal sum will automatically be the full amount of the Base Bid plus all accepted Alternates. If an amount is inserted, then the failure to state an amount equal to or greater than the total of the Base Bid plus all add Alternates that are accepted shall make the Bid non-responsive. If the successful Bidder provided a bid guaranty and contract bond as its Bid Guaranty under Section 4.2.1(i) and this Subsection 4.2.1.1, then the bid guaranty and contract bond shall become the performance and payment bond.

4.2.1.2 A certified check, cashier's check or letter of credit under Section 4.2.1(ii) herein should be equal to ten (10) percent of the Base Bid plus all add Alternates, and a failure to provide an amount equal to or greater than ten (10) percent of the total of the Base Bid plus all add Alternates that are accepted shall make the Bid non-responsive. Any letter of credit shall be revocable only by the Owner. Successful Bidders that provide a Bid Guaranty in the form of a certified check, cashier's check or letter of credit under Section 4.2.1(ii) and this subsection 4.2.1.2 shall, at the time of signing the Contract, provide a performance and payment bond meeting the requirements of Ohio Revised Code Sections 153.54(C) and 153.57.

4.2.1.3 A bond must be issued by a surety capable of demonstrating a record of competent underwriting, efficient management, adequate reserves, and sound investments. A bond must be signed by an authorized agent of an acceptable surety bonding company and by the Bidder. The bond must be issued by a surety company authorized by the Ohio Department of Insurance to transact business in the State of Ohio and a copy of that insurance company's certificate of compliance should be attached to the bond. Each bond shall also be supported by a power of attorney for the agent signing for the surety.

4.2.2 FORFEITURE

4.2.2.1 If for any reason, other than as authorized by Sections 4.4 and 4.5 herein, the Bidder fails to execute the Contract, and the Owner awards the Contract to another subsequent Bidder which the Owner determines is the lowest responsive and responsible Bidder, the Bidder who failed to enter into a Contract shall be liable to the Owner for the difference between such Bidder's Bid amount and the Bid amount of the subsequent Bidder awarded the Contract, but not to exceed ten (10) percent of the Bid amount of the Bidder who failed to enter into a Contract. For purposes of this Section 4.2.2, the Bid amount shall mean the Base Bid and Alternates selected by the Owner.

4.2.2.2 If the subsequent Bidder also fails or refuses to execute the Contract, the liability of such subsequent Bidder shall be the amount of the difference between the Bid amount of such subsequent Bidder and the Bid amount of another subsequent Bidder which the Owner determines is the lowest responsive and responsible Bidder, but not in excess of ten (10) percent of the Bid amount of the subsequent Bidder who failed to enter into a Contract. Liability on account of an award to each succeeding lowest responsible Bidder shall be determined in like manner.

4.2.2.3 If the Owner does not award the Contract to another Bidder which the Owner determines is the next lowest responsible Bidder, but resubmits the Project for bidding, the Bidder failing to execute the Contract shall be liable to the Owner for the costs in connection with the resubmission, of printing new Bidding Documents, required advertising and printing and mailing notices to prospective Bidders, but not to exceed ten percent (10%) of such Bidder's Bid amount.

4.3 SUBMISSION OF BIDS

4.3.1 The Bid, the Bid Guaranty 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 Bid 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 sealed Bid envelope is enclosed in another envelope for purpose of delivery, the exterior envelope shall also be addressed to the party receiving the Bid 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.

4.3.2 Bids shall be delivered to the designated location not later than the time and date for receipt of Bids. The cancellation or delay of the normal business activities of the Owner shall not be construed as an extension of the time and date for the receipt and opening of Bids. Bids received after the time and date for receipt of Bids will be returned unopened regardless of the reason for the delay.

4.3.3 The Bidder shall assume full responsibility for timely delivery at the location designated for receipt of Bids, regardless of the method of delivery. Ample time should be allowed for transmittal of Bids. Bidders should secure correct information relative to the probable time of arrival at the place where Bids are to be opened.

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

4.3.5 Form of Bid

4.3.5.1 Bids shall not contain a recapitulation of the Work to be done.

4.3.5.2 Before submitting a Bid, Bidders should carefully examine all of the Bidding Documents, visit the site and fully inform themselves as to all existing conditions and limitations that may affect the Work, including prevailing climate conditions and when the Work will be performed. Each Contractor shall be responsible for its portion of the Work regardless of what Drawing it may appear on or Specification division it is described in.

4.4 MODIFICATION OR WITHDRAWAL OF BID PRIOR TO BID OPENING

4.4.1 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 modification to the Bid amount shall be worded as not to reveal the amount of the original Bid, and changes shall provide an amount to be added to or subtracted from the Bid amount so that the final Bid amount can be determined only after the sealed envelope is opened.

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. The Bid Guaranty shall be in an amount sufficient for the Bid as resubmitted.

4.5 WITHDRAWAL OF BID AFTER BID OPENING

4.5.1 Following the Bid opening, withdrawal of Bids shall be governed by Ohio Revised Code Section 9.31.

4.5.2 A Bidder may withdraw a Bid from consideration after the Bid opening if the Bid amount was substantially lower than the amounts of other Bids, providing the Bid was submitted in good faith, and the reason for the Bid amount being substantially lower was a clerical mistake, as opposed to a judgment mistake, and was actually due to an unintentional and substantial arithmetic error or an unintentional omission of a substantial quantity of Work, labor, or material made directly in the compilation of the Bid amount.

4.5.2.1 Notice of a request to withdraw a Bid shall be made in writing filed with the Owner within two (2) business days after the conclusion of the bid opening. The Owner reserves the right to request the Bidder to submit evidence substantiating the Bidder's request to withdraw the Bid.

4.5.2.2 No Bid may be withdrawn under Section 4.5.2 which would result in awarding a Contract involving the same item on another Bid to the same Bidder.

4.5.3 If a Bidder withdraws its Bid under Section 4.5.2, the Owner may award the Contract to the next lowest responsive and responsible Bidder, or reject all Bids and rebid the Project. In the event the Owner rebids the Project, the withdrawing Bidder shall pay the costs, in connection with the re-bidding, of printing new Bidding Documents, required advertising, and printing and mailing of notices to prospective Bidders, if the Owner finds that these costs would not have been incurred but for the withdrawal.

4.5.4 If the Owner contests the right of a Bidder to withdraw a Bid pursuant to Section 4.5.2, it shall hold a hearing within ten (10) days after the Bid opening and the Owner shall issue an order allowing or denying the claim of this right within five (5) days after the hearing is concluded. The Owner shall give the withdrawing Bidder timely notice of the time and place of the hearing. The Owner shall make a stenographic record of all testimony, other evidence, and rulings on the admissibility of evidence presented at the hearing, and the Bidder shall pay the costs of the hearing. Pursuant to Ohio Revised Code Section 119.12, the Bidder may appeal the order of the Owner.

4.5.5 In the event the Owner denies the request for withdrawal and the Bidder elects to appeal or otherwise refuses to perform the Contract, the Owner may reject all Bids or award the Contract to the next lowest responsive and responsible Bidder.

4.5.6 A Bidder who is permitted to withdraw a Bid under Section 4.5.2 shall not supply material or labor to, or perform a subcontract or other work for, the person to whom the Contract is awarded, or otherwise benefit, directly or indirectly, from the performance of the Project for which the withdrawn Bid was submitted, without the Owner's prior written consent. The person to whom the Contract was awarded and the withdrawing Bidder are jointly liable to the Owner in an amount equal to any compensation paid to or for the benefit of the withdrawing Bidder without such approval, in addition to the penalty provided for in Ohio Revised Code Section 2913.31.

4.5.7 A request for a withdrawal of a Bid that is made more than two business days after the conclusion of the Bid opening shall be subject to Section 4.2.2 herein.

ARTICLE 5. CONSIDERATION OF BIDS

5.1 OPENING OF BIDS

5.1.1 Bids received on time will be publicly opened and will be read aloud. An abstract of the Bids may be made available to Bidders. Bids will be recorded showing the date and time received. Bids received prior to the time of opening will be securely kept, unopened. No responsibility will be accepted for the premature opening of a Bid not properly addressed and identified.

5.1.2 The public opening and reading of Bids is for informational purposes only and is not to be construed as an acceptance or rejection of any Bid submitted.

5.1.3 The contents of the Bid envelope shall be a public record and open for inspection, upon request, at any time after the completion of the entire Bid opening, except for any information that is not a public record under Ohio law.

5.1.4 All Bids shall remain open for acceptance for sixty (60) days following the day of the Bid opening, but the Owner may, in its sole discretion, release any Bid and return the Bid Guaranty prior to that date.

5.2 BID EVALUATION

5.2.1 The Owner shall have the right in its sole discretion to reject any or all Bids and submit the Project or any components thereof for rebidding. A Bid not accompanied by a required Bid Guaranty or by other data required by the Bidding Documents, or a Bid which is in any way incomplete or irregular is subject to rejection.

5.2.2 The Owner will have the right to take such steps as it deems necessary to determine the responsibility of the Bidder and the ability of the Bidder to perform the Work, and the Bidder shall furnish the Owner and Architect such data for this purpose as they may request. Such data may include but not be limited to:

5.2.2.1 Overall experience of the Bidder, including number of years in business under present and former business names. If the Bidder's management operates or has operated another construction company, the Owner may consider the work history of that company in determining the overall experience of the Bidder;

5.2.2.2 Complete listing of all ongoing and completed public and private construction projects of the Bidder in the last three years, including the nature and value of each contract and a name/address/phone number for each owner;

5.2.2.3 Complete listing of any public or private construction projects for which the Bidder has been declared in default; also, any EPA, OSHA or other regulating entity issues or citations in the last ten (10) years;

5.2.2.4 Additional financial information, including certified financial statements, bank references, and information concerning Bidder as reported by Dun & Bradstreet and other similar reporting services, all of which shall be confidential except under proper order of a court and shall not constitute a public record under Ohio Revised Code 149.43;

5.2.2.5 Description of relevant equipment and facilities of the Bidder;

5.2.2.6 Description of the management experience of the Bidder's project manager(s) and superintendent(s);

5.2.2.7 Complete list of Subcontractors which the Bidder proposes to employ on the Project;

5.2.2.8 Current Ohio Workers' Compensation Certificate;

5.2.2.9 If the Bidder is a foreign corporation, i.e., not incorporated under the laws of Ohio, a Certificate of Good Standing from the Secretary of State showing the right of the Bidder to do business in the State; or, if the Bidder is a person or partnership, the Bidder has filed with the Secretary of State a Power of Attorney designating the Secretary of State as the Bidder's agent for the purpose of accepting service of summons in any action;

5.2.2.10 Any prior rejections of a Bid submitted by the Bidder on a public project.

5.2.3 Failure to timely submit the requested information may be grounds for rejecting the Bid.

5.2.4 The right is reserved to reject Bids where an investigation of the available evidence or information does not satisfy the Owner that the Bidder is a responsible Bidder.

5.2.5 Bids which contain qualifications or conditions that are contrary to the text or intent of the Bidding Documents, and which are inserted in the Bid or submitted subsequent to the Bid opening for the purpose of limiting or otherwise qualifying the obligations of the Bidder, outside of the text or intent of the Bidding Documents, may be subject to disqualification.

5.2.6 The Owner reserves the right to reject the Bid of a Bidder who has previously failed to perform properly or to complete Contracts of a similar nature on time, who is not in a position to perform the Contract, or who has habitually, and without just cause neglected the payment of bills or otherwise disregarded its obligations to subcontractors, material persons, or employees.

5.2.7 The Owner reserves the right to waive, or to allow any Bidder a reasonable opportunity to cure, a minor irregularity or technical deficiency in a Bid, provided the irregularity or deficiency does not affect the Bid amount or otherwise give the Bidder a competitive advantage.

5.2.8 The Bidder authorizes the Owner and its representatives to contact the owners and professionals (including but not limited to architects, engineers and construction managers) on projects on which the Bidder has worked. Bidder shall provide full contact information for such owners and professionals, and Bidder authorizes such owners and professionals to provide the Owner with a candid evaluation of the Bidder's performance. By submitting its Bid, the Bidder agrees that if it or any person, directly or indirectly, on its behalf or for its benefit brings an action against any of such owners or professional or the employees of any of them as a result of or related to such candid evaluation, the Bidder will indemnify and hold harmless such owners and professionals and the employees of any of them from any claims whether or not proven that are part of or are related to such action and from all legal fees and expenses incurred by any of them arising out of or related to such legal action. This obligation is expressly intended for the benefit of such owners and professionals, and the employees of each of them.

5.3 ACCEPTANCE OF BID (AWARD)

5.3.1 Subject to the right of the Owner to reject each and every Bid, the Owner will award the Contract for the Work to the lowest responsible Bidder. In determining which Bid is the lowest responsible Bid, the Owner may take into consideration not only the amount of the Base Bid and the Bids for any Alternate the Owner determines to accept but such of the following criteria as Owner, in its discretion, deems appropriate, and Owner may give such weight thereto as it deems appropriate:

5.3.1.1 The Bidder's financial condition and ability to complete the Contract successfully without resort to its surety;

5.3.1.2 The Bidder's prior experience, including experience with similar work on comparable or more complex projects;

5.3.1.3 The management skills of the Bidder, including the competency and experience of the Bidder's proposed supervisory and management staff and the capability of the Bidder to construct and manage the entire Project, including but not limited to the plumbing, fire protection, heating, ventilating and air conditioning and electrical branches or classes of the Work;

5.3.1.4 The Bidder's prior history for the successful and timely completion of projects;

5.3.1.5 The Bidder's equipment and facilities;

5.3.1.6 The adequacy, in numbers and experience, of the Bidder's work force to complete the Contract successfully and on time;

5.3.1.7 The Bidder's prior experience on other projects of the Owner, including the Bidder's demonstrated ability to complete its work on these projects in accordance with the Bidding Documents and on time;

5.3.1.8 The Bidder's history of compliance with federal, state, and local laws, rules, and regulations;

5.3.1.9 A Bidder who submits a Bid for Work as a mechanical contractor or which includes mechanical contracting (i.e., electrical, plumbing, hydronics, refrigeration or heating, ventilating and air conditioning) shall submit evidence of licensure of the Bidder or applicable subcontractor by the Ohio Construction Industry Licensing Board;

5.3.1.10 The Owner's prior experience with the Bidder's surety;

5.3.1.11 The Bidder's interest in the Project as evidenced by its attendance at any pre-bid meetings or conferences for Bidder;

5.3.1.12 The Bidder's ability to work with the Owner, Architect and other Project personnel as a willing, cooperative and successful team member;

5.3.1.13 The Bidder shall certify it has not had a professional license revoked in the past five years in Ohio or in any other state;

5.3.1.14 The Bidder shall certify it has not been debarred from any public contract, federal, state or local, in the past five years;

5.3.1.15 Other essential factors as deemed appropriate by the Owner;

5.3.1.16 The foregoing information with respect to each of the subcontractors and suppliers that the Bidder intends to use on the Project.

ARTICLE 6. POST-BID INFORMATION

6.1 CONTRACTOR'S QUALIFICATION STATEMENT

Bidders to whom award of a Contract is under consideration shall submit to the Architect as promptly as possible but no later than 48 business hours after Bid opening a statement of the Bidder's qualifications. Unless a qualifications form is contained in the Project manual, Bidder shall use the AIA A305 form. Bidder shall thereafter promptly provide to the Architect no later than 24 business hours after request such additional information as the Architect may reasonably request regarding the Bidder's responsibility.

6.2 SUBMITTALS

6.2.1 The Bidder shall within 48 hours after Bid opening, or such longer time as may be permitted by Owner, furnish to the Owner through the Architect in writing the following information. Failure to submit this information within the required time may be grounds for rejection of the Bid:

.1 a designation of the Work to be performed with the Bidder's own forces;

.2 names of the manufacturers, products, and the suppliers of principal items or systems of materials and equipment proposed for the Work;

.3 names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for the principal portions of the Work;

.4 the list of all proposed Subcontractors and suppliers; and

.5 the breakdown of the labor and material for the Project, including the sum thereof.

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

6.2.3 Prior to the execution of the Contract, the Owner will notify the Bidder in writing if, after due investigation, the Owner has reasonable objection to a person or entity proposed by the Bidder. If the Owner has reasonable objection to a proposed person or entity, the Bidder shall submit an acceptable substitute person or entity at no additional cost to Owner.

6.2.4 Persons and entities proposed by the Bidder and to whom the Owner has 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.

6.3 NOTICE OF INTENT TO AWARD

6.3.1 The Owner shall notify the apparent successful Bidder of the Owner's intent to award the Bid of the Bidder. Following such notice, the Bidder shall submit the information listed in Section 8.4 as well as such additional information as required by Owner. The Owner reserves the right to rescind the notice if the Owner determines the notice was issued in error. The failure to submit required information or to meet the conditions specified in Section 8.4 herein on a timely basis may result in the determination that the Bidder is not the lowest responsible Bidder.

6.3.2 It is understood that notification of the Owner's intent to award does not constitute the formation of a Contract between Owner and Bidder, and it is further understood that acceptance by the Owner's governing body of the Bidder's Bid and the execution of a formal written Agreement by both the Owner and Bidder, which Agreement must contain a fiscal officer certificate as required by statute, are conditions to the formation of a Contract.

ARTICLE 7. FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR

Unless otherwise required in the Bidding Documents, the Agreement for the Work will be written on the Form of Agreement Between Owner and Contractor as contained in the Bidding Documents.

ARTICLE 8. SUPPLEMENTAL BIDDING INFORMATION

8.1 Communications for the administration of the Contract shall be as set forth in the Contract and, in general, shall be through the Architect.

8.2 If the Owner and a Bidder enter into a contract within 60 days of the Bid opening, the Contractor shall pay any and all material, labor or Subcontract cost increases which have occurred since the Bid opening. Contracts entered into beyond the 60-day period may contain additional amounts for cost increases if the cause for delay is not the fault of the Contractor.

8.3 By submitting a Bid, the Bidder represents that the Bidder is not subject to a finding for recovery under Ohio Revised Code Section 9.24, or that Bidder has taken the appropriate remedial steps required under Ohio Revised Code Section 9.24, or otherwise qualifies under this section.

8.4 Prior to the signing of a Contract, the successful Bidder shall furnish:

8.4.1 Certificates of insurance meeting the requirement of the Contract.

8.4.2 Performance and payment bond (if required by, and not already provided in accordance with, Section 4.2 herein).

8.4.3 Ohio Workers' Compensation Certificates.

8.4.4 If a Bidder is a foreign corporation (e.g., not incorporated under the laws of Ohio) it must submit a Certificate of Good Standing from the Ohio Secretary of State showing the right of the Bidder to conduct business in the state of Ohio.

8.4.5 If a Bidder is an individual or partnership, nonresident of the State, it must submit a Power of Attorney designating the Ohio Secretary of State as the Bidder's agent for accepting service of summons in any action brought under ORC Section 153.05 or under ORC Sections 4123.01 to 4123.94, inclusive.

8.4.6 Tax affidavit (Ohio Revised Code Section 5719.042).

8.4.7 Proof of enrollment in good standing in the Ohio Bureau of Workers' Compensation Drug-Free Workplace Program or an equivalent program in accordance with Ohio Revised Code Sections 153.03 to 153.031.

8.5 The award of the Contract and the execution of the Contract are based upon the expectation that the lowest responsible Bidder will comply with the requirements of Section 8.4. Noncompliance with the requirements within five (5) days of the date that the Bidder is notified of the notice of intent to award the Contract in accordance with Section 6.3 herein shall constitute a failure of the Bidder to execute the Contract and be cause for the Owner to cancel the award to the Bidder and to award the Contract to another Bidder which the Owner determines is the next lowest responsive and responsible Bidder, or resubmit the Contract for bidding, at the discretion of the Owner. The Owner may extend the time for compliance with the conditions for good cause shown. No extension shall operate as a waiver of the conditions precedent for execution of the Contract.

DOCUMENT 00 26 00.00 - PROCUREMENT SUBSTITUTION PROCEDURES

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 DEFINITIONS

A. Procurement Substitution Requests: Requests for changes in products, materials, equipment, and methods of construction from those indicated in the Procurement and Contracting Documents, submitted prior to receipt of bids.

B. Substitution Requests: Requests for changes in products, materials, equipment, and methods of construction from those indicated in the Contract Documents, submitted following Contract award. See Section 012500 "Substitution Procedures" for conditions under which Substitution requests will be considered following Contract award.

1.3 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.4 PROCUREMENT SUBSTITUTIONS

A. Procurement Substitutions, General: By submitting a bid, the Bidder represents that its bid is based on materials and equipment described in the Procurement and Contracting Documents, including Addenda. Bidders are encouraged to request approval of qualifying substitute materials and equipment when the Specifications Sections list materials and equipment by product or manufacturer name.

B. Procurement Substitution Requests will be received and considered by Owner when the following conditions are satisfied, as determined by A/E; otherwise requests will be returned without action:
   1. Extensive revisions to the Contract Documents are not required.
   2. Proposed changes are in keeping with the general intent of the Contract Documents, including the level of quality of the Work represented by the requirements therein.
   3. The request is fully documented and properly submitted.

1.5 SUBMITTALS

A. Procurement Substitution Request: Submit to A/E. Procurement Substitution Request must be made in writing in compliance with the following requirements:
   1. Requests for substitution of materials and equipment will be considered if received no later than 10 days prior to date of bid opening.
   2. Submittal Format: Electronically submit each written Procurement Substitution Request, using form bound in Project Manual in accordance with Division 00 Section “Instructions to Bidders”.
      a. Identify the product or the fabrication or installation method to be replaced in each request. Include related Specifications Sections and drawing numbers.
      b. Provide complete documentation on both the product specified and the proposed substitute, including the following information as appropriate:
         1) Point-by-point comparison of specified and proposed substitute product data, fabrication drawings, and installation procedures.
         2) Copies of current, independent third-party test data of salient product or system characteristics.
         3) Samples where applicable or when requested by A/E.

4) Detailed comparison of significant qualities of the proposed substitute with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.

5) Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.

6) Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, which will become necessary to accommodate the proposed substitute.

c. Provide certification by manufacturer that the substitute proposed is equal to or superior to that required by the Procurement and Contracting Documents, and that its in-place performance will be equal to or superior to the product or equipment specified in the application indicated.

d. Bidder, in submitting the Procurement Substitution Request, waives the right to additional payment or an extension of Contract Time because of the failure of the substitute to perform as represented in the Procurement Substitution Request.

B. A/E's Action:

1. A/E may request additional information or documentation necessary for evaluation of the Procurement Substitution Request. A/E will notify all bidders of acceptance of the proposed substitute by means of an Addendum to the Procurement and Contracting Documents.

C. A/E's approval of a substitute during bidding does not relieve Contractor of the responsibility to submit required shop drawings and to comply with all other requirements of the Contract Documents.

END OF DOCUMENT 00 26 00

DOCUMENT 00 26 00.01 - SUBSTITUTION REQUEST FORM
(During Bidding/Procurement Phase)

To mmyers@fhai.com Date: _____

Project Dublin Jerome High School – Weight Room Renovation

We hereby submit for your consideration the following product instead of the specified item(s) for the above project:

Section	Article/Paragraph (Page)	Specified Item
_____	_____	_____

Proposed
Substitution: _____ Model: _____

Manufacturer: _____ Phone: _____

Attach complete technical data including laboratory tests if applicable.

Include complete information changes to Drawings and/or Specifications which proposed substitution require for proper installation.

Fill in Blanks Below, use additional sheets if necessary:

A. Does the substitution affect dimensions shown on Drawings?

_____

B. Will the undersigned pay for changes to building design, including engineering and detailing costs caused by substitution, if any?

_____

C. What effect does substitution have on other trades? _____

_____

D. Differences between proposed substitution and specified item?

_____

E. Manufacturer's guarantees of proposed and specified items are:

_____Same _____Different (explain on attachment)

The undersigned certifies that the function, appearance and quality are equivalent or superior to the specified item.

Submitted By:

_____
Signature
_____
Firm _____
Address _____
_____
Telephone _____
Fax _____
Email _____

For Use by Design Consultant:

Accepted Accepted as Noted
Not Accepted Received too Late
PM _____
Specifier _____
Date _____
Remarks _____
Telephone _____

END OF SECTION 00 26 00.01

BID FORM

Project: Dublin City School District, Jerome High School Weight Room Renovation

The undersigned, having read and examined the premises and the Contract Documents, including without limitation the Drawings and Specifications, prepared for the above-referenced Project, and the following Addenda:

Addendum Number	Date of Receipt
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

submits its Bid for the Project.

The Contractor acknowledges that all Work shall be completed within the time established in the Contract Documents, and that each applicable portion of the Work shall be completed upon the respective milestone completion dates, unless an extension of time is granted in accordance with the Contract Documents.

The undersigned Bidder proposes to perform all Work for the applicable Contract, in accordance with the Contract Documents, for the following sums:

ITEM 1. BASE BID

ALL LABOR AND MATERIALS, for the sum of $_____

Sum in words:_____

ITEM 2. ALTERNATES

ALTERNATE 1: New RAF-1 Flooring.

If Alternate is accepted: ADD TO/DEDUCT FROM Base Bid (Circle appropriate choice):

$_____

Sum in words: _____

ALTERNATE 2: Storage Cage.

If Alternate is accepted: ADD TO/DEDUCT FROM Base Bid (Circle appropriate choice):

$_____

Sum in words: _____

ALTERNATE 3: Personal Record Station.

If Alternate is accepted: ADD TO/DEDUCT FROM Base Bid (Circle appropriate choice):

$_____

Sum in words: _____

ALTERNATE 4: Acoustical Ceiling System.

If Alternate is accepted: ADD TO/DEDUCT FROM Base Bid (Circle appropriate choice):

$_____

Sum in words: _____

BIDDER'S CERTIFICATION

The Bidder hereby acknowledges that the following representations in this Bid are material and not mere recitals:

1. Bidder has read and understands the Contract Documents and agrees to comply with all requirements of the Contract Documents, regardless of whether the Bidder has actual knowledge of the requirements and regardless of any statement or omission made by the Bidder which might indicate a contrary intention.

2. The Bidder represents that the Bid is based upon the standards specified by the Contract Documents.

3. The Bidder has visited the Project site, become familiar with local conditions and has correlated personal observations about the requirements of the Contract Documents. The Bidder has no outstanding questions regarding the interpretation of the Contract Documents.

4. The Bidder understands that the award of separate contracts for the Project will require sequential, coordinated and interrelated operations which may involve interference, disruption, hindrance or delay in the progress of the Bidder's Work. The Bidder agrees that the Contract price, as amended from time to time by Change Order, shall cover all amounts due from the Owner resulting from interference, disruption, hindrance or delay caused by or between Contractors or their agents and

employees. The Bidder agrees that any such interference, disruption, hindrance or delay is within the contemplation of the Bidder and the Owner and that the Contractor's sole remedy for such interference, disruption, hindrance or delay shall be an extension of time in accordance with the Contract Documents. This provision is intended to be, and shall be construed as, consistent with and not in conflict with, Section 4113.62, ORC, to the fullest extent permitted.

5. The Bidder and each person signing on behalf of the Bidder certifies, and in the case of a joint or combined Bid, each party thereto certifies as to such party's organization, under penalty of perjury, that to the best of the undersigned's knowledge and belief: (a) the Base Bid, any Unit Prices and any Alternate Bid in the Bid have been arrived at independently without collusion, consultation, communication or agreement, for the purpose of restricting competition as to any matter relating to such Base Bid, Unit Prices or Alternate Bid with any other Bidder; (b) unless otherwise required by law, the Base Bid, any Unit Prices and any Alternate Bid in the Bid have not been knowingly disclosed by the Bidder and will not knowingly be disclosed by the Bidder prior to the Bid opening, directly or indirectly, to any other Bidder who would have any interest in the Base Bid, Unit Prices or Alternate Bid; (c) no attempt has been made or will be made by the Bidder to induce any other individual, partnership or corporation to submit or not to submit a Bid for the purpose of restricting competition.

6. Bidder will enter into and execute the Agreement with the Owner, if a Contract is awarded on the basis of this Bid, and if the Bidder does not execute an Agreement for any reason, other than as authorized by law, the Bidder and the Bidder's Surety are liable to the Owner as provided in the Ohio Revised Code and as applicable to the Owner.

7. Bidder certifies that the upon the award of a Contract, it will make a good faith effort to ensure that all of its employees, while working on the site of the Project, will not purchase, transfer, use or possess illegal drugs or alcohol or abuse prescription drugs in any way.

8. Bidder agrees to furnish any information requested by the Owner to evaluate the responsibility of the Bidder.

9. The Bidder certifies that upon the execution of the Contract, the Contractor shall be enrolled in good standing in the Ohio Bureau of Workers' Compensation Drug-Free Workplace Program (DFWP) or an equivalent BWC approved DFWP throughout the entire Project, in accordance with Ohio Revised Code Sections 153.03 to 153.031. The Bidder acknowledges the responsibility to require all Subcontractors to be enrolled in good standing in the Ohio Bureau of Workers' Compensation DFWP or comparable Bureau of Workers' Compensation approved program that meets the requirements specified in Ohio Revised Code Sections 153.03 to 153.031, prior to the Subcontractor providing labor at the Project site.

Each Bid shall contain the name of every person interested therein. If the Bidder is a corporation, partnership or sole proprietorship, an officer, partner or principal of the Bidder, as applicable, shall print or type the legal name of the Bidder on the line provided and **sign the Bid Form**. If the Bidder is a joint venture, an officer, partner or principal, as applicable, of each member of the joint venture shall print or type the legal name of the applicable member on the line provided and sign the Bid Form.

BIDDER'S NAME:

Authorized Signature: _____

Print Name: _____

Title: _____

Company Name: _____

Mailing Address: _____

_____

Telephone Number: (_____) _____

Facsimile Number: (_____) _____

Where Incorporated: _____

Federal ID Number: _____

Contact Person for Contract processing:

Print Name: _____

Title: _____

E-mail: _____

BID GUARANTY AND CONTRACT BOND

(As prescribed by Section 153.571, ORC)

KNOW ALL PERSONS BY THESE PRESENTS, that we, the undersigned _____

_____

_____ as Principal at

_____

_____

(Address) and_____

_____

_____

as Surety, are hereby held and firmly bound unto the _____

_____ as Obligee in the penal sum of the dollar amount of the bid submitted by the Principal to the Obligee on (date) _____, 20__ to undertake the Project known as:

The penal sum, referred to herein, shall be the dollar amount of the Principal's bid to the Obligee, incorporating any additive or deductive alternate bids made by the Principal on the date referred to above to the Obligee, which are accepted by the Obligee. In no case shall the penal sum exceed the amount of $_____. (If the penal sum is left blank, the penal sum will be the full amount of the Principal's bid, including alternate bids. Alternatively, if completed, the amount stated must not be less than the full amount of the bid, including add alternate bids, in dollars and cents. A percentage is not acceptable.) For the payment of the penal sum well and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors and assigns.

THE CONDITION OF THE ABOVE OBLIGATION IS SUCH, that whereas the above-named Principal has submitted a bid on the above-referenced to Project.

NOW, THEREFORE, if the Obligee accepts the bid of the Principal, and the Principal fails to enter into a proper contract in accordance with the bid, plans, details, specifications and bills of

material; and in the event the Principal pays to the Obligee the difference not to exceed ten percent (10%) of the penalty hereof between the amount specified in the bid and such larger amount for which the Obligee may in good faith contract with the next lowest bidder to perform the Work covered by the bid; or resubmits the Project for bidding, the Principal will pay the Obligee the difference not to exceed ten percent (10%) of the penalty hereof between the amount specified in the bid, or the costs, in connection with the resubmission, of printing new contract documents, required advertising and the printing and mailing notices to prospective bidders, whichever is less, then this obligation shall be null and void, otherwise to remain in full force and effect, if the Obligee accepts the bid of the Principal, and the Principal, within ten (10) days after the awarding of the contract, enters into a proper contract in accordance with the bid, plans, details, specifications and bills of material, which said contract is made a part of this bond the same as though set forth herein; and

IF THE SAID Principal shall well and faithfully perform each and every condition of such contract; and indemnify the Obligee against all damage suffered by failure to perform such contract according to the provisions thereof and in accordance with the plans, details, specifications and bills of material therefor; and shall pay all lawful claims of subcontractors, materialmen and laborers for labor performed and materials furnished in the carrying forward, performing or completing of said contract; we, agreeing and assenting to, that this undertaking shall be for the benefit of any materialman or laborer having a just claim, as well as for the Obligee herein; then this obligation shall be void; otherwise the same shall remain in full force and effect; it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall in no event exceed the penal amount of this obligation as herein stated.

THE SAID Surety hereby stipulates and agrees that no modifications, omissions or additions, in or to the terms of said contract or in or to the plans and specifications, therefore, shall in any wise affect the obligations of said Surety on its bond, and it does hereby waive notice of any such modifications, omissions or additions to the terms of the contract or to the work or to the specifications. The said Surety further stipulates that it is authorized to execute bonds in the State of Ohio, and that the liability incurred is within the limits of Section 3929.02, ORC.

SIGNED this _____ day of_____, 20___.

PRINCIPAL:

_____

By: _____

Title: _____

SURETY:

_____

Address: _____

_____

Phone: (____) _____

By: _____

Attorney-in-Fact

SURETY AGENT:

_____

Address: _____

_____

Phone: (____) _____

AIA Document A305-2020

Contractor’s Qualification Statement

(Document enclosed hereinafter)

AIA® Document A305® – 2020

Contractor's Qualification Statement

THE PARTIES SHOULD EXECUTE A SEPARATE CONFIDENTIALITY AGREEMENT IF THEY INTEND FOR ANY OF THE INFORMATION IN THIS A305-2020 TO BE HELD CONFIDENTIAL.

SUBMITTED BY:
(Organization name and address.)

SUBMITTED TO:
(Organization name and address.)

TYPE OF WORK TYPICALLY PERFORMED
(Indicate the type of work your organization typically performs, such as general contracting, construction manager as constructor services, HVAC contracting, electrical contracting, plumbing contracting, or other.)

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

THIS CONTRACTOR'S QUALIFICATION STATEMENT INCLUDES THE FOLLOWING:
(Check all that apply.)

- [X] Exhibit A – General Information
- [X] Exhibit B – Financial and Performance Information
- [X] Exhibit C – Project-Specific Information
- [X] Exhibit D – Past Project Experience
- [X] Exhibit E – Past Project Experience (Continued)

CONTRACTOR CERTIFICATION
The undersigned certifies under oath that the information provided in this Contractor's Qualification Statement is true and sufficiently complete so as not to be misleading.

Organization's Authorized Representative Signature

Date

Printed Name and Title

NOTARY
State of:
County of:
Signed and sworn to before me this day of

Notary Signature

My commission expires:

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User Notes: (1735340633)

Certification of Document's Authenticity

AIA® Document D401™ – 2003

I, , hereby certify, to the best of my knowledge, information and belief, that I created the attached final document simultaneously with this certification at 09:30:00 ET on 03/15/2024 under Order No. 2114457273 from AIA Contract Documents software and that in preparing the attached final document I made no changes to the original text of AIA® Document A305™ – 2020, Contractor's Qualification Statement,other than changes shown in the attached final document by underscoring added text and striking over deleted text.

_____

(Signed)

_____

(Title)

_____

(Dated)

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AIA® Document A305® – 2020 Exhibit A

General Information

This Exhibit is part of the Contractor's Qualification Statement, submitted by and dated the day of in the year
(In words, indicate day, month and year.)

§ A.1 ORGANIZATION
§ A.1.1 Name and Location
§ A.1.1.1 Identify the full legal name of your organization.

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

§ A.1.1.2 List all other names under which your organization currently does business and, for each name, identify jurisdictions in which it is registered to do business under that trade name.

§ A.1.1.3 List all prior names under which your organization has operated and, for each name, indicate the date range and jurisdiction in which it was used.

§ A.1.1.4 Identify the address of your organization's principal place of business and list all office locations out of which your organization conducts business. If your organization has multiple offices, you may attach an exhibit or refer to a website.

§ A.1.2 Legal Status
§ A.1.2.1 Identify the legal status under which your organization does business, such as sole proprietorship, partnership, corporation, limited liability corporation, joint venture, or other.

.1 If your organization is a corporation, identify the state in which it is incorporated, the date of incorporation, and its four highest-ranking corporate officers and their titles, as applicable.

.2 If your organization is a partnership, identify its partners and its date of organization.

.3 If your organization is individually owned, identify its owner and date of organization.

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.4 If the form of your organization is other than those listed above, describe it and identify its individual leaders:

§ A.1.2.2 Does your organization own, in whole or in part, any other construction-related businesses? If so, identify and describe those businesses and specify percentage of ownership.

§ A.1.3 Other Information

§ A.1.3.1 How many years has your organization been in business?

§ A.1.3.2 How many full-time employees work for your organization?

§ A.1.3.3 List your North American Industry Classification System (NAICS) codes and titles. Specify which is your primary NAICS code.

§ A.1.3.4 Indicate whether your organization is certified as a governmentally recognized special business class, such as a minority business enterprise, woman business enterprise, service disabled veteran owned small business, woman owned small business, small business in a HUBZone, or a small disadvantaged business in the 8(a) Business Development Program. For each, identify the certifying authority and indicate jurisdictions to which such certification applies.

§ A.2 EXPERIENCE

§ A.2.1 Complete Exhibit D to describe up to four projects, either completed or in progress, that are representative of your organization's experience and capabilities.

§ A.2.2 State your organization's total dollar value of work currently under contract.

§ A.2.3 Of the amount stated in Section A.2.2, state the dollar value of work that remains to be completed:

§ A.2.4 State your organization's average annual dollar value of construction work performed during the last five years.

§ A.3 CAPABILITIES

§ A.3.1 List the categories of work that your organization typically self-performs.

§ A.3.2 Identify qualities, accreditations, services, skills, or personnel that you believe differentiate your organization from others.

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§ A.3.3 Does your organization provide design collaboration or pre-construction services? If so, describe those services.

§ A.3.4 Does your organization use building information modeling (BIM)? If so, describe how your organization uses BIM and identify BIM software that your organization regularly uses.

§ A.3.5 Does your organization use a project management information system? If so, identify that system.

§ A.4 REFERENCES

§ A.4.1 Identify three client references:
(Insert name, organization, and contact information)

§ A.4.2 Identify three architect references:
(Insert name, organization, and contact information)

§ A.4.3 Identify one bank reference:
(Insert name, organization, and contact information)

§ A.4.4 Identify three subcontractor or other trade references:
(Insert name, organization, and contact information)

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AIA® Document A305® – 2020 Exhibit B

Financial and Performance Information

This Exhibit is part of the Contractor's Qualification Statement, submitted by and dated the day of in the year
(In words, indicate day, month and year.)

§ B.1 FINANCIAL

§ B.1.1 Federal tax identification number:

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

§ B.1.2 Attach financial statements for the last three years prepared in accordance with Generally Accepted Accounting Principles, including your organization's latest balance sheet and income statement. Also, indicate the name and contact information of the firm that prepared each financial statement.

§ B.1.3 Has your organization, its parent, or a subsidiary, affiliate, or other entity having common ownership or management, been the subject of any bankruptcy proceeding within the last ten years?

§ B.1.4 Identify your organization's preferred credit rating agency and identification information.
(Identify rating agency, such as Dun and Bradstreet or Equifax, and insert your organization's identification number or other method of searching your organization's credit rating with such agency.)

§ B.2 DISPUTES AND DISCIPLINARY ACTIONS

§ B.2.1 Are there any pending or outstanding judgments, arbitration proceedings, bond claims, or lawsuits against your organization, its parent, or a subsidiary, affiliate, or other entity having common ownership or management, or any of the individuals listed in Exhibit A, Section 1.2, in which the amount in dispute is more than $75,000?
(If the answer is yes, provide an explanation.)

§ B.2.2 In the last five years has your organization, its parent, or a subsidiary, affiliate, or other entity having common ownership or management:
(If the answer to any of the questions below is yes, provide an explanation.)

.1 failed to complete work awarded to it?

.2 been terminated for any reason except for an owners' convenience?

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User Notes: (1999853880)

.3 had any judgments, settlements, or awards pertaining to a construction project in which your organization was responsible for more than $75,000?

.4 filed any lawsuits or requested arbitration regarding a construction project?

§ B.2.3 In the last five years, has your organization, its parent, or a subsidiary, affiliate, or other entity having common ownership or management; or any of the individuals listed in Exhibit A Section 1.2:
(If the answer to any of the questions below is yes, provide an explanation.)

.1 been convicted of, or indicted for, a business-related crime?

.2 had any business or professional license subjected to disciplinary action?

.3 been penalized or fined by a state or federal environmental agency?

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AIA® Document A305® – 2020 Exhibit C

Project Specific Information

This Exhibit is part of the Contractor's Qualification Statement, submitted by and dated the day of in the year
(In words, indicate day, month and year.)

PROJECT:
(Name and location or address.)

General - Specifications

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

CONTRACTOR'S PROJECT OFFICE:
(Identify the office out of which the contractor proposes to perform the work for the Project.)

TYPE OF WORK SOUGHT
(Indicate the type of work you are seeking for this Project, such as general contracting, construction manager as constructor, design-build, HVAC subcontracting, electrical subcontracting, plumbing subcontracting, etc.)

CONFLICT OF INTEREST
Describe any conflict of interest your organization, its parent, or a subsidiary, affiliate, or other entity having common ownership or management, or any of the individuals listed in Exhibit A Section 1.2, may have regarding this Project.

§ C.1 PERFORMANCE OF THE WORK
§ C.1.1 When was the Contractor's Project Office established?

§ C.1.2 How many full-time field and office staff are respectively employed at the Contractor's Project Office?

§ C.1.3 List the business license and contractor license or registration numbers for the Contractor's Project Office that pertain to the Project.

§ C.1.4 Identify key personnel from your organization who will be meaningfully involved with work on this Project and indicate (1) their position on the Project team, (2) their office location, (3) their expertise and experience, and (4) projects similar to the Project on which they have worked.

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User Notes: (1115057764)

§ C.1.5 Identify portions of work that you intend to self-perform on this Project.

§ C.1.6 To the extent known, list the subcontractors you intend to use for major portions of work on the Project.

§ C.2 EXPERIENCE RELATED TO THE PROJECT

§ C.2.1 Complete Exhibit D to describe up to four projects performed by the Contractor's Project Office, either completed or in progress, that are relevant to this Project, such as projects in a similar geographic area or of similar project type. If you have already completed Exhibit D, but want to provide further examples of projects that are relevant to this Project, you may complete Exhibit E.

§ C.2.2 State the total dollar value of work currently under contract at the Contractor's Project Office:

§ C.2.3 Of the amount stated in Section C.2.2, state the dollar value of work that remains to be completed:

§ C.2.4 State the average annual dollar value of construction work performed by the Contractor's Project Office during the last five years.

§ C.2.5 List the total number of projects the Contractor's Project Office has completed in the last five years and state the dollar value of the largest contract the Contractor's Project Office has completed during that time.

§ C.3 SAFETY PROGRAM AND RECORD

§ C.3.1 Does the Contractor's Project Office have a written safety program?

§ C.3.2 List all safety-related citations and penalties the Contractor's Project Office has received in the last three years.

§ C.3.3 Attach the Contractor's Project Office's OSHA 300a Summary of Work-Related Injuries and Illnesses form for the last three years.

§ C.3.4 Attach a copy of your insurance agent's verification letter for your organization's current workers' compensation experience modification rate and rates for the last three years.

§ C.4 INSURANCE

§ C.4.1 Attach current certificates of insurance for your commercial general liability policy, umbrella insurance policy, and professional liability insurance policy, if any. Identify deductibles or self-insured retentions for your commercial general liability policy.

§ C.4.2 If requested, will your organization be able to provide property insurance for the Project written on a builder's risk "all-risks" completed value or equivalent policy form and sufficient to cover the total value of the entire Project on a replacement cost basis?

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§ C.4.3 Does your commercial general liability policy contain any exclusions or restrictions of coverage that are prohibited in AIA Document A101-2017, Exhibit A, Insurance A.3.2.2.2? If so, identify.

§ C.5 SURETY

§ C.5.1 If requested, will your organization be able to provide a performance and payment bond for this Project?

§ C.5.2 Surety company name:

§ C.5.3 Surety agent name and contact information:

§ C.5.4 Total bonding capacity:

§ C.5.5 Available bonding capacity as of the date of this qualification statement:

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AIA® Document A305® – 2020 Exhibit D

Contractor's Past Project Experience

	1	2	3	4
PROJECT NAME				
PROJECT LOCATION				
PROJECT TYPE				
OWNER				
ARCHITECT				
CONTRACTOR'S PROJECT EXECUTIVE				
KEY PERSONNEL (include titles)				
PROJECT DETAILS	Contract Amount Completion Date % Self-Performed Work	Contract Amount Completion Date % Self-Performed Work	Contract Amount Completion Date % Self-Performed Work	Contract Amount Completion Date % Self-Performed Work
PROJECT DELIVERY METHOD	☐ Design-bid-build ☐ Design-build ☐ CM constructor ☐ CM advisor ☐ Other:	☐ Design-bid-build ☐ Design-build ☐ CM constructor ☐ CM advisor ☐ Other:	☐ Design-bid-build ☐ Design-build ☐ CM constructor ☐ CM advisor ☐ Other:	☐ Design-bid-build ☐ Design-build ☐ CM constructor ☐ CM advisor ☐ Other:
SUSTAINABILITY CERTIFICATIONS				

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User Notes: (3B9ADA3F)

AIA® Document A305® – 2020 Exhibit E

Contractor's Past Project Experience, Continued

	1	2	3	4
PROJECT NAME				
PROJECT LOCATION				
PROJECT TYPE				
OWNER				
ARCHITECT				
CONTRACTOR'S PROJECT EXECUTIVE				
KEY PERSONNEL (include titles)				
PROJECT DETAILS	Contract Amount Completion Date % Self-Performed Work	Contract Amount Completion Date % Self-Performed Work	Contract Amount Completion Date % Self-Performed Work	Contract Amount Completion Date % Self-Performed Work
PROJECT DELIVERY METHOD	☐ Design-bid-build ☐ Design-build ☐ CM constructor ☐ CM advisor ☐ Other:	☐ Design-bid-build ☐ Design-build ☐ CM constructor ☐ CM advisor ☐ Other:	☐ Design-bid-build ☐ Design-build ☐ CM constructor ☐ CM advisor ☐ Other:	☐ Design-bid-build ☐ Design-build ☐ CM constructor ☐ CM advisor ☐ Other:
SUSTAINABILITY CERTIFICATIONS				

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CONTRACTOR'S PERSONAL PROPERTY TAX AFFIDAVIT
(O.R.C. § 5719.042)

State of Ohio
County of _____, ss:

_____ ("Affiant"), being first duly sworn, deposes and says that
(Name)

Affiant is the _____ of _____
(Title) (Name and Address of Contractor)

_____ (the "Contractor") and

as the Contractor's duly authorized representative, states that effective this ____ day of _____, 20__,

the Contractor:

( ) is charged with delinquent personal property taxes on the general list of personal property as set forth below:

County	Amount (include total amount penalties and interest thereon)
_____ County	$_____
_____ County	$_____
_____ County	$_____

( ) is not charged with delinquent personal property taxes on the general list of personal property in any Ohio county.

_____
(Affiant)

Sworn to or affirmed and subscribed before me by the above-named Affiant on this _____ day of _____, 20___.

_____
Signature of Notary Public – State of Ohio

My commission expires:_____
(date)

AIA Document A101-2017

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

(Document enclosed hereinafter)

DRAFT

AIA® Document A101™ – 2017

Standard Form of Agreement Between Owner and Contractor

where the basis of payment is a Stipulated Sum

AGREEMENT made as of the « » day of « » in the year «2026»
(In words, indicate day, month and year.)

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

Board of Education of the Dublin City School District
6371A Shier Rings Road
Dublin, Ohio, 43016

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

« »« »
« »
« »
« »

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

Dublin Jerome High School Weight Room Renovation

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

Fanning Howey Associates, Inc.
5200 Upper Metro Place, Suite 350
Dublin, Ohio 43017

The Owner and Contractor agree as follows.

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed.

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

The parties should complete A101™–2017, Exhibit A, Insurance and Bonds, contemporaneously with this Agreement. AIA Document A201™–2017, General Conditions of the Contract for Construction, is adopted in this document by reference. Do not use with other general conditions unless this document is modified.

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User Notes: (1783131443)

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

~~EXHIBIT A INSURANCE AND BONDS~~

ARTICLE 1 THE CONTRACT DOCUMENTS

The Contract Documents consist of this Agreement, Bidding Requirements, Conditions of the Contract (General, Supplementary, and other Conditions), 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. In the event of inconsistencies within or between parts of the Contract Documents, the Contractor shall provide the better quality or greater quantity of Work or comply with the more stringent requirement.

ARTICLE 2 THE WORK OF THIS CONTRACT

The Contractor shall fully execute the Work described in the Contract Documents and reasonably inferable, 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:
(Check one of the following boxes.)

[« »] The date of this Agreement.

[« »] A date set forth in a notice to proceed issued by the Owner.

[« »] Established as follows:
(Insert a date or a means to determine the date of commencement of the Work.)

« »

If a date of commencement of the Work is not selected, then the date of commencement shall be the date of this Agreement.

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

§ 3.3 Substantial Completion

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§ 3.3.1 Subject to adjustments of the Contract Time as provided in the Contract Documents, the Contractor shall achieve Substantial Completion of the entire Work:
(Check one of the following boxes and complete the necessary information.)

[« »] Not later than « » (« ») calendar days from the date of commencement of the Work.

[« »] By the following date: « »

§ 3.3.2 Subject to adjustments of the Contract Time as provided in the Contract Documents, if portions of the Work are to be completed prior to Substantial Completion of the entire Work, the Contractor shall achieve Substantial Completion of such portions by the following dates:

Portion of Work	Substantial Completion Date

§ 3.3.3 If the Contractor fails to achieve Substantial Completion as provided in this Section 3.3, liquidated damages, if any, shall be assessed as set forth in Section 4.5.

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.

§ 4.2 Alternates

§ 4.2.1 Alternates, if any, included in the Contract Sum:

Item	Price
N/A	

§ 4.2.2 Subject to the conditions noted below, the following alternates may be accepted by the Owner following execution of this Agreement. Upon acceptance, the Owner shall issue a Modification to this Agreement.
(Insert below each alternate and the conditions that must be met for the Owner to accept the alternate.)

Item	Price	Conditions for Acceptance

§ 4.3 Allowances, if any, included in the Contract Sum:
(Identify each allowance.)

Item	Price

§ 4.4 Unit prices, if any:
(Identify the item and state the unit price and quantity limitations, if any, to which the unit price will be applicable.)

Item	Units and Limitations	Price per Unit ($0.00)
N/A		

§ 4.5 Liquidated damages, if any:
(Insert terms and conditions for liquidated damages, if any.)

~~«~~§ 4.5.1 If the Contractor shall fail, neglect, and/or refuse to attain Substantial Completion of the Work by the date set forth in Section 3.3.1, Contractor shall be subject to liquidated damages (not a penalty) at the rate set forth below per calendar day for the total number of days the portion of that Work is delayed beyond the required Substantial Completion date:

LIQUIDATED DAMAGES

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Contract Sum	Dollars Per Day
$100,000.00 or less	$250.00
$100,000.01 to $500,000.00	$500.00
$500,000.01 to $2,000,000.00	$1,000.00
$2,000,000.01 to $5,000,000.00	$2,000.00
$5,000,000.01 to $10,000,000.00	$2,500.00
More than $10,000,000.00	$3,000.00

Such liquidated damages are hereby agreed to be a reasonable pre-estimate of damages the Owner will incur as a result of delayed completion of the Work and shall be in addition to any other remedies available to Owner. The Owner may deduct liquidated damages from any unpaid amounts then or thereafter due Contractor. Any liquidated damages not so deducted shall be payable by the Contractor to the Owner upon demand. Liquidated damages are not intended to compensate the Owner for any damages the Owner incurs on account of any direct damages and claims attributable to the Contractor that are brought by others, including Separate Contractors.

~~»~~

~~§ 4.6 Other:~~

~~*(Insert provisions for bonus or other incentives, if any, that might result in a change to the Contract Sum.)*~~

~~«»~~

ARTICLE 5 PAYMENTS

§ 5.1 Progress Payments

§ 5.1.1 Based upon Applications for Payment submitted to the Owner and the Architect by the Contractor, such other supporting information and documentation as the Owner and Architect may require, 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. The Contractor shall utilize AIA Document G-702, Application and Certificate for Payment unless a different form is designated by Owner or Architect.

§ 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 and all supporting information and documentation is received by the Architect not later than the «fifth» day of a month, the Owner shall make payment of the amount certified to the Contractor not later than the «last» day of the «that» month. If an Application for Payment is received by the Architect after the application date fixed above, payment of the amount certified shall be made by the Owner not later than «thirty» («30») days after the Architect receives the Application for Payment.
~~(Federal, state or local laws may require payment within a certain period of time.)~~

§ 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 of values shall be used as a basis for reviewing the Contractor's Applications for Payment. The Contractor shall utilize AIA Document G-703 in submitting its schedule of values unless a different form is designated by Owner or Architect.

§ 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.

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§ 5.1.6 In accordance with AIA Document A201™–2017, General Conditions of the Contract for Construction, and subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

§ 5.1.6.1 The amount of each progress payment shall first include:

.1 That portion of the Contract Sum properly allocable to completed Work;

.2 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; and

.3 That portion of Construction Change Directives that the Architect determines, in the Architect's professional judgment, to be reasonably justified.

§ 5.1.6.2 The amount of each progress payment shall then be reduced by:

.1 The aggregate of any amounts previously paid by the Owner;

.2 The amount, if any, for Work that remains uncorrected and for which the Architect has previously withheld a Certificate for Payment as provided in Article 9 of AIA Document A201–2017;

.3 Any amount for which the Contractor does not intend to pay a Subcontractor or material supplier, unless the Work has been performed by others the Contractor intends to pay;

.4 For Work performed or defects discovered since the last payment application, any amount for which the Architect may withhold payment, or nullify a Certificate of Payment in whole or in part, as provided in Article 9 of AIA Document A201–2017; and

.5 Retainage withheld pursuant to Section 5.1.7.

§ 5.1.7 Retainage

§ 5.1.7.1 For each progress payment made prior to Substantial Completion of the Work, the Owner may withhold the following amount, as retainage, from the payment otherwise due:

(Insert a percentage or amount to be withheld as retainage from each Application for Payment. The amount of retainage may be limited by governing law.)

« Retainage shall be governed by the requirements of Ohio Revised Code Chapter 153.

(a) Labor. Payments for labor performed will be at the rate of ninety six percent (96%) of the amount set forth in the Contractor's Application for Payment and approved by the Architect.

(b) Materials and Equipment. There shall be paid to the Contractor a sum at the rate of ninety-two percent (92%) of the invoice costs, not to exceed the scheduled value, of material delivered on the site of the Work, or suitably stored off site. The balance of the scheduled value will be payable when the materials and equipment are incorporated into the Project and accepted by Owner. The Contractor shall be paid at the rate of one hundred percent (100%) of the scheduled value for materials incorporated into the Project. Incorporated into the Project means such materials and equipment are installed and conform to the requirements of the Project. Partial or full payment to the Contractor for material, equipment, or Work in place shall not start any applicable warranty period.

(c) It shall be within the Owner's discretion to determine the type of investment account for placement of retainage, and interest earnings payable to the Contractor on the retainage is limited to just interest accrued on that retainage in the investment account selected by Owner.

(d) No Subcontractor or supplier shall be paid at a rate lower than the rate being paid to the Contractor under this Section 5.1.7.1.»

§ 5.1.7.1.1 The following items are not subject to retainage:

(Insert any items not subject to the withholding of retainage, such as general conditions, insurance, etc.)

«N/A»

§ 5.1.7.2 [intentionally Deleted]. ~~Reduction or limitation of retainage, if any, shall be as follows:~~

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~~(If the retainage established in Section 5.1.7.1 is to be modified prior to Substantial Completion of the entire Work, including modifications for Substantial Completion of portions of the Work as provided in Section 3.3.2, insert provisions for such modifications.)~~

~~«»~~

§ 5.1.7.3 Except as set forth in this Section 5.1.7.3, upon Substantial Completion of the Work, the Contractor may submit an Application for Payment that includes the retainage withheld from prior Applications for Payment pursuant to this Section 5.1.7. The Application for Payment submitted at Substantial Completion shall not include retainage as follows:
(Insert any other conditions for release of retainage upon Substantial Completion.)

« Owner may continue to withhold retainage in an amount reasonably necessary to assure final completion of the Work. »

§ 5.1.8 If final completion of the Work is materially delayed through no fault of the Contractor, the Owner shall pay the Contractor any additional amounts in accordance with Article 9 of AIA Document A201–2017.

§ 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 Article 12 of AIA Document A201–2017, and to satisfy other requirements, if any, which extend beyond final payment; and

.2 a final Certificate for Payment has been issued by the Architect.

§ 5.2.2 The Owner's final payment to the Contractor shall be made no later than 30 days after the issuance of the Architect's final Certificate for Payment~~, or as follows:~~

~~«»~~

§ 5.3 Interest

Payments due and unpaid under the Contract shall bear interest from the date payment is due at the rate stated below, or in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.
(Insert rate of interest agreed upon, if any.)

«N/A» % «N/A»

ARTICLE 6 DISPUTE RESOLUTION

§ 6.1 Initial Decision Maker

The Architect will serve as the Initial Decision Maker pursuant to Article 15 of AIA Document A201–2017, unless the parties appoint below another individual, not a party to this Agreement, to serve as the 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.)*~~

~~«»~~
~~«»~~
~~«»~~
~~«»~~

§ 6.2 Binding Dispute Resolution

For any ~~Claim~~ dispute subject to, but not resolved by, mediation pursuant to Article 15 of AIA Document A201–2017, the method of binding dispute resolution shall be as follows:

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(Check the appropriate box.)

[« »] Arbitration pursuant to Section 15.4 of AIA Document A201–2017

[«X»] Litigation in a court of competent jurisdiction

[« »] Other *(Specify)*

« »

If the Owner and Contractor do not select a method of binding dispute resolution, 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.

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 A201–2017.

§ 7.1.1 If the Contract is terminated for the Owner's convenience in accordance with Article 14 of AIA Document A201–2017, then the Owner shall pay the Contractor a termination fee as follows:
(Insert the amount of, or method for determining, the fee, if any, payable to the Contractor following a termination for the Owner's convenience.)

«N/A – there shall be no termination fee.»

§ 7.2 The Work may be suspended by the Owner as provided in Article 14 of AIA Document A201–2017.

ARTICLE 8 MISCELLANEOUS PROVISIONS

§ 8.1 Where reference is made in this Agreement to a provision of AIA Document A201–2017 or another Contract Document, the reference refers to that provision as modified, amended or supplemented by the Owner or other provisions of the Contract Documents.

§ 8.2 The Owner's representative:
(Name, address, email address, and other information)

Jeff Stark, Chief Operating Officer
Dublin City School District»
6371A Shier Rings Road
Dublin, Ohio 43016
Phone: (614) 760-4323»
E-mail: stark_jeff@dublinschools.net

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

« »
« »
« »
« »
« »
« »

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

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§ 8.5 Insurance and Bonds

§ 8.5.1 The Owner and the Contractor shall purchase and maintain insurance as set forth in AIA Document A201–2017~~AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum, Exhibit A, Insurance and Bonds,~~ and elsewhere in the Contract Documents.

§ 8.5.2 The Contractor shall provide bonds meeting the requirements of Ohio Revised Code Section 153.54 and elsewhere in the Contract Documents. ~~as set forth in AIA Document A101™–2017 Exhibit A, and elsewhere in the Contract Documents.~~

§ 8.6 [Intentionally Deleted].~~Notice in electronic format, pursuant to Article 1 of AIA Document A201–2017, may be given in accordance with AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, if completed, or as otherwise set forth below:~~
~~(If other than in accordance with AIA Document E203–2013, insert requirements for delivering notice in electronic format such as name, title, and email address of the recipient and whether and how the system will be required to generate a read receipt for the transmission.)~~

§ 8.7 Other provisions:

~~«~~**§ 8.7.1 Award of Subcontracts and Other Contracts for Portions of the Work**

§ 8.7.1.1 Unless otherwise required by the Contract Documents or the Bidding Documents, within seven (7) days after the date of commencement of the Work, the Contractor shall submit the names of the Subcontractors, persons or entities it proposes to use, including those who are to furnish materials or equipment, the subcontract amount, and a list of such materials or equipment including the manufacturer thereof. The Architect will promptly reply to the Contractor in writing stating whether or not the Owner or the Architect has reasonable objection to any such Subcontractor, person or entity. Copies of bids or other proposals from such Subcontractors, persons or entities shall, upon request of the Owner or Architect, be submitted to the Owner and the Architect.

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

§ 8.7.1.3 If the Owner or Architect has reasonable objection to a Subcontractor, person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection.

§ 8.7.1.4 The Contractor shall not substitute a Subcontractor, person or entity previously selected if the Owner or Architect makes reasonable objection to such substitution. The Contractor shall notify the Owner and the Architect of the proposed substitution of a Subcontractor, person, or entity a minimum of 10 days prior to the proposed change. The Owner may require the Contractor to change a Subcontractor, person or entity previously approved.

§ 8.7.2 Progress Meetings

~~«~~»

§ 8.7.2.1 The Architect may, as Architect deems necessary, schedule progress meetings for all Contractors. The purpose of the progress meeting is to review progress in the Work, discuss anticipated progress during the following weeks, and review critical operations and existing and potential problems. The Contractor shall attend and shall be represented at every progress meeting by a person authorized with signature authority to make decisions regarding possible modification of the Contract Documents, and the Contractor shall have any of the Contractor's Subcontractors and material suppliers attend the progress meeting as deemed advisable by the Contractor or as requested by the Architect.

§ 8.7.3 If all or part of any funds of the Contractor that are held by the Owner, whether it be retainage, escrowed funds, unpaid balance of the Contract Sum or otherwise, should be attached, garnished or levied upon under any order of court, or if the delivery thereof shall be stayed or enjoined by any order of court, or if any other writ, order, judgment, or decree shall be made or entered by any court affecting the held funds, or any part thereof whether with or without jurisdiction, and in case Owner obeys and complies with any such writ, order judgment, or decree, Owner shall not be liable to the Contractor, its successors, or assigns, and Contractor shall indemnify and hold Owner

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harmless for its compliance with such writ, order, judgment or decree, notwithstanding that such writ, order, judgment or decree be subsequently reversed, modified, annulled, set aside, or vacated.

§ 8.7.4 Contractor shall adhere to the Owner's *Vendor Criminal History Record Check* requirements as contained in the Contract Documents including certification on Contractor's letterhead the names of individuals who will be working on Owner property and who meet the requirements of the *Vendor Criminal History Record Check* requirements.

§ 8.7.5 Limitations on a Subcontractor's overhead and profit for increases or decreases in the cost of its portion of the Work shall be 15% of the sum of the Subcontractor's costs that are associated with that changed Work.

§ 8.7.6 The Contractor's fee for adjustment of the Contract Sum on account of a change in the Work shall not exceed ten percent (10%) of the sum of the costs described in Section 8.7.5 herein and Sections 7.3.4.1 through 7.3.4.6 of AIA Document A201–2017 that are associated with that changed Work provided however that the Contractor shall not assign any portion of the Work to another person or entity whereby the Contractor would benefit directly or indirectly from the double application of charges for overhead and profit.

§ 8.7.7 With respect to Section 7.3.4 of the General Conditions, rental rates for Contractor-owned equipment shall not exceed one hundred percent (100%) of the cost listed by the current edition of the Associated EquipmentWatch's *AED Green Book* heavy equipment rental rates, or if no such cost is listed, the standard rental rate paid at the place of the Project.

§ 8.7.8 On a minimum of a weekly basis, or otherwise as agreed to by the Owner, the Contractor shall submit written progress reports to the Owner and Architect, showing percentages of completion, activities in progress and expected completion, activities to be started or finished, and other information required by the Architect or Owner.

§ 8.7.9 Under no circumstances will the Contractor propose to use any materials or equipment which is not specified, and the failure by the Owner or Architect to object to materials or equipment which are not specified shall not constitute the approval of them.

§ 8.7.10 Owner will provide to Contractor, upon request, a completed State of Ohio Sales and Use Tax Construction Contract Exemption Certificate.

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 This Agreement is comprised of the following documents:

.1 This modified AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor

.2 [Intentionally Deleted] ~~AIA Document A101™–2017, Exhibit A, Insurance and Bonds~~

.3 Modified AIA Document A201™–2017, General Conditions of the Contract for Construction as contained in the Project Manual dated .

.4 AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, dated as indicated below:
(Insert the date of the E203-2013 incorporated into this Agreement.)

«N/A»

.5 Drawings

Number	Title	Date

.6 Specifications

Section	Title	Date	Pages

.7 Addenda, if any:

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Number	Date	Pages

~~Portions of Addenda relating to bidding or proposal requirements are not part of the Contract Documents unless the bidding or proposal requirements are also enumerated in this Article 9.~~

.8 Other Exhibits:
(Check all boxes that apply and include appropriate information identifying the exhibit where required.)

[«N/A»] AIA Document E204™–2017, Sustainable Projects Exhibit, dated as indicated below:
(Insert the date of the E204-2017 incorporated into this Agreement.)

« »

[«N/A»] The Sustainability Plan:

Title	Date	Pages

[«N/A»] Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages

.9 Other documents, if any, listed below:
~~*(List here any additional documents that are intended to form part of the Contract Documents. AIA Document A201™–2017 provides that the advertisement or invitation to bid, Instructions to Bidders, sample forms, the Contractor's bid or proposal, portions of Addenda relating to bidding or proposal requirements, and other information furnished by the Owner in anticipation of receiving bids or proposals, are not part of the Contract Documents unless enumerated in this Agreement. Any such documents should be listed here only if intended to be part of the Contract Documents.*~~
« »

This Agreement entered into as of the day and year first written above.

OWNER *(Signature)*	**CONTRACTOR** *(Signature)*
«Brian Kern, Treasurer» ~~*(Printed name and title)*~~	« »« » *(Printed name and title)*

CERTIFICATE
(Section 5705.41, R.C.)

I certify that the money required to meet the obligations of the Board of Education during the current fiscal year under the Agreement has been lawfully appropriated for those purposes and is in the treasury or in the process of collection to the credit of an appropriate fund, free from any previous encumbrances. This Certificate is given in compliance with Section 5705.41 of the Revised Code.

By: _____

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Brian Kern, Treasurer, Board of Education

Dated: _____, 2026

DRAFT

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CERTIFICATE OF FUNDS
(Section 5705.41, ORC)

In the matter of: _____ (Contractor)

IT IS HEREBY CERTIFIED that the moneys required to meet the obligations of the Board of Education of the _____ School District under the foregoing Contract have been lawfully appropriated for such purposes and are in the treasury of the Dublin City School District or are in the process of collection to an appropriate fund, free from any previous encumbrance.

_____ **SCHOOL DISTRICT**

By: _____

Treasurer

Dated: _____,

DOCUMENT 00 61 00 - CONTRACT BOND
(O.R.C. § 153.57)

KNOW ALL PERSONS BY THESE PRESENTS, that we, the undersigned, _____ _____ ("Contractor") as principal and _____as surety, are hereby held and firmly bound unto the Board of Education of the Dublin City School (the "Board"), Franklin County, Ohio, as obligee, in the penal sum of _____ Dollars ($_____), for the payment of which well and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors, and assigns.

Signed this _____ day of _____, 20___.

THE CONDITION OF THE ABOVE OBLIGATION IS SUCH that whereas, the above-named principal did on the _____ day of _____, 20___, enter into a contract with the Board for the _____ ("Project"), which said contract is made a part of this bond the same as though set forth herein:

Now, if the said Contractor shall well and faithfully do and perform the things agreed by the Contractor to be done and performed according to the terms of said contract; and shall pay all lawful claims of subcontractors, material suppliers, and laborers, for labor performed and materials furnished in the carrying forward, performing, or completing of said contract; we agreeing and assenting that this undertaking shall be for the benefit of any material supplier or laborer having a just claim, as well as for the obligee herein; then this obligation shall be void; otherwise the same shall remain in full force and effect; it being expressly understood and agreed that the liability of the surety for any and all claims hereunder shall in no event exceed the penal amount of this obligation as herein stated.

The said surety hereby stipulates and agrees that no modifications, omissions, or additions in or to the terms of the said contract or in or to the plans or specifications therefore shall in any wise affect the obligations of said surety on its bond, and does hereby waive notice of any such modifications, omissions or additions to the terms of the contract or to the work or to the specifications.

Signed and sealed this ____ day of _____, 20___.

_____
(PRINCIPAL)

By: _____

Printed Name & Title: _____

_____

_____
(SURETY)

By: _____

Printed Name & Title: _____

_____

Surety's Address: _____

_____

Surety's Agent's Tel. & Fax Numbers: _____

_____
NAME OF SURETY'S AGENT

Surety's Agent's Address: _____

_____

Surety's Agent's Tel. & Fax Numbers: _____

Surety's Agent's Fax Number: _____

DOCUMENT 00 65 72 – CLAIM FORM

Name of Contractor: _____

Date written claim given: _____

Contractor's representative to contact regarding the claim:

Name: _____ Title: _____

Telephone No. _____(office) FAX No.: _____

E-mail: _____

General description of claim:

_____

_____

_____

Contract Documents. If the claim is based upon any part or provision in the Contract Documents, including but not limited to pages in the Drawings and/or paragraphs in the Specifications, Owner-Contractor Agreement, General Conditions or Supplementary General Conditions, state upon which parts or provisions the claim is based:

_____

_____

_____

Delay claims:

- Date delay commenced: _____
- Duration or expected duration of the delay, if known: _____
- Apparent cause of the delay and part of critical path affected:

_____

_____

_____

- Expected impact of the delay and recommendations for minimizing such impact:

_____

_____

_____

Additional compensation. Set forth in detail all additional compensation to which the Contractor believes it is entitled with respect to this claim:

_____

_____

_____

By submitting this claim, the Contractor and its representative certify that after conscientious and thorough review and to the best of his or her knowledge and belief, the information in this Claim is accurate, and the Contractor has not knowingly presented a false or fraudulent claim.

CONTRACTOR: _____

By: _____

Name and Title: _____

Date: _____

END OF DOCUMENT

AIA Document A201-2017

AIA General Conditions of the Contract for Construction

(Document enclosed hereinafter)

AIA® Document A201® – 2017

General Conditions of the Contract for Construction

for the following PROJECT:
(Name and location or address)

Dublin Jerome High School Weight Room Renovation

THE OWNER:
(Name, legal status and address)

Board of Education of the Dublin City School District
6371A Shier Rings Road
Dublin, Ohio, 43016

THE ARCHITECT:
(Name, legal status and address)

Fanning Howey Associates, Inc.
5200 Upper Metro Place, Suite 350
Dublin, Ohio 43017

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

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

For guidance in modifying this document to include supplementary conditions, see AIA Document A503™, Guide for Supplementary Conditions.

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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 (these General Conditions, the Supplementary and other Conditions), 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 or proposal 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.

§ 1.2 Correlation and Intent of the Contract Documents

§ 1.2.1 The intent of the Contract Documents is to include all items necessary and reasonably inferable for the proper execution and completion of the Work by the Contractor, whether or not expressly shown or described. 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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§ 1.2.1.1 The invalidity of any provision of the Contract Documents shall not invalidate the Contract or its remaining provisions. If it is determined that any provision of the Contract Documents violates any law, or is otherwise invalid or unenforceable, then that provision shall be revised to the extent necessary to make that provision legal and enforceable. In such case the Contract Documents shall be construed, to the fullest extent permitted by law, to give effect to the parties' intentions and purposes in executing the Contract.

§ 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.

§ 1.2.4 The terms "knowledge," "recognize," and "discover," their respective derivatives, and similar terms in the Contract Documents, as used in reference to the Contractor, shall mean that which the Contractor knows (or should know), recognizes (or should recognize) and discovers (or should discover) in exercising the care, skill, and diligence required by the Contract Documents. Analogously, the expression "reasonably inferable" and similar terms in the Contract Documents shall be interpreted to mean reasonably inferable by a contractor exercising the care, skill, and diligence required of the Contractor by the Contract Documents.

§ 1.3 Capitalization

Terms capitalized in these General Conditions include those that are (1) specifically defined or (2) the titles of numbered articles.

§ 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. The use of the word "including," when following any general statement, term, or matter, shall not be construed to limit such statement, term, or matter to the specific items or matters set forth immediately following such word or to similar items or matters, whether or not non-limiting language (such words as "without limitation," or "but not limited to," or words of similar import) is used with reference thereto, but rather shall be deemed to refer to all other items or matters that could reasonably fall within the broadest possible scope of such general statement, term, or matter. All personal pronouns used in this Contract, whether used in the masculine, feminine, or neuter gender, shall include all other genders; and the singular shall include the plural and vice versa. Titles of articles, sections, and subsections are for convenience only and neither limit nor amplify the provisions of the Contract.

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

§ 1.5.1 Unless otherwise indicated in the agreement between the Owner and the Architect, 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 retain all common law, statutory, and other reserved rights in their Instruments of Service, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and 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 the 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 suppliers are authorized to use and reproduce the Instruments of Service provided to them, subject to any protocols established pursuant to Section 1.7, 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 suppliers may not use the Instruments of Service on other projects or for additions to the Project outside the scope of the Work without the specific written consent of the Owner, Architect, and the Architect's consultants.

§ 1.5.3 The Owner alone owns all Project-related documents, including those in electronic form, prepared by the Contractor and Subcontractors, and every right, title, and interest therein from the moment of creation. The Contractor must execute and deliver and cause its employees and agents and all Subcontractors to execute and deliver to the Owner any transfers, assignments, documents, or other instruments (if any) necessary to vest in the Owner complete

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right, title, interest in and ownership of the Contractor's documents. The Contractor may retain copies, including reproducible copies, of the Contractor's documents for information, reference, and performance of the Work. The submission or distribution of the Contractor's documents to meet official regulatory requirements or for similar purposes in connection with the Project is not a waiver of the Owner's reserved rights in the Contractor's documents. Any unauthorized use of the Contractor's documents shall be at the sole risk of the entity making the unauthorized use.

§ 1.6 Notice

§ 1.6.1 Except as otherwise provided in Section 1.6.2, where the Contract Documents require one party to notify or give notice to the other party, such notice shall be provided in writing to the designated representative of the party to whom the notice is addressed and shall be deemed to have been duly served if delivered in person, by mail, by courier, or by electronic transmission if a method for electronic transmission is set forth in the Agreement.

§ 1.6.2 Notice of Claims as provided in Section 15.1.2 shall be provided in writing and shall be deemed to have been duly served only if delivered to the designated representative of the party to whom the notice is addressed by certified or registered mail, or by courier providing proof of delivery.

§ 1.7 Digital Data Use and Transmission

The Owner and Contractor acknowledge and reasonably expect that they will provide or cause to be provided electronic files to each other, including, but not limited to, Revit, Computer-Aided Design ("CAD") or Building Information Modeling ("BIM") files (collectively "Electronic Files"), and that they will receive Electronic Files from and provide Electronic Files to the Architect, to facilitate the design and construction of the Project consistent with current practices and customs in the construction industry. The Owner and Contractor acknowledge that the use of Electronic Files involves risks not generally associated with the use of paper documents. Those risks include, for example and without limitation, alteration (inadvertent or intentional) and deterioration, both of which may not be readily apparent through casual observation. The Owner and Contractor do not warrant to each other that any Electronic File they provide to each other or that they receive from or provide to the Architect (1) was not altered though transmission; (2) is compatible with the recipient's computer system or software; (3) will not be altered through degradation of the recipient's storage media; or (4) is suitable for conversion/translation to and subsequent use in a system or format other than the Electronic File's original system or format. Before relying on any Electronic File it receives, the recipient is responsible for verifying that the Electronic File was not altered though transmission, degradation of the recipient's own storage media, or other causes. If the recipient of an Electronic File converts/translates the Electronic File from its original system or format to an alternate system or format, the recipient assumes the risk that the conversion/translation created errors in the converted/translated file. Owner and Contractor shall each maintain and operate its own computer systems and storage media in a commercially reasonable way and take reasonable steps to prevent errors in and deterioration of the Electronic Files it creates, provides, and receives. In the event of a discrepancy between information contained in a paper version of a document and the Electronic File of that document, the paper version will govern. This Section does not relieve the Contractor of its responsibility for the preparation, completeness, or accuracy of the Contractor's documents. The parties shall also follow any other protocols governing the development, transmission, exchange and use of Instruments of Service, Electronic Files or any other information or documentation in digital form as may be agreed upon in writing by the Owner, Contractor and Architect.

(Paragraphs deleted)

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 matters requiring the Owner's approval or authorization provided that the representative shall have only such authority as is expressly authorized by the Owner's governing board. 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 a notice of commencement as may be required by Ohio Revised Code Chapter 1311. The Contractor shall provide a copy of any notice of commencement to its Subcontractor and any known Sub-subcontractors. The Contractor will immediately deliver to the Architect and Owner copies of notices of furnishing that Contractor receives.

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(Paragraphs deleted)

§ 2.3 Information and Services Required of the Owner

§ 2.3.1 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.

§ 2.3.2 The Owner shall retain a professional design firm lawfully licensed to practice architecture or engineering, or an entity lawfully practicing architecture or engineering, 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.

§ 2.3.3 If the employment of the Architect terminates, the Owner shall employ a successor whose status under the Contract Documents shall be that of the Architect.

§ 2.3.4 The Owner shall, if necessary for the execution of the Work, furnish surveys or other information 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.

§ 2.3.5 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 reasonably necessary 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.

§ 2.3.6 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.

§ 2.4 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. The rights of the Owner under this Section are in addition to Owner's rights and remedies contained elsewhere in the Contract Documents.

§ 2.5 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 notice from the Owner to correct such default or neglect, the Owner may, without prejudice to other remedies the Owner may have, correct such default or neglect. If such default or neglect results in an emergency and/or a threat to the safety of persons or property, the Contractor shall immediately commence and continue without interruption using best efforts to correct such default or neglect upon receipt of written or oral notice thereof or otherwise becoming aware, and if Contractor fails to do so, then Owner may correct such default or neglect. The Owner or Architect may, pursuant to Section 9.5.1, withhold or nullify a Certificate for Payment in whole or in part, to the extent reasonably necessary to reimburse the Owner for 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. If current and future payments are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner. If the Contractor disagrees with the actions of the Owner or the Architect, or the amounts claimed as costs to the Owner, the Contractor may file a Claim pursuant to Article 15. The rights of Owner under this Section are in addition to the rights of Owner as set forth in Articles 12 and 14 herein.

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

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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 its 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.

§ 3.1.4 The Contractor shall attend preconstruction meetings with representatives of the Architect and Owner. The Contractor shall have any of its Subcontractors and suppliers at the meeting as necessary or as requested by the Architect. The preconstruction meetings will serve to acquaint the participants with the general plan of the construction operation and all other requirements of the Project. The date, time, and place of the meetings will be designated by the Owner.

§ 3.1.5 If the Project is designed and constructed with a Sustainable Objective identified in the Agreement for the Project, the Contractor shall perform the Work for which the Contractor is responsible in furtherance of the Sustainable Objective and shall provide submittals certifying achievement of the Sustainable Objective criteria for verification by a third party, and the submittals shall be provided in accordance with any deadlines set forth in the schedule and Contract Documents. In the absence of schedules or deadlines, the Contractor will submit the documents with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or Separate Contractors. The Contractor shall include with any requests for substitution any potential effect the substitution may have on the Sustainable Objective. The Contractor grants to the Architect and Owner the right to submit the Contractor's submittals to the rating system as required in order to achieve or maintain the Sustainable Objective.

§ 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. By executing the Agreement, the Contactor certifies that it has evaluated and satisfied itself as to the conditions and limitations under which the Work is to be performed, including, without limitation, (i) the location, condition, layout, and nature of the Project site and surrounding areas, including but not limited to utilities, access restraints to the Project site and access restraints to neighboring facilities, (ii) generally prevailing climatic conditions, (iii) anticipated labor supply and costs, (iv) availability and cost of materials, tools, and equipment, and (v) other similar issues. The Contractor shall be solely responsible for providing a safe place for the performance of the Work. The Owner shall not be required to make any adjustment in either the Contract Sum or the Contract Time in connection with any failure by the Contractor or any Subcontractor to have complied with the requirements of this Section 3.2.1.

§ 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 2.3.4, 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. The Contractor shall satisfy itself as to the accuracy of all grades, elevations, dimensions, and locations. In all cases of interconnection of its Work with existing or other work, Contractor shall verify at the site all dimensions relating to such existing or other work. Any errors due to the Contractor's failure to so verify all such grades, elevations, dimensions, or locations shall be promptly rectified by the Contractor without any additional cost to the Owner. These obligations are for the purpose of facilitating coordination and construction by the Contractor, for determining that the Work is constructible, for determining if the Work of the Contractor is coordinated in the Contract Documents with the Work of Separate Contractors under a separate contract with the Owner, and for verifying that field conditions, including the Work of other Contractors, are consistent with the information in the Contract Documents and ready for Work and are not for the purpose of discovering errors, omissions, or inconsistencies in the design information contained 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.

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§ 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, and proceeding without reporting such nonconformity shall make the Contractor responsible for any costs and expenses incurred by the Contractor related to the claimed deficiencies.

§ 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 submit Claims as provided in Article 15, and the time limit for initiating a Claim begins to run on the date of the Architect's issuance. 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, subject to Section 15.1.7, 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.

§ 3.2.5 The Owner is entitled to reimbursement from the Contractor for amounts paid to the Architect for evaluating and responding to the Contractor's requests for information that are not prepared in accordance with the Contract Documents and/or where the requested information is available to the Contractor from a careful study and comparison of the Contract Documents, field conditions, other Owner-provided information, Contractor-prepared coordination drawings, or prior Project correspondence or documentation.

§ 3.2.6 If the Architect does not specify a form for Contractor to submit a request for information, then Contractor shall utilize the AIA Document G-716.

§ 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. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences, or procedures, the Contractor shall evaluate the jobsite safety thereof and shall be solely responsible for the jobsite safety of such means, methods, techniques, sequences, or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely notice to the Owner and Architect, and shall propose alternative means, methods, techniques, sequences, or procedures. The Architect shall evaluate the proposed alternative solely for conformance with the design intent for the completed construction. Unless the Architect objects to the Contractor's proposed alternative, the Contractor shall perform the Work using its alternative 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, including Sub-subcontractors of any tier, and Contractor shall be responsible for ensuring the performance of the Work regardless of whether the work is performed by the Contractor, a Subcontractor or Sub-subcontractors of any tier. The Contractor shall be responsible for scheduling and coordinating the work of its Subcontractors and suppliers. This section shall apply with equal force and effect regardless of whether any Subcontractors are selected by the Contractor or assigned by the Owner.

§ 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, storage and other facilities and services necessary for proper execution and completion of the Work, including but not limited to

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field offices, toilets, other trailers, or buildings, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work. The Contractor shall use best efforts to conserve any utilities furnished by Owner.

§ 3.4.2 Except in the case of minor changes in the Work approved by the Architect in accordance with Section 3.12.8 or ordered by the Architect in accordance with Section 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. The Contractor shall provide all data, information, regulations and certifications required by Architect and Owner in evaluating the proposed substitution. The Owner shall be entitled to reimbursement from the Contractor for amounts paid for reviewing the Contractor's proposed substitutions and making agreed-upon changes in the Drawings and Specifications resulting from such substitutions.

§ 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

§ 3.5.1 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 warrants that the Work will conform to the requirements of the Contract Documents, will be of good workmanship 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 shall be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, improper alterations to the Work except when 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.

§ 3.5.2 All material, equipment, or other special warranties required by the Contract Documents shall be issued in the name of the Owner, or shall be transferable to the Owner, and shall commence in accordance with Section 9.8.4.

§ 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. Owner will provide to Contractor, upon request, a completed State of Ohio Sales and Use Tax Construction Contract Exemption Certificate.

§ 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 all other permits, fees, licenses, and inspections by utilities or 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 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 14 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 that an equitable adjustment be made in the Contract Sum or

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Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor, stating the reasons. If Contractor disputes the Architect's determination or recommendation, the Contractor may submit a Claim as provided in Article 15, and the time limit for initiating a Claim as set forth in Section 15.1.2 herein related to subsurface, concealed or unknown conditions begins to run on the date the Architect issues its determination or recommendation.

§ 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, not in the allowances, and shall not be chargeable against the allowance; 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. The Contractor shall obtain a Change Order before incurring any costs in excess of an allowance.

§ 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 If not already approved in advance by the Owner, the Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the name and qualifications of a proposed superintendent. Within 14 days of receipt of the information, the Owner or Architect may notify the Contractor, stating whether the Owner or the Architect (1) has reasonable objection to the proposed superintendent or (2) requires additional time for review. Failure of the Owner or Architect to provide notice 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. The Owner shall have the right to require the Contractor to remove a superintendent from the Project whose performance is not satisfactory, and to replace the superintendent with a superintendent who is satisfactory to the Owner.

§ 3.10 Contractor's Construction and Submittal Schedules

§ 3.10.1 If not already provided to the Owner in accordance with the Agreement, the Contractor, promptly after execution of the Agreement or Guaranteed Maximum Price Amendment, shall submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall contain detail appropriate for the Project, including (1) the date of commencement of the Work, interim schedule milestone dates, and the dates of Substantial Completion and final completion; (2) an apportionment of the Work by construction activity; (3)

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identifying the critical path of the Work; (4) a graphic representation of activities and events that will occur during performance of the Work; (5) identifying the crew size and total resource hours for each activity in the schedule; (6) identifying disruptions and shutdowns; and (7) the time required for completion of each portion of the Work. The schedule shall provide for the orderly progression of the Work to completion and shall not exceed time limits current under the Contract Documents. If the schedule is not accepted by the Owner and Architect, the Contractor shall promptly revise the schedule in accordance with the recommendations of the Owner and Architect and resubmit to Owner and Architect for acceptance. The schedule shall be revised at appropriate intervals as required by the conditions of the Work and Project.

§ 3.10.1.1 In certain occupied buildings, tasks might be of such a nature that noise and vibration cannot be tolerated. In such spaces, Work shall be scheduled for other than normal working hours. The Contractor is cautioned that weekend or overtime work, if required to avoid such noise and vibration, shall be performed at no additional cost. Permission to work other than standard hours shall be received from the Owner prior to the occurrence. Weekend and overtime Work shall be reflected in the construction schedule.

§ 3.10.1.2 In the event that critical path activities, schedule milestone completion dates, Substantial Completion or final completion dates will not be met, Contractor shall devise an affirmative time recovery plan acceptable to the Owner and Architect to avoid or minimize any delay. Such a plan may include, without limitation, increasing the Contractor's workforce in such quantities as will eliminate the backlog of Work, increasing the number of working hours per shift, shifts per workday, workdays per week, the amount of construction equipment, or any combination thereof, rescheduling of activities to achieve maximum practical concurrency of Work efforts and, if appropriate, time extensions.

§ 3.10.1.3 Unless otherwise provided in the Agreement, or unless different intervals are agreed to by the Owner, the Contractor shall update the construction schedule bi-weekly consistent with time limits established under the Contract Document and shall obtain the Owner's and Architect's approval. The updated construction schedule shall show all changes to the previous schedule. The updated construction schedule shall be signed by the Contractor and shall serve as an affirmation that the Contractor agrees to and can meet the requirements of the updated construction schedule.

§ 3.10.1.4 The Contractor shall participate with Separate Contractors and the Owner in reviewing their construction schedules and the Contractor shall coordinate its Work with the activities of the Owner's own forces and of Separate Contractors. The Contractor shall make any revisions to the construction schedule in order to coordinate its Work as required by this Section.

§ 3.10.2 The Contractor, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, shall submit a submittal schedule for the Architect's approval. The Architect's approval shall not be unreasonably 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, or fails to provide submittals in accordance with the approved 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 make available, at the Project site, the Contract Documents, including Change Orders, Construction Change Directives, and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, the approved Shop Drawings, Product Data, Samples, and similar required submittals, accurate, current and reproducible as-built drawings (showing Work as actually performed, variations from the original Contract Documents and the location of any concealed and/or buried items, utilities, mechanical or electrical systems and components), and accurate records of any changes made to the Specifications, noting particularly any variation from manufacturer's installation instructions and recommendations. Contractor shall also maintain at the site: a daily log in which it has recorded Project related information, including but not limited to, weather, number of workers on site, identification of equipment, Work accomplished, problems encountered and other similar relevant Project data; manufacturers' installation, operating and/or maintenance instructions or requirements, certificates and warranties; any special guarantees or warranties required by the Contract Documents; all the

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Contractor's communications, including but not limited to letters, memoranda, e-mails, invoices and bills of lading, arising out of or related to the Project with the Architect, Owner, and/or Subcontractors, suppliers and/or employees; assignment of all guarantees or warranties from Subcontractors, vendors, suppliers or manufacturers; a list of the names, addresses and telephone numbers of all Subcontractors and any other persons providing guarantees and warranties; and quality control procedures and documents related thereto. These shall be in electronic form or paper copy, available to the Architect and Owner, and 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 how 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. In the event of conflicts between submittals and the Contract Documents, the Contract Documents take precedence and govern the Work. 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. The Contractor shall pay all costs incurred by the Architect and Owner for attendant delay, interference, hindrance or disruption of the Project due to (i) review of submittals out of sequence from the agreed-upon schedule provided that the Architect has demonstrated that it has been financially impacted and/or (ii) due to excessive re-submittals without fault of the Architect. Unless otherwise provided in the Contract Documents, re-submittals in excess of one (1) without fault of the Architect or Owner shall be deemed excessive. If the Shop Drawings or other submittals show variations from the requirements of the Contract Documents, the Contractor shall specify such variations in the Contractor's letter of submittal to the Architect accompanying the submittal. Variations must be approved in writing.

§ 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 the requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples, or similar submittals, unless the Contractor has specifically notified the Architect 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

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Data, Samples, or similar submittals, by the Architect's approval thereof. The review and approval of a separate item shall not indicate approval of the assembly in which the item functions.

§ 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 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.

§ 3.12.10.1 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 be entitled to reasonably rely upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents. The Contractor shall cause such services or certifications to be provided by an appropriately 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 and accuracy of the services, certifications, and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor the performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review and 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.

§ 3.12.10.2 If the Contract Documents require the Contractor's design professional to certify that the Work has been performed in accordance with the design criteria, the Contractor shall furnish such certifications to the Architect at the time and in the form specified by the Architect.

§ 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, lawful orders of public authorities, and the Contract Documents and shall not unreasonably encumber the site with materials or equipment. Protection of construction materials and equipment stored at the Project site from weather, theft, damage, and all other adversity is solely the responsibility of the Contractor. The Contractor shall use commercially reasonable efforts to minimize any interference with the occupancy or beneficial use of (i) any areas and buildings adjacent to the site of the Work and (ii) the Project site and any buildings located thereon in the event of partial occupancy. Without prior approval of the Owner, the Contractor shall not permit any workers to use any existing facilities at the Project site, including, without limitation, lavatories, toilets, entrances, and parking areas other than those designated by the Owner.

§ 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, or patching shall be restored to the condition existing prior to the cutting, fitting, or 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 construction by the Owner or a Separate Contractor except with written consent of the Owner and of the Separate Contractor. Consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold, from the Owner or a Separate Contractor, its consent to cutting or otherwise altering the Work.

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§ 3.15 Cleaning Up

§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials, dirt, dust and 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 except that the Contractor shall give to the Owner any surplus materials that are required by the Contract Documents, but not incorporated into the Project, for future maintenance or repairs. The Contractor shall be responsible for compliance with all requirements regarding notification and disposal of construction demolition debris.

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

§ 3.16 Access to Work

The Contractor shall provide the Owner and Architect with 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 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 an infringement of a copyright or patent is discovered by, or made known to, the Contractor, the Contractor shall be responsible for the loss unless the 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) and/or a violation of applicable law, but only to the extent caused by the negligent acts or omissions or willful misconduct 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 any insurance policy provided or required in connection with the Project and/or 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. As between the Owner and Contractor, Contractor waives its immunities as may be applicable under law for purposes of confirming the indemnity obligations of this Agreement. Contractor shall require of its Subcontractors, by appropriate written agreements, similar waivers each in favor of all parties, including the Owner and Contractor; all sub-subcontractors at every tier shall also be bound by and comply with this same requirement in their respective agreements.

§ 3.19 Underground Utility Facilities

§ 3.19.1 The Contractor shall comply with ORC Sections 3781.25 through 3781.32. In addition, before starting excavation or trenching, the Contractor shall determine the location of any underground utilities and notify any public authority or utility having jurisdiction over the Project and secure any required approval. The Contractor shall alert immediately the occupants of any premises near the Work and the Architect as to any emergency that it may create or discover. The Contractor shall notify the operator of the underground facility and the Architect of any break or leak in the utility lines or any dent, gouge, groove, or other damage to such lines made or discovered in the course of excavation.

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ARTICLE 4 ARCHITECT

§ 4.1 General

§ 4.1.1 The Architect is the person or entity retained by the Owner pursuant to Section 2.3.2 and identified as such in the Agreement.

§ 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 and Architect. Consent shall not be unreasonably withheld.

§ 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 for such additional periods thereafter as the Owner and Architect may agree. 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. The Contractor shall reimburse the Owner for amounts paid to the Architect for site visits that are in addition to what is required of the Architect as described in this Section and that are made necessary by the fault of the Contractor or by defects and deficiencies in the Work.

§ 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 promptly report to the Owner (1) known deviations from the Contract Documents, (2) known deviations from the most recent construction schedule submitted by the Contractor, and (3) 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

The Owner and Contractor shall include the Architect in all communications that relate to or affect the Architect's services or professional responsibilities. The Owner shall promptly notify the Architect of the substance of any direct communications between the Owner and the Contractor otherwise relating to the Project and the Contractor shall do likewise with respect to direct communications with the Owner. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and suppliers shall be through the Contractor. Communications by and with Separate Contractors shall be through the Owner. The Contract Documents may specify other communication protocols.

§ 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, including those tests and inspections as provided in accordance with Sections 13.4.2 and 13.4.3, whether or not the 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, 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

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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 the Contract, including but not limited to Sections 3.3, 3.5, and 3.12. The Architect's review shall not constitute approval of safety precautions or 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 order 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 the Project representatives shall be as set forth in the agreement between the Owner and Architect.

§ 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 accordance with its standard of care.

§ 4.2.13 The Architect's decisions on matters relating to aesthetic effect will be subject to Owner's prior approval.

§ 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, including material suppliers. 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 the 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, including material suppliers. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor of any tier or an authorized representative of the Sub-subcontractor.

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

§ 5.2.1 Retention of Subcontractors shall be as set forth in the Agreement.

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(Paragraphs deleted)

§ 5.3 Subcontractual Relations

By appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by 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 that the Contractor, by these Contract Documents, assumes toward the Owner and Architect. Each subcontract agreement shall provide that the Owner is a third party beneficiary of the subcontract agreement and 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 that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, 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. Contractor shall promptly provide to Owner copies of any subcontract agreement along with copies of all bids or other proposals from Subcontractors. The subcontract agreement shall meet the applicable requirements of Ohio Administrative Code 153:1-3.

§ 5.4 Contingent Assignment of Subcontracts

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

.1 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; 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 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 term "Separate Contractor(s)" shall mean other contractors retained by the Owner under separate agreements. The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and with Separate Contractors retained under Conditions of the Contract substantially similar to those of this Contract.

§ 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 any Separate Contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to its 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.

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(Paragraph deleted)

§ 6.2 Mutual Responsibility

§ 6.2.1 The Contractor shall lay out and install its Work at such time or times and in such manner as not to delay or interfere with the carrying forward of the Work of Separate Contractors. 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 notify the Architect of apparent discrepancies or defects in the construction or operations by the Owner or Separate Contractor that would render it unsuitable for proper execution and results of the Contractor's Work. Failure of the Contractor to notify the Architect of apparent discrepancies or defects prior to proceeding with the Work 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. The Contractor shall not be responsible for discrepancies or defects in the construction or operations by the Owner or Separate Contractor that are not apparent.

§ 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 that the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or Separate Contractor 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.

§ 6.4 Owner's Provided Materials

The Owner may provide materials for Contractor to incorporate into the Project, and the Contractor shall incorporate such materials as part of its Work for the Project. The Contractor shall be fully responsible for and the Contract Sum shall cover, all matters relating to the receipt of materials provided by Owner as if the Contractor were the original purchaser, including but not limited to verifying correct quantities; coordinating purchases; providing, obtaining and managing all warranties and guarantees required by the Contract Documents including assistance to the Owner with the enforcement of such warranties and guarantees; inspection and acceptance of the materials; and loss or damage to the materials following acceptance of the materials by the Owner due to the negligence of the Contractor. The Contractor shall coordinate delivery schedules, sequence of delivery, loading orientation, and other arrangements normally required by the Contractor for the particular material furnished. The Contractor shall provide all services required for the unloading, handling and storage of materials through installation. The Contractor shall determine prior to incorporation into the Work if such materials are patently defective and whether they are in conformity with the Contract Documents (and, if applicable, any specifications provided by the Owner). If the Contractor discovers defects or non-conformities upon such visual inspection, the Contractor shall not utilize such materials in the Contractor's Work and instead shall properly notify the Owner of the defective or nonconforming condition so that repair or replacement of those materials can occur without undue delay or interruption to the Project. If the Contractor fails to perform such inspection and incorporates such defective or non-conforming materials into the Contractor's Work, Contractor shall be responsible for all damages to the Owner resulting from Contractor's incorporation of such materials into the Work. The Contractor shall maintain records of all Owner-provided materials it incorporates into the Work and shall account to the Owner for all Owner-provided materials delivered into the Contractor's or Subcontractor's possession.

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ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

§ 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. The Contractor shall proceed promptly with changes in the Work, unless otherwise provided in the Change Order, Construction Change Directive, or order for a minor change in the Work.

§ 7.1.4 The Contractor shall not proceed with any change in the Work without the appropriate written authorization. Except as otherwise provided herein, the Contractor's failure to obtain prior written authorization for a change in the Work shall constitute a waiver by the Contractor of an adjustment to the Contract Sum and/or Contract Time for the related Work. No course of conduct or dealings between the parties, nor express or implied acceptance of alterations or additions to the Work shall be the basis of any claim to an increase in any amounts due under the Contract Documents or a change in any time period provided for in the Contract Documents.

§ 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.

§ 7.2.2 Agreement on any Change Order shall constitute a final settlement of all matters relating to the change in the Work that is the subject of the Change Order, including, but not limited to, all direct and indirect costs and consequential damages associated with such change, the cumulative impact of the associated change in the Work in combination with one or more other changes in the Work, and any and all adjustments to the Contract Sum and the Contract Time. The Contractor is not entitled to reserve any rights or take other similar action with respect to a Change Order if the effect or intent of the reservation or action would be to accommodate a further adjustment of the Contract Sum or Contract Times, or both, after the Contractor signs the Change Order. A Change Order signed by the Contractor without any indication of change in the Contract Sum and/or Contract Time indicates the Contractor's agreement that there will be no change in the Contract Sum and/or Contract Time. Unless agreed otherwise by the parties, the Change Order form shall be the AIA Document G-701.

§ 7.2.3 The Contractor shall proportionately increase the amount of its bond whenever the Contract Sum is increased. If notice of any change affecting the Contract is required by a provision of the bond, giving the notice shall be the Contractor's responsibility.

§ 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;

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.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 7.3.4.

§ 7.3.4 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Owner or Architect shall determine 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 as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Owner or 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 7.3.4 shall be limited to the following:

.1 Costs or credits arising from a change in the quantity of field labor directly involved in the Work, including applicable payroll taxes, fringe benefits required by agreement or custom, workers' compensation insurance, and other employee costs approved by the Architect. Each of the fringe benefits shall be a separate line item, and the Contractor shall submit documentation supporting the calculation of the amounts for each fringe benefit for each worker. Each of the allowable payroll expenses shall be a separate line item. Costs that shall not be reimbursed include voluntary employee deductions (such as but not limited to deductions for charitable donations or U.S. savings bonds) and employee profit sharing;
.2 Costs of materials, supplies, and equipment, including cost of transportation (based on reasonable delivery charge or per-mile trucking charge for delivery of required materials or equipment), whether incorporated or consumed. The cost or credit for reusable materials (e.g. concrete form lumber, shoring, or temporary enclosures) shall be limited to 33 percent of the material cost for each use;
.3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others. Downtime due to repairs, maintenance and weather delays shall not be allowed;
.4 Costs of premiums for all bonds and insurance, permit fees, and sales, use, or similar taxes, directly related to the change;
.5 Costs or credits arising from a change in the quantity of supervision and field office personnel directly attributable to the change;
.6 General Conditions Costs. Any costs or credit arising from a change in the quantity of the Contractor's general conditions costs shall be limited to the extent to which the change is attributable to an associated change in the Contract Time for attainment of Substantial Completion resulting from the change in the Work.

§ 7.3.5 If the Contractor disagrees with the adjustment as determined by the Architect, the Contractor may make a Claim in accordance with applicable provisions of Article 15, and the timeline for initiating a Claim begins to run on the date the Architect issues its final determination.

§ 7.3.6 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.

§ 7.3.7 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.

§ 7.3.8 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

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reasonably justified. The Architect's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order.

§ 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. Disagreements with the Architect's final determination shall be resolved in accordance with Article 15.

§ 7.4 Minor Changes in the Work

The Architect may order minor changes in the Work that are consistent with the intent of the Contract Documents and do not involve an adjustment in the Contract Sum or an extension of the Contract Time. The Architect's order for minor changes shall be in writing. If the Contractor believes that the proposed minor change in the Work will affect the Contract Sum or Contract Time, the Contractor shall notify the Architect and shall not proceed to implement the change in the Work. If the Contractor performs the Work set forth in the Architect's order for a minor change without prior notice to the Architect that such change will affect the Contract Sum or Contract Time, the Contractor waives any adjustment to the Contract Sum or extension of the Contract Time. Unless otherwise designated by the Architect, the form to be utilized by Architect in authorizing minor changes in the Work shall be the AIA Document G-710, Architect's Supplemental Instructions.

§ 7.5 Proposal Requests

§7.5.1 The Architect may issue to Contractor at any time a proposal request for a change in the Work, including a change in the Contract Sum and Contract Time (a "Proposal Request"). A Proposal Request is not a Change Order, a Construction Change Directive, an order for a minor change in the Work, or authorization to proceed with the change in the Work described in the Proposal Request. Unless otherwise designated by the Architect, the form to be utilized by Architect for a Proposal Request shall be the AIA Document G709, Proposal Request.

§7.5.2 The Contractor shall respond with a proposal to the Architect (a "Proposal") within seven (7) days after receiving the Proposal Request, and the Contractor shall include with its Proposal the Contractor's proposed adjustments to the Contract Sum and Contract Time. The allowable time for the Contractor's response may be extended by written agreement of the Contractor, the Owner and the Architect. Failure to respond within the allowed time frame may result in the Owner proceeding with the work through any other means.

§7.5.3 The Contractor shall hold the Proposal valid and open for acceptance for at least thirty (30) days. The acceptance period may be adjusted by mutual written consent of the Contractor and the Owner.

§7.5.4 The Owner may accept the Proposal in writing at which point the Contractor's obligations to perform the work as outlined in the Proposal shall become binding. The parties promptly thereafter shall memorialize the Owner's acceptance of the Proposal through a Change Order.

§ 7.6 Request for Change Order

§7.6.1 The Contractor may initiate a Change Order request by submitting written notice to the Architect and Owner accompanied by a Proposal meeting the requirements of Section 7.5.

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 pursuant to 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. Where the term "business day" is used, if the last day of the period falls on a Saturday, Sunday, or a legal holiday, that day shall be omitted and the period shall end on the next day which is not a Saturday, Sunday, or legal holiday.

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§ 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, except by agreement or instruction of the Owner in writing, commence the Work prior to the effective date of insurance required to be 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 Subject to other provisions of the Contract, the Contractor will not be entitled to an increase in the Contract Sum and will only be entitled to an extension of the Contract Time on account of delay in the commencement or progress of Work on the critical path of the construction schedule caused by acts of nature or the public enemy, acts or orders of the government not arising from the Contractor's failure to comply with applicable law, fires, floods, weather, and labor disputes beyond the Contractor's control.

§ 8.3.2 Notwithstanding any other provision of the Contract Documents to the contrary, the Contractor shall not be entitled to an increase in the Contract Sum, or an extension of the Contract Time, or both: (i) on account of the impact of any normal adverse weather on any of the Work or on account of the impact of any abnormal adverse weather on Work not on the critical path; (ii) to the extent that a delay occurs concurrently with a delay attributable to the Contractor; or (iii) on account of the delay of any Work not on the critical path.

§ 8.3.3 Notwithstanding any other provision of the Contract Documents to the contrary, the Contractor shall not be entitled to an increase in the Contract Sum or any type of damages on account of a delay in the commencement or progress of Work on the critical path unless (i) the delay is caused by the Owner or (ii) the delay was not authorized or permitted under the Contract.

§ 8.3.4 Claims under this Section 8.3 shall be made in accordance with applicable provisions of Article 15.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

§ 9.1.1 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.

§ 9.1.2 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed by twenty percent (20%) or more so that application of such unit prices to the actual quantities causes substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 9.2 Schedule of Values

Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, and unless a different timeline is specified in the Agreement, the Contractor shall submit a schedule of values to the Architect within ten (10) days following the date of commencement of the Work, allocating the entire Contract Sum to the various portions of the Work. The schedule of values shall be prepared in the form, and supported by the data to substantiate its accuracy, required by the Architect. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment. Any changes to the schedule of values, including changes to the Contract Sum and changes required by the Architect if the Architect subsequently determines the schedule of values to be in any way unreasonable or inaccurate, shall be promptly submitted to the Architect and supported by such data to substantiate its accuracy as the Architect may require, and unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's subsequent Applications for Payment.

§ 9.3 Applications for Payment

§ 9.3.1 In accordance with the timelines established in the Agreement, 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,

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for completed portions of the Work. The application shall be notarized, if required, and supported by (i) an affidavit that all payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the previous Application for Payment was submitted have been paid or otherwise satisfied; (ii) a current list of the Subcontractors and suppliers showing their respective contract sums, amounts paid, and amounts due; (iii) schedule of all materials and equipment stored on-site; (iv) documentation required for materials and equipment stored off-site; (v) conditional lien waivers and releases from Contractor and from all Subcontractors and suppliers to be paid from the payment resulting from the Application for Payment; (vi) unconditional lien waivers and releases from Contractor and from all Subcontractors and suppliers for which Contractor was required to provide a conditional lien waiver in connection with a prior Application for Payment; and (vii) such other data substantiating the Contractor's right to payment that the Owner or Architect require, such as copies of requisitions, and shall reflect retainage if provided for in the Contract Documents.

§ 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 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.

§ 9.3.2.1 The Contractor's request for storage of materials and equipment off site shall minimally include:

- **.1** A list of the fabricated materials consigned to the Project (which shall be clearly identified), giving the place of storage, together with copies of invoices and reasons why materials cannot be delivered to the site.
- **.2** Certification that items have been tagged for delivery to the Project and that they will not be used for another purpose.
- **.3** A letter from the Contractor's surety indicating agreement to the arrangements and that payment to the Contractor shall not relieve the Contractor of its responsibility to complete the Work.
- **.4** Evidence of adequate insurance covering the material in storage, which shall name the Owner as an additional insured.
- **.5** Information pertaining to the Contractor's place of storage, the layout and security of the place of storage, and such information that verifies that the materials are securely stored at the place of storage.
- **.6** Subsequent Applications for Payment shall itemize the materials and their cost which were approved on previous Applications for Payment and remain in off-site storage.

§ 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 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, suppliers, or other persons or entities that provided labor, materials, and equipment relating to the Work.

§ 9.4 Certificates for Payment

§ 9.4.1 The Architect will either (1) issue to the Owner a Certificate for Payment in the full amount of the Application for Payment, with a copy to the Contractor; or (2) issue to the Owner a Certificate for Payment for such amount as the Architect determines is properly due, and notify the Contractor and Owner of the Architect's reasons for withholding certification in part as provided in Section 9.5.1; or (3) withhold certification of the entire Application for Payment, and notify the Contractor and Owner of the Architect's reason for withholding certification in whole as provided in Section 9.5.1.

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§ 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 in the Application for Payment, that, to the best of the Architect's knowledge, information, and belief, the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and that the Contractor is entitled to payment in the amount certified. 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. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site 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 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 suppliers 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 Contractor disputes the Architect's decision regarding a Certificate for Payment under Section 9.5.1, in whole or in part, the Contractor may submit a Claim in accordance with Article 15.

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

§ 9.5.4 If the Contractor disputes a determination by the Architect with regard to a Certificate of Payment, and during any related dispute resolution, litigation, or other proceeding, the Contractor nevertheless shall continue to prosecute the Work.

§ 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, and shall so notify the Architect.

§ 9.6.2 The Contractor shall pay each Subcontractor, no later than the timeline set forth in Ohio Revised Code 4113.61, 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 [Intentionally Deleted].

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§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and 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 and suppliers 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 or supplier, except as may otherwise be required by law.

§ 9.6.5 The Contractor's payments to 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 or provided by 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, create any fiduciary liability or tort liability on the part of the Contractor for breach of trust, or entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

§ 9.6.8 Provided the Owner has fulfilled its payment obligations under the Contract Documents, the Contractor shall defend and indemnify the Owner from all loss, liability, damage or expense, including reasonable attorney's fees and litigation expenses, arising out of any lien claim or other claim for payment by any Subcontractor or supplier of any tier, including but not limited to claims for unjust enrichment. In the event that the Owner receives a claim affidavit in accordance with Ohio Revised Code Chapter 1311 relating to amounts due and unpaid for labor and work performed and material furnished for the Work, the Owner shall detain the amount due and owing from the Contractor unless and until the claim is released and/or discharged as more particularly set forth in said Chapter 1311. Posting a bond or other security discharging a lien shall not relieve the Contractor of its indemnity obligations in this Section.

§ 9.7 Failure of Payment

If the Owner, through no fault of the Contractor, does not pay the Contractor within seven days after the date established in the Agreement, the amount certified by the Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days' notice to the Owner and Architect, stop the Work until payment of the amount owing has been received provided that Contractor shall not stop Work for non-payment if the Owner initiates the payment process for any undisputed amounts due the Contractor.

§ 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, including all necessary testing and/or startup, and when all required occupancy permits and any other necessary permits and approvals, if any, have been issued, so that the Owner can occupy or utilize the Work for its intended use, subject only to the completion or correction of minor items of Work that will not interfere with or hinder the Owner's use of the Work and areas adjacent to the Project site.

§ 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 or correct 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. The Contractor shall pay all costs incurred by the Architect, Owner and Separate Contractors for costs due to excessive inspections without fault of the Architect or Owner. Unless otherwise provided in the

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Contract Documents, inspections to determine Substantial Completion in excess of one (1) without the fault of the Architect or Owner shall be deemed excessive.

§ 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; establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance; and fix the time within which the Contractor shall finish all items on the list accompanying the Certificate (the "punch list"), or, if no timeframe is fixed, then not greater than thirty (30) days from the date of the Certificate. Failure to include an item on the Certificate and punch list does not alter the responsibility of the Contractor to complete or correct deficiencies in the Work in accordance with the Contract Documents. 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 the Certificate. Upon such acceptance, and consent of surety if any, and following certification of an Application for Payment, the Owner shall make payment of retainage as set forth in the Agreement.

§ 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 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 shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of 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 in writing, 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 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. 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 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. The Contractor shall pay all costs incurred by the Architect, Owner and Separate Contractors for costs due to excessive inspections without fault of the Architect or Owner. Unless otherwise provided in the Contract Documents, inspections to determine final completion in excess of one (1) without the fault of the Architect or Owner shall be deemed excessive.

§ 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 the Project (less amounts withheld by Owner) have been paid or otherwise satisfied (unless a different form is agreed to, Contractor shall provide the AIA Document G-706, Contractors Affidavit of Payment of Debts and Claims and AIA Document G-706A, Contractors Affidavit of Release of Liens), (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect, (3) a written statement that the insurance will be renewable to cover the period required by the Contract Documents, (4) consent of

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the Contractor's surety, if any, to final payment, (5) documentation of any special warranties, such as manufacturers' warranties or specific Subcontractor warranties, (6) all documents and items required to be submitted by Contractor in accordance with the Contract Documents which shall include those items set forth in Section 3.11 which have not previously been delivered to Owner, (7) unconditional lien waivers and releases from Contractor and all Subcontractors and suppliers; and (8) if required by the Owner, other data establishing payment or satisfaction of obligations 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, claim, security interest, or encumbrance. If a lien, claim, security interest, or encumbrance 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 the lien, claim, security interest, or encumbrance, 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, corrected, 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 the 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;
- **.3** terms of special warranties and guarantees required by the Contract Documents;
- **.4** audits performed by the Owner, if permitted by the Contract Documents, after final payment; or
- **.5** claims, damages, losses or expenses for indemnification.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor, or a 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. The Contractor's safety program shall be written and a copy maintained at the Project site for inspection, upon request. Neither the Owner nor the Architect accept any responsibility or liability for the safety of the Contractor's employees or for enforcing the Contractor's safety program. Additionally, Contractor shall comply with the Owner's rules, regulations, and policies including, but not limited to, the Owner's safety, health, and infection control policies and programs.

§ 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, a Subcontractor, or a Sub-subcontractor;
- **.3** other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures, benchmarks, monuments, other reference points, and utilities not designated for removal, relocation, or replacement in the course of construction; and
- **.4** construction or operations by the Owner and Separate Contractors.

§ 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.

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§ 10.2.3 The Contractor shall implement, 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 the owners and users of adjacent sites and utilities of the safeguards.

§ 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 give Owner and Architect reasonable advance notice thereof and 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. The Contractor may make a Claim for the cost to remedy the damage or loss to the extent such damage or loss is 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, notice of the 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 and names of witnesses to enable the other party to investigate the matter.

§ 10.2.9 If a Separate Contractor incurs damages resulting from the Contractor's performance of its Work, and the Contractor fails to remedy the damage or to reimburse the Separate Contractor for its damages, then the Owner reserves the right to pay the Separate Contractor suffering the damage and deduct such amounts from the amount due the Contractor.

§ 10.2.10 The Contractor acknowledges that the safety of the public and of the employees, invitees and guests of the Owner is of the utmost importance. While the Contractor is at the Project site, the Contractor will take no action that would jeopardize the safety of the public and of the Owner's employees, invitees or guests and, without the Owner's written approval, shall take no action that would interfere with the Owner's activities. The Owner reserves the right to require the Contractor and its employees to wear identification (subject to applicable safety standards), to stay in designated Work areas at all times while on the Owner's property and to record on a log a person's presence immediately upon entering the Owner's property. The Owner shall have the right to effect the immediate removal of a person from the Project site for failure to wear identification, for being outside a designated work area, for fraternizing with or engaging in any inappropriate behavior directed toward or in the vicinity of employees, invitees or guests of the Owner or for other good cause shown.

§ 10.2.11 The Contractor shall be enrolled in and remain in good standing in the Ohio Bureau of Workers' Compensation Drug-Free Safety Program or a comparable program approved by the Bureau that meets the requirements of Ohio Revised Code 153.03. Contractor shall comply with and shall require its Subcontractors to comply with the Ohio Bureau of Workers' Compensation's Drug-Free Workplace Program requirements under Revised Code 153.03(E), and Contractor shall include language in its subcontractual agreements mandating that each Subcontractor require Sub-subcontractors to similarly comply with the Ohio Bureau of Workers' Compensation's Drug-Free Workplace Program requirements.

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§ 10.3 Hazardous Materials and Substances

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials or substances. If the Contractor encounters a hazardous material or substance that is concealed or 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 notify the Owner and Architect of the condition.

§ 10.3.2 Upon receipt of the Contractor's notice, the Owner shall obtain or cause to be obtained 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. The Work in the affected area shall be resumed immediately following the occurrence of any one of the following events: (i) the Owner causes remedial work to be performed that results in the absence of the materials or substances or renders the material or substance harmless as evidenced by a written report which is prepared by an environmental consultant retained by Owner, or (ii) the Owner and the Contractor, by written agreement, decide to resume performance of the Work, or (iii) the Work may safely and lawfully proceed, as determined by an appropriate governmental authority. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum equitably adjusted based on the amount of the Contractor's reasonable additional costs of shutdown, delay, and start-up.

§ 10.3.3 [Intentionally Deleted].

§ 10.3.4 The Owner shall not be responsible under this Section 10.3 for hazardous 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 hazardous 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. Hazardous materials or substances to be used at the Project site by Contractor shall be identified by a Safety Data Sheet. The Contractor shall assemble all of its applicable Safety Data Sheet in a notebook and submit it to the Architect for its information prior to a hazardous material or substance being brought to the Project site. The Contractor shall maintain all Safety Data Sheet notebooks at the Project site for the duration of the Project.

§ 10.3.5 The Contractor shall reimburse the Owner for the cost and expense the Owner incurs (1) for remediation of hazardous materials or substances 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 [Intentionally Deleted].

§ 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 Insurance and Bonds

§ 11.1.1 The Contractor shall purchase from and maintain in a company or companies rated A- or higher by Best Insurance Reports and lawfully authorized to do business in the State of Ohio 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.

§ 11.1.2 The insurance required by Section 11.1.1 shall include and shall be written for not less than the following, or as required by law, whichever coverage is greater.

- **.1** Workers' Compensation: Statutory
- **.2** Employer's Liability: (1) an each-accident limit of not less than $1,000,000, (2) a disease each-employee limit of not less than $1,000,000, and (3) a disease policy limit of not less than $1,000,000;

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.3 Commercial General Liability ("CGL"): (1) an each-occurrence limit of not less than $2,000,000, (2) a general-aggregate limit of not less than $2,000,000, and (3) a products and completed-operations aggregate limit of not less than $2,000,000. The CGL insurance shall provide at least equivalent coverage for liability arising from premises, operations, independent contractors, products/completed-operations (shall not exclude coverage to the additional insured(s) for bodily injury or property damage), personal and advertising injury, and liability assumed under an insured contract. The CGL insurance shall not exclude coverage for damage to electronic data. The CGL policy shall be endorsed providing equivalent coverage to provide that the general aggregate limit applies separately to each of the insured's projects;

.4 Automobile Liability: covering all owned, non-owned, and hired vehicles used in connection with the Work: Bodily injury (including death and emotional distress) and property damage with a combined single limit of $1,000,000 each accident;

.5 Umbrella/Excess Liability: Such policies shall be supplemented by an umbrella policy of additional protection in the amount of $5,000,000 aggregate;

.6 If the Contractor is required to furnish professional services as part of the Work, the Contractor shall maintain Professional Liability Insurance covering performance of the professional services, with policy limits of not less than $1,000,000 per claim and $1,000,000 in the aggregate; and

.7 Pollution Liability: If the Work includes environmentally sensitive, hazardous types of activities (such as demolition, exterior insulation finish systems, asbestos abatement, storage-tank removal, or similar activities), or involves hazardous materials, the Contractor shall maintain a contractor's pollution liability policy with (1) a per-claim limit of not less than $1,000,000 and (2) an annual-aggregate limit of not less than $1,000,000, covering the acts, errors and/or omissions of the Contractor for damages (including from mold) sustained by the Owner by reason of the Contractor's performance of the Work. The policy shall have an effective date, which is on or before the date of commencement of the Work.

The Contractor shall maintain required coverages without interruption from the date of commencement of the Work and for not less than five years following Substantial Completion. The Contractor shall pay all deductibles, self-insured retentions, or both contained in the policies of insurance. The Contractor shall continue to provide evidence of coverage to the Owner on an annual basis during the aforementioned period.

§ 11.1.3 The Contractor shall submit to the Architect and the Owner a copy of certificates of insurance prior to commencement of the Work. Certificates shall include each and every type of coverage specified. Such certificates shall name the Owner and Architect as additional insureds and shall contain a statement that the Owner will be notified 30 days prior to the cancellation of any insurance policy evidenced by this certificate. The additional insureds requirements of this Section shall include completed and ongoing operations and Contractor shall provide additional insured endorsements. An additional certificate evidencing continuation of liability coverage, including coverage for completed and ongoing operations, shall be submitted with the final Application for Payment as required by Section 9.10.2. 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 if and to the extent required to meet the insurance requirements of this Section 11.1. All renewal and replacement policies shall comply with the requirements of this Section 11.1. A failure of the Owner to request a certificate or other evidence of compliance with the insurance requirements or a failure of the Owner to identify a deficiency from evidence that is provided shall not be construed as a waiver of the Contractor's obligation to maintain the required insurance.

§ 11.1.4 The Contractor shall cause all Subcontractors to provide Workers' Compensation, Comprehensive General Liability, and Automobile Liability Insurance with commercially reasonable limits and certificates of insurance related thereto. Such certificates shall name the Owner and Architect as additional insureds.

§ 11.1.5 The Contractor shall not commence Work under the Contract until the Contractor has obtained and provided proof of all insurance required under this heading.

§ 11.1.6 All liability policies required in this Section 11.1 shall be primary and non-contributory with respect to any other insurance or self-insurance programs that cover the Owner or an additional insured.

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§ 11.1.7 If Contractor fails to purchase and/or maintain any insurance required under Section 11.1, the Owner may, but shall not be obligated to, upon seven (7) days written notice to Contractor, purchase such insurance on behalf of the Contractor and shall be entitled to be reimbursed by the Contractor upon demand.

§ 11.1.8 Performance Bond and Payment Bond

§ 11.1.8.1 The Contractor shall furnish bonds as required in the Agreement between Owner and Contractor.

§ 11.1.8.2 The Contractor shall keep the surety informed of the progress of the Work, and, where necessary, obtain the surety's consent to, or waiver of, (i) notice of changes in the Work; (ii) request for reduction or release of retainage; (iii) request for final payment; and (iv) any other item required by the surety. The Owner shall be notified by the Contractor, in writing, of all communications with the surety. The Owner may, in the Owner's sole discretion, inform the surety of the progress of the Work and obtain consents as necessary to protect the Owner's rights, interests, privileges and benefits under and pursuant to any bond issued in connection with the Work. The Contractor shall be notified by the Owner, in writing, of any communications with the surety.

§ 11.1.8.3 If at any time any surety providing bonds for the Project (1) is adjudged bankrupt or has made a general assignment for the benefit of its creditors; (2) has liquidated all assets or has made a general assignment for the benefit of its creditors; (3) is placed in receivership; (4) otherwise petitions a state or federal court for protection from its creditors; or (5) allows its license to do business in Ohio to lapse or to be revoked, then the Contractor shall immediately, but no later than 21 days of any such action listed above, provide the Owner with new bonds in the form and amount required under the Contract.

§ 11.2 Property Insurance

§ 11.2.1 Unless otherwise provided in the Agreement, 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. 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 or until no person or entity other than the Owner has an insurable interest in the property required by this Section to be covered, whichever is later.

(Paragraphs deleted)

§ 11.2.1.1 Property insurance shall be on an "all-risk" or equivalent policy form and shall include 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, tornado, flood, windstorm, explosion, breakage of glass, falsework, testing and startup, temporary buildings and structures, materials used in the construction process, hot and cold testing, 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. Coverage shall include a provision to pay the reasonable extra costs of acceleration and expediting temporary and permanent repairs to, or permanent replacement of, damaged property (including overtime wages directly incurred to accelerate restoration or repair of the damaged property, and the extra costs that are directly incurred to rapidly transport materials and supplies necessary to the repair or replacement); soft costs coverage to the extent commercially available to comparable insureds, including the reasonable direct costs incurred by Architect and/or Contractor as a result of a property damage loss covered by the policy; and provisions for mechanical or electrical breakdown, or boiler system testing. Coverage shall be primary to all other applicable insurance. Notwithstanding any of the foregoing, the insurance shall include coverage only for those costs incurred as a direct result of direct physical damage to property otherwise covered by the policy; business income, business interruption, home office overhead, and lost productivity costs of Contractor or any subcontractor at any tier shall not be covered.

§ 11.2.1.2 If the property insurance requires minimum deductibles, the Contractor shall pay costs not covered by the insurance because of such deductibles.

§ 11.2.1.3 This property insurance shall cover portions of the Work stored off the site after written approval of the Owner at the value established in the approval, and also portions of the Work in transit.

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§ 11.2.1.4 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 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.

§ 11.2.1.5 The insurance required by this Section 11.2 is not intended to cover machinery, tools, apparatus, scaffolding, hoists, forms, staging, shoring or other equipment owned or rented by the Contractor which are utilized in the performance of the Work but not incorporated into the permanent improvements. The Contractor shall, at the Contractor's own expense, provide insurance coverage for owned or rented machinery, tools or equipment.

§ 11.3 WAIVERS OF SUBROGATION

The Contractor waives all rights against the Owner and their agents and employees for damages to the extent covered by any insurance, except rights to the proceeds of that insurance. All policies shall accomplish the waiver of subrogation by endorsement or otherwise. Contractor shall require of its Subcontractors, by appropriate written agreements, similar waivers each in favor of the Owner and Contractor; all Sub-subcontractors at every tier shall also be bound by and comply with this same requirement in their respective agreements.

(Paragraphs deleted)

§ 11.4 A loss insured under the Owner's property insurance shall be adjusted by the Owner in good faith and made payable to the Owner for the insureds, as their interests may appear. 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-subcontractors in similar manner. The Owner in good faith shall have power to adjust and settle a loss with insurers.

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 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, the Contractor shall be entitled to an equitable adjustment to the Contract Sum and Contract Time as may be appropriate. If such Work is not in accordance with the Contract Documents, the costs of uncovering the Work, and the cost of correction, shall be at the Contractor's expense.

§ 12.2 Correction of Work

§ 12.2.1 Before Substantial Completion

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, discovered before 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, for a period of one year after the date of Substantial Completion of the Work or designated portion thereof, the Contractor shall correct any of the Work that is found defective in workmanship, materials or not in accordance with the requirements of the Contract Documents. If defective or nonconforming Work becomes apparent within the one-year period, the Owner shall notify the Contractor in writing. Within fourteen (14) days of receipt of said notice, the Contractor shall visit the Project in the company of one or more representatives of the Owner to determine the extent of the defective or nonconforming Work. If the defective or nonconforming Work is considered by the Owner to be an emergency, the Owner may require the Contractor to visit the Project within one (1) calendar day or less of receipt of said notice. The Contractor shall promptly repair or replace the defective or nonconforming Work, including all adjacent Work damaged as a result of such defective or nonconforming Work. The Contractor shall be fully responsible for the cost of temporary materials, facilities, utilities or equipment required during the repair or replacement of the defective or nonconforming Work. If

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the Contractor fails to correct defective or 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 2.5.

§ 12.2.2.2 With respect to items of Work that are corrected, completed or first performed after Substantial Completion but prior to final completion of the Project, including completed punch list items, the one-year period with respect to these items shall commence upon correction or completion of the item.

§ 12.2.2.3 One month prior to the end of the one (1) year period, the Contractor shall attend a walk-through of the Project scheduled by the Architect.

§ 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 of the Owner or Separate Contractors, whether completed or partially completed, 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. The acceptance of nonconforming Work by the Owner shall be by written Change Order.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

The Contract shall be governed by the laws of the State of Ohio. Any suit, which may be brought to enforce any provision of this Agreement or any remedy with respect hereto, shall be brought in the Common Pleas Court of the County where the Project is located which shall have exclusive jurisdiction to the exclusion of all other jurisdictions. The applicable statutes of limitations and repose under Ohio law shall apply to all causes of action between the Owner and Contractor.

§ 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 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 the assignment.

§ 13.3 Rights and Remedies

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

§ 13.3.2 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 thereunder, except as may be specifically agreed upon in writing.

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§ 13.4 Tests and Inspections

§ 13.4.1 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 be present at and shall give the Architect timely notice of when and where tests and inspections are to be made, including intermediate and final inspections, so that the Architect may be present for such procedures. The Owner shall bear costs of tests, inspections, or approvals that do not become requirements until after bids are received or negotiations concluded. The Owner shall directly arrange and pay for tests, inspections, or approvals where building codes or applicable laws or regulations so require.

§ 13.4.2 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 13.4.1, 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 13.4.3, shall be at the Owner's expense.

§ 13.4.3 If procedures for testing, inspection, or approval under Sections 13.4.1 and 13.4.2 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. The Contractor also agrees the cost of testing services required for the convenience of the Contractor in the scheduling and performance of the Work, and the cost of testing services related to remedial operations performed to correct deficiencies in the Work, shall be borne by the Contractor.

§ 13.4.4 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.

§ 13.4.5 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.

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

§ 13.4.7 Any reports or documents resulting from tests, inspections and approvals required under this Section 13.4 shall be submitted to the Owner and Architect.

§ 13.5 Interest

Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at the rate set forth in the Agreement.

§ 13.6 Training Sessions

The Contractor will participate in training sessions for the Owner in cooperation with the Architect, Owner, Owner's personnel and consultants and the Contractor will participate in tests in cooperation with the Architect, Owner, Owner's personnel and consultants to the extent applicable to the Contractor's Work.

§ 13.7 Equal Opportunity

§ 13.7.1 The Contractor shall comply with applicable law regarding equal employment opportunity, including Ohio Revised Code Section 153.59. The Contractor shall cooperate fully with the State's Equal Opportunity Coordinator, with any other official or agency of the state or federal government that seeks to eliminate unlawful employment discrimination, and with all other state and federal efforts to assure equal employment practices under the Contract. The Contractor agrees to the following:

§ 13.7.1.1. That, in the hiring of employees for the performance of Work under the Contract or any Subcontract, Contractor and any Subcontractor or person acting on Contractor's or a Subcontractor's behalf shall not discriminate

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against any citizen of the state who are qualified and available to perform the services to which the employment relates by reason of race, color, religion, sex, age, disability, military status as defined in section 4112.01 of the Revised Code, veteran status, national origin, ancestry, sexual orientation, gender identity (including gender expression), marital status or genetics; and

§ 13.7.1.2. That Contractor and any Subcontractor or person acting on Contractor's or a Subcontractor's behalf shall not in any manner discriminate against, intimidate, or retaliate against any employee hired for the performance of services under the Contract on account of race, color, religion, sex, age, disability, military status, veteran status, national origin, ancestry, sexual orientation, gender identity (including gender expression), marital status or genetics.

§ 13.7.2. In the event the Contractor fails to comply with these nondiscrimination clauses, the Contractor shall be subject to the forfeiture requirements of Ohio Revised Code Section 153.60.

§ 13.7.3 Hiring Under State Public Improvement Contracts. Any provision of a hiring hall contract or agreement which obligates the Contractor to hire, if available, only employees referred to the Contractor by a labor organization shall be void as against public policy and unenforceable with respect to employment under any public improvement contract unless at the date of execution of the hiring hall contract or agreement, or within thirty (30) days thereafter, the labor organization has procedures in effect for referring qualified employees for hire without regard to race, color, religion, national origin, military status as defined in Ohio Revised Code Section 4112.01, or ancestry and unless the labor organization includes in its apprentice and journeyperson's membership, or otherwise has available for job referral without discrimination, qualified employees, both whites and non-whites (including African-Americans).

§ 13.8 The table of contents, titles, headings, running headlines and marginal notes contained in the Contract are solely to facilitate reference to various provisions of the Contract Documents and in no way affect, limit or describe or limit the interpretation of the provisions to which they refer.

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 75 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, 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; or
- **.2** An act of government, such as a declaration of national emergency, that requires all Work to be stopped; or
- **.3** Because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents.
- **.4** [Intentionally Deleted].

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, 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 thirty days' notice to the Owner and Architect, terminate the Contract provided that the reason for the termination is not cured within the thirty-day period and recover from the Owner payment for Work executed as of the date of termination, but not overhead and profit on Work not executed and not to exceed the Contract Sum (however, if such reason for termination cannot reasonably be cured within the thirty-day period, then Contractor shall not terminate the Contract so long as Owner commences to cure the reason for termination within such thirty-day period and diligently pursues such cure).

(Paragraph deleted)

§ 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;

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.2 fails to make payment to Subcontractors or suppliers in accordance with the respective agreements between the Contractor and the Subcontractors or Suppliers;

.3 repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or

.4 otherwise is in material breach of a provision of the Contract Documents.

§ 14.2.2 When any of the reasons described in Section 14.2.1 exist, the Owner 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' notice, and provided that the reason for the termination is not cured within the seven-day period, terminate employment of the Contractor and/or exercise the following non-exclusive remedies which will be cumulative:

.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 general 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, then Contractor shall be paid for Work that it satisfactorily performed prior to the date of termination but not to exceed such excess unpaid balance. If such costs and damages exceed the unpaid balance, the Contractor and the Contractor's surety 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.

§ 14.2.5 Should the Owner terminate this Agreement for cause under this Section 14.2, but that cause be subsequently found insufficient to support termination, the termination shall be deemed one of convenience under Section 14.4.

§ 14.2.6 If the Contract is terminated for cause, the Contractor's surety may perform the Contract. If the Contractor's surety does not commence performance of the Contract within ten (10) days of the date of Contract termination, the Owner may complete the Work by means the Owner determines appropriate. If the Contractor's surety performs the Work, the provisions of the Contract Documents govern the surety's performance, with the surety in place of the Contractor in all provisions including, but not limited to, provisions for payment for the Work, and provisions of the right of the Owner to complete the Work.

§ 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 equitably adjusted for increases in the cost and time caused by suspension, delay, or interruption under 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 in whole or in part for the Owner's convenience and without cause.

§ 14.4.2 Upon receipt of notice from the Owner of such termination for the Owner's convenience, the Contractor shall with respect to the Work that is terminated:

.1 cease operations as directed by the Owner in the notice;

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.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; and

.4 deliver to Owner all Project-related documents and work product of Contractor and its Subcontractors related to the Work.

§ 14.4.3 If the Contract is terminated in accordance with this Section 14.4, the Owner will pay the Contractor, i) for Work performed under the Contract up to the date the notice of termination is received by the Contractor at the rates for Work performed under the Contract, including overhead and profit up to the date of termination and reasonable expenses directly attributable to the termination, but not for overhead or lost profit on unperformed Work, ii) for Work performed at the direction of the Owner on and after the date on which the notice of termination is received by the Contractor, as determined by the procedures applicable to Construction Change Directives, and iii) for Work necessary to protect and preserve the Work, as determined by the procedures applicable to Construction Change Directives. .

§ 14.4.4 The termination of the Contract under this Section 14.4 shall be without prejudice to rights or remedies which exist at the time of termination.

§ 14.5 Contractor Insolvency

§ 14.5.1 The Owner may immediately terminate the Agreement for cause if:

§ 14.5.1.1 the Contractor commences a voluntary case under Title 11 of the United States Code or the corresponding provisions of any successor laws; or

§ 14.5.1.2 any legal entity commences an involuntary case against the Contractor under Title 11 of the United States Code or the corresponding provisions of any successor laws and (1) the case is not dismissed within 60 days after its commencement; or (2) the court before which the case is pending issues an order for relief or similar order approving the case; or

§ 14.5.1.3 a court of competent jurisdiction appoints, or the Contractor makes an assignment of all or substantially all of its assets to, a receiver, trustee, liquidator, or other similar custodian for the Contractor or all or substantially all of the Contractor's assets; or

§ 14.5.1.4 any attachment, execution, or other judicial seizure is levied against all or substantially all of the Contractor's assets; or

§ 14.5.1.5 the Contractor takes any action toward the dissolution or winding up of its business; or

§ **14.5.1.6** the Contractor fails generally to pay its debts as they become due (unless those debts are subject to a good-faith dispute as to liability or amount) or it acknowledges in writing that it is unable to do so.

§ 14.5.2 If the Contractor files a voluntary petition in bankruptcy or has an involuntary petition in bankruptcy filed against it, the Contractor, the Contractor as the debtor-in-possession, or the trustee of the Contractor's bankruptcy estate shall file a motion to assume or reject the Contract under Bankruptcy Code §365, 11 U.S.C. §365, within 20 days after the filing of the voluntary petition or involuntary petition and shall diligently prosecute that motion to conclusion so as to obtain an order granting or denying that motion within 45 days after the filing of the voluntary or involuntary petition.

§ 14.5.3 If the Owner intends to exercise its termination rights under this Section 14.5, the Owner shall notify the Contractor in writing of the Owner's termination of the Contract and the cause(s) for that termination.

§ 14.5.4 The Contractor agrees to the granting of relief from the automatic stay of the Bankruptcy Code, 11 U.S.C. §362(a), to permit the Owner to terminate the Contract for cause in such instance and issue and serve all notices necessary to terminate the Contract or arising out of the termination of the Contract and to take any and all other action necessary to terminate the Contract.

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ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

§ 15.1.1 Definition

A Claim is a demand or assertion by the Contractor seeking, as a matter of right, payment of money, a change in the Contract Time, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question asserted by the Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the Contractor. The Contract, including but not limited to this Article 15 does not require the Owner to make a claim, dispute, demand or assertion against the Contractor for the payment of money, a change in the Contract Time or other relief or in order for the Owner to exercise its rights and remedies against the Contractor, including but not limited to the remedying of a Contractor default, the imposition of liquidated damages and binding dispute resolution in accordance with the Contract Documents.

(Paragraphs deleted)

§ 15.1.2 Time Limits on Causes of Action

The Owner and Contractor shall commence all causes of action against the other and arising out of or related to the Contract, whether in contract, tort, breach of warranty or otherwise, in accordance with the requirements of the binding dispute resolution method selected in the Agreement and within the period specified by applicable statute of limitation and repose. The Owner and Contractor waive all causes of action not commenced in accordance with this Section 15.1.2.

§ 15.1.3 Notice of Claims

§ 15.1.3.1 Time Limit on Claims. Claims by Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the Owner 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 the Contractor under this Section 15.1.3.1 shall be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after Contractor first recognizes the condition giving rise to the Claim, whichever is later. Failure to submit proper and timely notice in accordance with this Section shall constitute a waiver and abandonment of the Claim by Contractor.

§ 15.1.3.2 Contractor Claims and claims by the Owner, where the condition giving rise is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party. In such event, no decision by the Initial Decision Maker is required.

§ 15.1.4 Continuing Contract Performance

§ 15.1.4.1 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.

§ 15.1.4.2 The Contract Sum and Contract Time shall be adjusted in accordance with the Initial Decision Maker's decision, subject to the right of either party to proceed in accordance with this Article 15. The Architect will issue Certificates for Payment in accordance with the decision of the Initial Decision Maker.

§ 15.1.5 Claims for Additional Cost

If the Contractor wishes to make a Claim for an increase in the Contract Sum, notice as provided in Section 15.1.3 shall be given before proceeding to execute the portion of the Work that is the subject of the Claim. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

§ 15.1.6 Claims for Additional Time

§ 15.1.6.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, notice as provided in Section 15.1.3 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.

§ 15.1.6.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions, as recorded at the government-controlled weather-recording facility nearest to the Project site, were abnormal for the period of time, could not have been reasonably anticipated, and had an adverse effect on the scheduled construction.

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§ 15.1.6.3 The Contractor shall not be entitled to a separate increase in the Contract Time for each one of the number of causes of delay which may have concurrent or interrelated effects on the progress of the Work, or for concurrent delays due to the fault of the Contractor

§ 15.1.7 Waiver of 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.

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 15.1.7 shall be deemed to preclude assessment of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents, nor shall this Section 15.1.7 apply to a party's gross negligence, willful misconduct or indemnity obligations.

§ 15.1.8 Substantiation and Certification of Claim

§ 15.1.8.1 Substantiation of Claim. Within fifteen (15) days after the initiation of a Claim by Contractor, the Contractor shall substantiate its Claim by providing the following minimum written information to Owner: (i) a narrative of the circumstances which gave rise to the Claim, including, without limitation, the start date of the event or events and the actual, or anticipated, finish date; (ii) detailed identification of the Work affected by the event giving rise to the Claim; (iii) copies of the Contractor's daily log for each day of impact; (iv) copies of relevant correspondence and other information regarding or supporting Contractor's entitlement; (v) copies of the Contractor's most recent income statement, including segregated general and administrative expenses for the most recent reporting period, and for the period of the Contract, if available, and similar information for any Subcontractor claim included; (vi) if the Claim is for additional cost, the amount of the Claim, the information specified in Section 15.1.5 herein and a statement that the increase requested is the entire increase in the Contract Sum associated with the Claim; (vii) if the Claim is for additional Contract Time, the information specified in Section 15.1.6 herein. Contractor shall also provide such additional information as requested by Owner or Architect to substantiate the Contractor's Claim within ten (10) days following request. The Contractor shall provide the required information in the formats requested, which include both paper and electronic copies. The Contractor's failure to comply with the requirements of this Section shall constitute an irrevocable waiver of the Claim.

§ 15.1.8.2 Certification of Claim. Within fifteen (15) days after the initiation of the Claim by Contractor, the Contractor shall certify its Claim by providing the notarized certification, signed and dated by the Contractor, as follows: "The undersigned Contractor certifies that the Claim is made in good faith; that the supporting data is accurate and complete to the best of the Contractor's knowledge and belief; that the amount requested is a fair, reasonable, and necessary adjustment for which the Contractor believes the Owner is liable; and that the undersigned is duly authorized to certify the Claim on behalf of the Contractor." The Contractor's failure to comply with the requirements of this Section shall constitute an irrevocable waiver of the Claim.

§ 15.2 Initial Decision

§ 15.2.1 Contractor Claims, excluding those where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2 or arising under Sections 10.3 and10.4, 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. If an initial decision has not been rendered within 30 days after the Claim has been referred to the Initial Decision Maker, Contractor may demand mediation and binding dispute resolution without a 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.

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§ 15.2.2 The Initial Decision Maker will review Claims and take one or more of the following actions: (1) request additional supporting data from the Contractor or a response with supporting data from the Owner, (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 the 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.

§ 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 receipt of an initial decision, demand in writing that the other party file for mediation. If such a demand is made and the party receiving the demand fails to file for mediation within 30 days after receipt thereof, 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, either party may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.

§ 15.3 Mediation

§ 15.3.1 Disputes, or other matters in controversy between the parties, including a Claim, arising out of or related to the Contract, except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.7, shall be subject to mediation as a condition precedent to binding dispute resolution.

§ 15.3.2 The parties shall endeavor to resolve their disputes or other matters in controversy by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures 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 Either party may, within 30 days from the date that mediation has been concluded without resolution of the dispute or 60 days after mediation has been demanded without resolution of the dispute, demand in writing that the other party file for binding dispute resolution. If such a demand is made and the party receiving the demand fails to

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file for binding dispute resolution within 60 days after receipt thereof, then both parties waive their rights to binding dispute *resolution* proceedings with respect to the initial decision.

§ 15.3.4 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. The Arbitration shall be conducted in the place where the Project is located, unless another location is mutually agreed upon. 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 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party 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 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party 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 those of the Owner and Contractor under this Agreement.

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PAGE 1

Dublin Jerome High School Weight Room Renovation

...

Board of Education of the Dublin City School District
6371A Shier Rings Road
Dublin, Ohio, 43016

...

Fanning Howey Associates, Inc.
5200 Upper Metro Place, Suite 350
Dublin, Ohio 43017

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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,~~ (these General Conditions, the Supplementary and other Conditions), 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 or proposal requirements.

...

The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2. ~~The Initial Decision Maker shall not show partiality to the Owner or Contractor and shall not be liable for results of interpretations or decisions rendered in good faith.~~

...

§ 1.2.1 The intent of the Contract Documents is to include all items necessary and reasonably inferable for the proper execution and completion of the Work by the ~~Contractor.~~ Contractor, whether or not expressly shown or described. 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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§ 1.2.4 The terms "knowledge," "recognize," and "discover," their respective derivatives, and similar terms in the Contract Documents, as used in reference to the Contractor, shall mean that which the Contractor knows (or should

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know), recognizes (or should recognize) and discovers (or should discover) in exercising the care, skill, and diligence required by the Contract Documents. Analogously, the expression "reasonably inferable" and similar terms in the Contract Documents shall be interpreted to mean reasonably inferable by a contractor exercising the care, skill, and diligence required of the Contractor by the Contract Documents.

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.~~defined or (2) the titles of numbered articles.

...

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. The use of the word "including," when following any general statement, term, or matter, shall not be construed to limit such statement, term, or matter to the specific items or matters set forth immediately following such word or to similar items or matters, whether or not non-limiting language (such words as "without limitation," or "but not limited to," or words of similar import) is used with reference thereto, but rather shall be deemed to refer to all other items or matters that could reasonably fall within the broadest possible scope of such general statement, term, or matter. All personal pronouns used in this Contract, whether used in the masculine, feminine, or neuter gender, shall include all other genders; and the singular shall include the plural and vice versa. Titles of articles, sections, and subsections are for convenience only and neither limit nor amplify the provisions of the Contract.

...

§ 1.5.1 ~~The~~ Unless otherwise indicated in the agreement between the Owner and the Architect, 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 retain all common law, statutory, and other reserved rights in their Instruments of Service, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and 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 the 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 suppliers are authorized to use and reproduce the Instruments of Service provided to them, subject to any protocols established pursuant to ~~Sections 1.7 and 1.8,~~ Section 1.7, 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 suppliers may not use the Instruments of Service on other projects or for additions to the Project outside the scope of the Work without the specific written consent of the Owner, Architect, and the Architect's consultants.

§ 1.5.3 The Owner alone owns all Project-related documents, including those in electronic form, prepared by the Contractor and Subcontractors, and every right, title, and interest therein from the moment of creation. The Contractor must execute and deliver and cause its employees and agents and all Subcontractors to execute and deliver to the Owner any transfers, assignments, documents, or other instruments (if any) necessary to vest in the Owner complete right, title, interest in and ownership of the Contractor's documents. The Contractor may retain copies, including reproducible copies, of the Contractor's documents for information, reference, and performance of the Work. The submission or distribution of the Contractor's documents to meet official regulatory requirements or for similar purposes in connection with the Project is not a waiver of the Owner's reserved rights in the Contractor's documents. Any unauthorized use of the Contractor's documents shall be at the sole risk of the entity making the unauthorized use.

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§ 1.6.2 Notice of Claims as provided in Section ~~15.1.3~~ 15.1.2 shall be provided in writing and shall be deemed to have been duly served only if delivered to the designated representative of the party to whom the notice is addressed by certified or registered mail, or by courier providing proof of delivery.

...

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The ~~parties shall agree upon written protocols governing the transmission and use of, and reliance on, Instruments of Service~~ Owner and Contractor acknowledge and reasonably expect that they will provide or cause to be provided electronic files to each other, including, but not limited to, Revit, Computer-Aided Design ("CAD") or Building Information Modeling ("BIM") files (collectively "Electronic Files"), and that they will receive Electronic Files from and provide Electronic Files to the Architect, to facilitate the design and construction of the Project consistent with current practices and customs in the construction industry. The Owner and Contractor acknowledge that the use of Electronic Files involves risks not generally associated with the use of paper documents. Those risks include, for example and without limitation, alteration (inadvertent or intentional) and deterioration, both of which may not be readily apparent through casual observation. The Owner and Contractor do not warrant to each other that any Electronic File they provide to each other or that they receive from or provide to the Architect (1) was not altered though transmission; (2) is compatible with the recipient's computer system or software; (3) will not be altered through degradation of the recipient's storage media; or (4) is suitable for conversion/translation to and subsequent use in a system or format other than the Electronic File's original system or format. Before relying on any Electronic File it receives, the recipient is responsible for verifying that the Electronic File was not altered though transmission, degradation of the recipient's own storage media, or other causes. If the recipient of an Electronic File converts/translates the Electronic File from its original system or format to an alternate system or format, the recipient assumes the risk that the conversion/translation created errors in the converted/translated file. Owner and Contractor shall each maintain and operate its own computer systems and storage media in a commercially reasonable way and take reasonable steps to prevent errors in and deterioration of the Electronic Files it creates, provides, and receives. In the event of a discrepancy between information contained in a paper version of a document and the Electronic File of that document, the paper version will govern. This Section does not relieve the Contractor of its responsibility for the preparation, completeness, or accuracy of the Contractor's documents. The parties shall also follow any other protocols governing the development, transmission, exchange and use of Instruments of Service, Electronic Files or any other information or documentation in digital ~~form.~~form as may be agreed upon in writing by the Owner, Contractor and Architect.

~~§ 1.8 Building Information Models Use and Reliance~~

~~Any use of, or reliance on, all or a portion of a building information model without agreement to written protocols governing the use of, and reliance on, the information contained in the model shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.~~

...

§ 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.~~ authorization provided that the representative shall have only such authority as is expressly authorized by the Owner's governing board. 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.~~Contractor a notice of commencement as may be required by Ohio Revised Code Chapter 1311. The Contractor shall provide a copy of any notice of commencement to its Subcontractor and any known Sub-subcontractors. The Contractor will immediately deliver to the Architect and Owner copies of notices of furnishing that Contractor receives.

~~§ 2.2 Evidence of the Owner's Financial Arrangements~~

~~**§ 2.2.1** Prior to commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. The Contractor shall have no obligation to commence the Work until the Owner provides such evidence. If commencement of the Work is delayed under this Section 2.2.1, the Contract Time shall be extended appropriately.~~

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~~**§ 2.2.2** Following commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract only if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due; or (3) a change in the Work materially changes the Contract Sum. If the Owner fails to provide such evidence, as required, within fourteen days of the Contractor's request, the Contractor may immediately stop the Work and, in that event, shall notify the Owner that the Work has stopped. However, if the request is made because a change in the Work materially changes the Contract Sum under (3) above, the Contractor may immediately stop only that portion of the Work affected by the change until reasonable evidence is provided. If the Work is stopped under this Section 2.2.2, 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 in the Contract Documents.~~

~~**§ 2.2.3** After the Owner furnishes evidence of financial arrangements under this Section 2.2, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.~~

~~**§ 2.2.4** Where the Owner has designated information furnished under this Section 2.2 as "confidential," the Contractor shall keep the information confidential and shall not disclose it to any other person. However, the Contractor may disclose "confidential" information, after seven (7) days' notice to the Owner, where disclosure is required by law, including a subpoena or other form of compulsory legal process issued by a court or governmental entity, or by court or arbitrator(s) order. The Contractor may also disclose "confidential" information to its employees, consultants, sureties, Subcontractors and their employees, Sub-subcontractors, and others who need to know the content of such information solely and exclusively for the Project and who agree to maintain the confidentiality of such information.~~

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§ 2.3.2 The Owner shall retain ~~an architect~~ a professional design firm lawfully licensed to practice ~~architecture,~~ architecture or engineering, or an entity lawfully practicing ~~architecture,~~ architecture or engineering, 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.

§ 2.3.3 If the employment of the Architect terminates, the Owner shall employ a successor ~~to whom the Contractor has no reasonable objection and~~ whose status under the Contract Documents shall be that of the Architect.

§ 2.3.4 The Owner ~~shall furnish surveys~~ shall, if necessary for the execution of the Work, furnish surveys or other information 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.

§ 2.3.5 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 reasonably necessary 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.

...

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.~~entity. The rights of the Owner under this Section are in addition to Owner's rights and remedies contained elsewhere in the Contract Documents.

...

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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 notice from the Owner to ~~commence and continue correction of such default or neglect with diligence and promptness,~~ correct such default or neglect, the Owner may, without prejudice to other remedies the Owner may have, correct such default or neglect. ~~Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect and the~~ If such default or neglect results in an emergency and/or a threat to the safety of persons or property, the Contractor shall immediately commence and continue without interruption using best efforts to correct such default or neglect upon receipt of written or oral notice thereof or otherwise becoming aware, and if Contractor fails to do so, then Owner may correct such default or neglect. The Owner or Architect may, pursuant to Section 9.5.1, withhold or nullify a Certificate for Payment in whole or in part, to the extent reasonably necessary to reimburse the Owner for 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. If current and future payments are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner. If the Contractor disagrees with the actions of the Owner or the Architect, or the amounts claimed as costs to the Owner, the Contractor may file a Claim pursuant to Article 15. The rights of Owner under this Section are in addition to the rights of Owner as set forth in Articles 12 and 14 herein.

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§ 3.1.4 The Contractor shall attend preconstruction meetings with representatives of the Architect and Owner. The Contractor shall have any of its Subcontractors and suppliers at the meeting as necessary or as requested by the Architect. The preconstruction meetings will serve to acquaint the participants with the general plan of the construction operation and all other requirements of the Project. The date, time, and place of the meetings will be designated by the Owner.

§ 3.1.5 If the Project is designed and constructed with a Sustainable Objective identified in the Agreement for the Project, the Contractor shall perform the Work for which the Contractor is responsible in furtherance of the Sustainable Objective and shall provide submittals certifying achievement of the Sustainable Objective criteria for verification by a third party, and the submittals shall be provided in accordance with any deadlines set forth in the schedule and Contract Documents. In the absence of schedules or deadlines, the Contractor will submit the documents with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or Separate Contractors. The Contractor shall include with any requests for substitution any potential effect the substitution may have on the Sustainable Objective. The Contractor grants to the Architect and Owner the right to submit the Contractor's submittals to the rating system as required in order to achieve or maintain the Sustainable Objective.

§ 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. By executing the Agreement, the Contactor certifies that it has evaluated and satisfied itself as to the conditions and limitations under which the Work is to be performed, including, without limitation, (i) the location, condition, layout, and nature of the Project site and surrounding areas, including but not limited to utilities, access restraints to the Project site and access restraints to neighboring facilities, (ii) generally prevailing climatic conditions, (iii) anticipated labor supply and costs, (iv) availability and cost of materials, tools, and equipment, and (v) other similar issues. The Contractor shall be solely responsible for providing a safe place for the performance of the Work. The Owner shall not be required to make any adjustment in either the Contract Sum or the Contract Time in connection with any failure by the Contractor or any Subcontractor to have complied with the requirements of this Section 3.2.1.

§ 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 2.3.4, 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. The Contractor shall satisfy itself as to the accuracy of all grades, elevations, dimensions, and locations. In all cases of interconnection of its Work with existing or other work, Contractor shall verify at the site all dimensions relating to such existing or other work. Any errors due to the Contractor's failure to so verify all such grades, elevations, dimensions, or locations shall be promptly rectified by the Contractor without any additional cost to the Owner. These obligations are for the purpose of facilitating coordination and construction by the Contractor, for determining that the Work is constructible, for determining if the Work of the Contractor is coordinated in the Contract Documents with the Work of Separate Contractors under a separate contract with the Owner, and for verifying that field conditions, including the Work of

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other Contractors, are consistent with the information in the Contract Documents and ready for Work and are not for the purpose of discovering errors, omissions, or inconsistencies in the design information contained 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.~~require, and proceeding without reporting such nonconformity shall make the Contractor responsible for any costs and expenses incurred by the Contractor related to the claimed deficiencies.

§ 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 submit Claims as provided in Article ~~15.~~ 15, and the time limit for initiating a Claim begins to run on the date of the Architect's issuance. 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, subject to Section 15.1.7, 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.

§ 3.2.5 The Owner is entitled to reimbursement from the Contractor for amounts paid to the Architect for evaluating and responding to the Contractor's requests for information that are not prepared in accordance with the Contract Documents and/or where the requested information is available to the Contractor from a careful study and comparison of the Contract Documents, field conditions, other Owner-provided information, Contractor-prepared coordination drawings, or prior Project correspondence or documentation.

§ 3.2.6 If the Architect does not specify a form for Contractor to submit a request for information, then Contractor shall utilize the AIA Document G-716.

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§ 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.~~Subcontractors, including Sub-subcontractors of any tier, and Contractor shall be responsible for ensuring the performance of the Work regardless of whether the work is performed by the Contractor, a Subcontractor or Sub-subcontractors of any tier. The Contractor shall be responsible for scheduling and coordinating the work of its Subcontractors and suppliers. This section shall apply with equal force and effect regardless of whether any Subcontractors are selected by the Contractor or assigned by the Owner.

...

§ 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, storage and other facilities and services necessary for proper execution and completion of the Work, including but not limited to field offices, toilets, other trailers, or buildings, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work. The Contractor shall use best efforts to conserve any utilities furnished by Owner.

§ 3.4.2 Except in the case of minor changes in the Work approved by the Architect in accordance with Section 3.12.8 or ordered by the Architect in accordance with Section 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. The Contractor shall provide all data, information, regulations and certifications required by Architect and Owner in evaluating the proposed substitution. The Owner shall be entitled to reimbursement from the

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Contractor for amounts paid for reviewing the Contractor's proposed substitutions and making agreed-upon changes in the Drawings and Specifications resulting from such substitutions.

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§ 3.5.1 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 warrants that the Work will conform to the requirements of the Contract ~~Documents~~ Documents, will be of good workmanship 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~~ shall be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, improper alterations to the Work ~~not~~ except when 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.

...

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. Owner will provide to Contractor, upon request, a completed State of Ohio Sales and Use Tax Construction Contract Exemption Certificate.

...

§ 3.7.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit as well as for all other permits, fees, licenses, and inspections by utilities or 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.

...

§ 3.7.3 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.

...

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 14 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 that an equitable adjustment be made in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor, stating the reasons. If ~~either party~~ Contractor disputes the Architect's determination or recommendation, ~~that party~~ the Contractor may submit a Claim as provided in Article ~~15.~~15, and the time limit for initiating a Claim as set forth in Section 15.1.2 herein related to subsurface, concealed or unknown conditions begins to run on the date the Architect issues its determination or recommendation.

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.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;~~ Sum, not in the allowances, and shall not be chargeable against the allowance; and

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.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. The Contractor shall obtain a Change Order before incurring any costs in excess of an allowance.

...

§ 3.9.2 ~~The~~ If not already approved in advance by the Owner, the Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the name and qualifications of a proposed superintendent. Within 14 days of receipt of the information, the Owner or Architect may notify the Contractor, stating whether the Owner or the Architect (1) has reasonable objection to the proposed superintendent or (2) requires additional time for review. Failure of the Owner or Architect to provide notice 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. The Owner shall have the right to require the Contractor to remove a superintendent from the Project whose performance is not satisfactory, and to replace the superintendent with a superintendent who is satisfactory to the Owner.

...

§ 3.10.1 ~~The Contractor, promptly after being awarded the Contract,~~ If not already provided to the Owner in accordance with the Agreement, the Contractor, promptly after execution of the Agreement or Guaranteed Maximum Price Amendment, shall submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall contain detail appropriate for the Project, including (1) the date of commencement of the Work, interim schedule milestone dates, and the ~~date of Substantial Completion;~~ dates of Substantial Completion and final completion; (2) an apportionment of the Work by construction activity; ~~and (3)~~ (3) identifying the critical path of the Work; (4) a graphic representation of activities and events that will occur during performance of the Work; (5) identifying the crew size and total resource hours for each activity in the schedule; (6) identifying disruptions and shutdowns; and (7) the time required for completion of each portion of the Work. The schedule shall provide for the orderly progression of the Work to completion and shall not exceed time limits current under the Contract Documents. If the schedule is not accepted by the Owner and Architect, the Contractor shall promptly revise the schedule in accordance with the recommendations of the Owner and Architect and resubmit to Owner and Architect for acceptance. The schedule shall be revised at appropriate intervals as required by the conditions of the Work and Project.

§ 3.10.1.1 In certain occupied buildings, tasks might be of such a nature that noise and vibration cannot be tolerated. In such spaces, Work shall be scheduled for other than normal working hours. The Contractor is cautioned that weekend or overtime work, if required to avoid such noise and vibration, shall be performed at no additional cost. Permission to work other than standard hours shall be received from the Owner prior to the occurrence. Weekend and overtime Work shall be reflected in the construction schedule.

§ 3.10.1.2 In the event that critical path activities, schedule milestone completion dates, Substantial Completion or final completion dates will not be met, Contractor shall devise an affirmative time recovery plan acceptable to the Owner and Architect to avoid or minimize any delay. Such a plan may include, without limitation, increasing the Contractor's workforce in such quantities as will eliminate the backlog of Work, increasing the number of working hours per shift, shifts per workday, workdays per week, the amount of construction equipment, or any combination thereof, rescheduling of activities to achieve maximum practical concurrency of Work efforts and, if appropriate, time extensions.

§ 3.10.1.3 Unless otherwise provided in the Agreement, or unless different intervals are agreed to by the Owner, the Contractor shall update the construction schedule bi-weekly consistent with time limits established under the Contract Document and shall obtain the Owner's and Architect's approval. The updated construction schedule shall show all changes to the previous schedule. The updated construction schedule shall be signed by the Contractor and shall serve as an affirmation that the Contractor agrees to and can meet the requirements of the updated construction schedule.

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§ 3.10.1.4 The Contractor shall participate with Separate Contractors and the Owner in reviewing their construction schedules and the Contractor shall coordinate its Work with the activities of the Owner's own forces and of Separate Contractors. The Contractor shall make any revisions to the construction schedule in order to coordinate its Work as required by this Section.

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The Contractor shall make available, at the Project site, the Contract Documents, including Change Orders, Construction Change Directives, and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, ~~and~~ the approved Shop Drawings, Product Data, Samples, and similar required ~~submittals.~~ submittals, accurate, current and reproducible as-built drawings (showing Work as actually performed, variations from the original Contract Documents and the location of any concealed and/or buried items, utilities, mechanical or electrical systems and components), and accurate records of any changes made to the Specifications, noting particularly any variation from manufacturer's installation instructions and recommendations. Contractor shall also maintain at the site: a daily log in which it has recorded Project related information, including but not limited to, weather, number of workers on site, identification of equipment, Work accomplished, problems encountered and other similar relevant Project data; manufacturers' installation, operating and/or maintenance instructions or requirements, certificates and warranties; any special guarantees or warranties required by the Contract Documents; all the Contractor's communications, including but not limited to letters, memoranda, e-mails, invoices and bills of lading, arising out of or related to the Project with the Architect, Owner, and/or Subcontractors, suppliers and/or employees; assignment of all guarantees or warranties from Subcontractors, vendors, suppliers or manufacturers; a list of the names, addresses and telephone numbers of all Subcontractors and any other persons providing guarantees and warranties; and quality control procedures and documents related thereto. These shall be in electronic form or paper copy, available to the Architect and Owner, and delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

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§ 3.12.4 Shop Drawings, Product Data, Samples, and similar submittals are not Contract Documents. Their purpose is to demonstrate how 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. In the event of conflicts between submittals and the Contract Documents, the Contract Documents take precedence and govern the Work. 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. The Contractor shall pay all costs incurred by the Architect and Owner for attendant delay, interference, hindrance or disruption of the Project due to (i) review of submittals out of sequence from the agreed-upon schedule provided that the Architect has demonstrated that it has been financially impacted and/or (ii) due to excessive re-submittals without fault of the Architect. Unless otherwise provided in the Contract Documents, re-submittals in excess of one (1) without fault of the Architect or Owner shall be deemed excessive. If the Shop Drawings or other submittals show variations from the requirements of the Contract Documents, the Contractor shall specify such variations in the Contractor's letter of submittal to the Architect accompanying the submittal. Variations must be approved in writing.

...

§ 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 the requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples, or similar submittals, unless the Contractor has specifically notified the Architect 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. The review and approval of a separate item shall not indicate approval of the assembly in which the item functions.

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§ 3.12.10.1 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 be entitled to reasonably rely upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents. The Contractor shall cause such services or certifications to be provided by an appropriately 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 and accuracy of the services, certifications, and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor the performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review and 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 confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, lawful orders of public authorities, and the Contract Documents and shall not unreasonably encumber the site with materials or equipment. Protection of construction materials and equipment stored at the Project site from weather, theft, damage, and all other adversity is solely the responsibility of the Contractor. The Contractor shall use commercially reasonable efforts to minimize any interference with the occupancy or beneficial use of (i) any areas and buildings adjacent to the site of the Work and (ii) the Project site and any buildings located thereon in the event of partial occupancy. Without prior approval of the Owner, the Contractor shall not permit any workers to use any existing facilities at the Project site, including, without limitation, lavatories, toilets, entrances, and parking areas other than those designated by the Owner.

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§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste ~~materials~~ materials, dirt, dust and 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.~~the Project except that the Contractor shall give to the Owner any surplus materials that are required by the Contract Documents, but not incorporated into the Project, for future maintenance or repairs. The Contractor shall be responsible for compliance with all requirements regarding notification and disposal of construction demolition debris.

...

§ 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),~~ itself) and/or a violation of applicable law, but only to the extent caused by the negligent acts or omissions or willful misconduct 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 any insurance policy provided or required in connection with the Project and/or 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. As between the Owner and Contractor, Contractor waives its immunities as may be applicable under law

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for purposes of confirming the indemnity obligations of this Agreement. Contractor shall require of its Subcontractors, by appropriate written agreements, similar waivers each in favor of all parties, including the Owner and Contractor; all sub-subcontractors at every tier shall also be bound by and comply with this same requirement in their respective agreements.

§ 3.19 Underground Utility Facilities

§ 3.19.1 The Contractor shall comply with ORC Sections 3781.25 through 3781.32. In addition, before starting excavation or trenching, the Contractor shall determine the location of any underground utilities and notify any public authority or utility having jurisdiction over the Project and secure any required approval. The Contractor shall alert immediately the occupants of any premises near the Work and the Architect as to any emergency that it may create or discover. The Contractor shall notify the operator of the underground facility and the Architect of any break or leak in the utility lines or any dent, gouge, groove, or other damage to such lines made or discovered in the course of excavation.

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§ 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,~~ Owner and Architect. Consent shall not be unreasonably withheld.

...

§ 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.~~ Payment and for such additional periods thereafter as the Owner and Architect may agree. 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. The Contractor shall reimburse the Owner for amounts paid to the Architect for site visits that are in addition to what is required of the Architect as described in this Section and that are made necessary by the fault of the Contractor or by defects and deficiencies in the Work.

...

The Owner and Contractor shall include the Architect in all communications that relate to or affect the Architect's services or professional responsibilities. The Owner shall promptly notify the Architect of the substance of any direct communications between the Owner and the Contractor otherwise relating to the ~~Project. Communications~~ Project and the Contractor shall do likewise with respect to direct communications with the Owner. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and suppliers shall be through the Contractor. Communications by and with Separate Contractors shall be through the Owner. The Contract Documents may specify other communication protocols.

...

§ 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~~ Work, including those tests and inspections as provided in accordance with Sections 13.4.2 and 13.4.3, whether or not the 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, suppliers, their agents or employees, or other persons or entities performing portions of the Work.

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§ 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 the Contract, including but not limited to Sections 3.3, 3.5, and 3.12. The Architect's review shall not constitute approval of safety precautions or 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.

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§ 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 ~~Owner shall notify the Contractor of any change in the~~ duties, responsibilities and limitations of authority of the Project ~~representatives.~~representatives shall be as set forth in the agreement between the Owner and Architect.

...

§ 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.~~accordance with its standard of care.

§ 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.~~subject to Owner's prior approval.

...

§ 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.~~ Work, including material suppliers. 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 the 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.~~ Work, including material suppliers. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor of any tier or an authorized representative of the Sub-subcontractor.

...

§ 5.2.1 ~~Unless otherwise stated in the Contract Documents, the Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the persons or entities proposed for each principal portion of the Work, including those who are to furnish materials or equipment fabricated to a special design. Within 14 days of receipt of the information, the Architect may notify the Contractor whether the Owner or the Architect (1) has reasonable objection to any such proposed person or entity or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.~~Retention of Subcontractors shall be as set forth in the Agreement.

§ 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.~~

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~~**§ 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 for one previously selected if the Owner or Architect makes reasonable objection to such substitution.~~

By appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by 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 that the Contractor, by these Contract Documents, assumes toward the Owner and Architect. Each subcontract agreement shall provide that the Owner is a third party beneficiary of the subcontract agreement and 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 that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, 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. Contractor shall promptly provide to Owner copies of any subcontract agreement along with copies of all bids or other proposals from Subcontractors. The subcontract agreement shall meet the applicable requirements of Ohio Administrative Code 153:1-3.

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§ 6.1.1 The term "Separate Contractor(s)" shall mean other contractors retained by the Owner under separate agreements. The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and with Separate Contractors retained under Conditions of the Contract substantially similar to those of this ~~Contract, including those provisions of the Conditions of the Contract related to insurance and waiver of subrogation.~~Contract.

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~~**§ 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 or with Separate Contractors, the Owner or its Separate Contractors shall have the same obligations and rights that the Contractor has under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6, and Articles 10, 11, and 12.~~

§ 6.2.1 The Contractor shall lay out and install its Work at such time or times and in such manner as not to delay or interfere with the carrying forward of the Work of Separate Contractors. 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.

...

§ 6.4 Owner's Provided Materials

The Owner may provide materials for Contractor to incorporate into the Project, and the Contractor shall incorporate such materials as part of its Work for the Project. The Contractor shall be fully responsible for and the Contract Sum shall cover, all matters relating to the receipt of materials provided by Owner as if the Contractor were the original

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purchaser, including but not limited to verifying correct quantities; coordinating purchases; providing, obtaining and managing all warranties and guarantees required by the Contract Documents including assistance to the Owner with the enforcement of such warranties and guarantees; inspection and acceptance of the materials; and loss or damage to the materials following acceptance of the materials by the Owner due to the negligence of the Contractor. The Contractor shall coordinate delivery schedules, sequence of delivery, loading orientation, and other arrangements normally required by the Contractor for the particular material furnished. The Contractor shall provide all services required for the unloading, handling and storage of materials through installation. The Contractor shall determine prior to incorporation into the Work if such materials are patently defective and whether they are in conformity with the Contract Documents (and, if applicable, any specifications provided by the Owner). If the Contractor discovers defects or non-conformities upon such visual inspection, the Contractor shall not utilize such materials in the Contractor's Work and instead shall properly notify the Owner of the defective or nonconforming condition so that repair or replacement of those materials can occur without undue delay or interruption to the Project. If the Contractor fails to perform such inspection and incorporates such defective or non-conforming materials into the Contractor's Work, Contractor shall be responsible for all damages to the Owner resulting from Contractor's incorporation of such materials into the Work. The Contractor shall maintain records of all Owner-provided materials it incorporates into the Work and shall account to the Owner for all Owner-provided materials delivered into the Contractor's or Subcontractor's possession.

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§ 7.1.4 The Contractor shall not proceed with any change in the Work without the appropriate written authorization. Except as otherwise provided herein, the Contractor's failure to obtain prior written authorization for a change in the Work shall constitute a waiver by the Contractor of an adjustment to the Contract Sum and/or Contract Time for the related Work. No course of conduct or dealings between the parties, nor express or implied acceptance of alterations or additions to the Work shall be the basis of any claim to an increase in any amounts due under the Contract Documents or a change in any time period provided for in the Contract Documents.

...

§ 7.2.2 Agreement on any Change Order shall constitute a final settlement of all matters relating to the change in the Work that is the subject of the Change Order, including, but not limited to, all direct and indirect costs and consequential damages associated with such change, the cumulative impact of the associated change in the Work in combination with one or more other changes in the Work, and any and all adjustments to the Contract Sum and the Contract Time. The Contractor is not entitled to reserve any rights or take other similar action with respect to a Change Order if the effect or intent of the reservation or action would be to accommodate a further adjustment of the Contract Sum or Contract Times, or both, after the Contractor signs the Change Order. A Change Order signed by the Contractor without any indication of change in the Contract Sum and/or Contract Time indicates the Contractor's agreement that there will be no change in the Contract Sum and/or Contract Time. Unless agreed otherwise by the parties, the Change Order form shall be the AIA Document G-701.

§ 7.2.3 The Contractor shall proportionately increase the amount of its bond whenever the Contract Sum is increased. If notice of any change affecting the Contract is required by a provision of the bond, giving the notice shall be the Contractor's responsibility.

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§ 7.3.4 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Owner or Architect shall determine 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 as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Owner or 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 7.3.4 shall be limited to the following:

.1 Costs ~~of labor,~~ or credits arising from a change in the quantity of field labor directly involved in the Work, including applicable payroll taxes, fringe benefits required by agreement or custom, workers' compensation insurance, and other employee costs approved by ~~the Architect;~~the Architect. Each of the

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fringe benefits shall be a separate line item, and the Contractor shall submit documentation supporting the calculation of the amounts for each fringe benefit for each worker. Each of the allowable payroll expenses shall be a separate line item. Costs that shall not be reimbursed include voluntary employee deductions (such as but not limited to deductions for charitable donations or U.S. savings bonds) and employee profit sharing;

.2 Costs of materials, supplies, and equipment, including cost of ~~transportation, whether incorporated or consumed;~~transportation (based on reasonable delivery charge or per-mile trucking charge for delivery of required materials or equipment), whether incorporated or consumed. The cost or credit for reusable materials (e.g. concrete form lumber, shoring, or temporary enclosures) shall be limited to 33 percent of the material cost for each use;

.3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or ~~others;~~others. Downtime due to repairs, maintenance and weather delays shall not be allowed;

.4 Costs of premiums for all bonds and insurance, permit fees, and sales, use, or similar taxes, directly related to the change; ~~and~~

.5 Costs or credits arising from a change in the quantity of supervision and field office personnel directly ~~attributable to the change.~~attributable to the change;

.6 General Conditions Costs. Any costs or credit arising from a change in the quantity of the Contractor's general conditions costs shall be limited to the extent to which the change is attributable to an associated change in the Contract Time for attainment of Substantial Completion resulting from the change in the Work.

§ 7.3.5 If the Contractor disagrees with the adjustment ~~in the Contract Time,~~ as determined by the Architect, the Contractor may make a Claim in accordance with applicable provisions of Article ~~15.~~15, and the timeline for initiating a Claim begins to run on the date the Architect issues its final determination.

...

§ 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.~~Order.

§ 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. Disagreements with the Architect's final determination shall be resolved in accordance with Article 15.

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The Architect may order minor changes in the Work that are consistent with the intent of the Contract Documents and do not involve an adjustment in the Contract Sum or an extension of the Contract Time. The Architect's order for minor changes shall be in writing. If the Contractor believes that the proposed minor change in the Work will affect the Contract Sum or Contract Time, the Contractor shall notify the Architect and shall not proceed to implement the change in the Work. If the Contractor performs the Work set forth in the Architect's order for a minor change without prior notice to the Architect that such change will affect the Contract Sum or Contract Time, the Contractor waives any adjustment to the Contract Sum or extension of the Contract Time. Unless otherwise designated by the Architect, the form to be utilized by Architect in authorizing minor changes in the Work shall be the AIA Document G-710, Architect's Supplemental Instructions.

§ 7.5 Proposal Requests

§7.5.1 The Architect may issue to Contractor at any time a proposal request for a change in the Work, including a change in the Contract Sum and Contract Time (a "Proposal Request"). A Proposal Request is not a Change Order, a Construction Change Directive, an order for a minor change in the Work, or authorization to proceed with the change in the Work described in the Proposal Request. Unless otherwise designated by the Architect, the form to be utilized by Architect for a Proposal Request shall be the AIA Document G709, Proposal Request.

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§7.5.2 The Contractor shall respond with a proposal to the Architect (a "Proposal") within seven (7) days after receiving the Proposal Request, and the Contractor shall include with its Proposal the Contractor's proposed adjustments to the Contract Sum and Contract Time. The allowable time for the Contractor's response may be extended by written agreement of the Contractor, the Owner and the Architect. Failure to respond within the allowed time frame may result in the Owner proceeding with the work through any other means.

§7.5.3 The Contractor shall hold the Proposal valid and open for acceptance for at least thirty (30) days. The acceptance period may be adjusted by mutual written consent of the Contractor and the Owner.

§7.5.4 The Owner may accept the Proposal in writing at which point the Contractor's obligations to perform the work as outlined in the Proposal shall become binding. The parties promptly thereafter shall memorialize the Owner's acceptance of the Proposal through a Change Order.

§ 7.6 Request for Change Order

§7.6.1 The Contractor may initiate a Change Order request by submitting written notice to the Architect and Owner accompanied by a Proposal meeting the requirements of Section 7.5.

...

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

...

§ 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined. Where the term "business day" is used, if the last day of the period falls on a Saturday, Sunday, or a legal holiday, that day shall be omitted and the period shall end on the next day which is not a Saturday, Sunday, or legal holiday.

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§ 8.2.2 The Contractor shall ~~not knowingly,~~ not, except by agreement or instruction of the Owner in writing, commence the Work prior to the effective date of insurance required to be furnished by the Contractor and Owner. The date of commencement of the Work shall not be changed by the effective date of such insurance.

...

§ 8.3.1 ~~If the Contractor is delayed at any time in the commencement or progress of the Work by (1) an act or neglect of the Owner or Architect, of an employee of either, or of a Separate Contractor; (2) by changes ordered in the Work; (3) by labor disputes, fire, unusual delay in deliveries, unavoidable casualties, adverse weather conditions documented in accordance with Section 15.1.6.2, or other causes beyond the Contractor's control; (4) by delay authorized by the Owner pending mediation and binding dispute resolution; or (5) by other causes that the Contractor asserts, and the Architect determines, justify delay, then the Contract Time shall be extended for such reasonable time as the Architect may determine.~~Subject to other provisions of the Contract, the Contractor will not be entitled to an increase in the Contract Sum and will only be entitled to an extension of the Contract Time on account of delay in the commencement or progress of Work on the critical path of the construction schedule caused by acts of nature or the public enemy, acts or orders of the government not arising from the Contractor's failure to comply with applicable law, fires, floods, weather, and labor disputes beyond the Contractor's control.

§ 8.3.2 ~~Claims relating to time shall be made in accordance with applicable provisions of Article 15.~~Notwithstanding any other provision of the Contract Documents to the contrary, the Contractor shall not be entitled to an increase in the Contract Sum, or an extension of the Contract Time, or both: (i) on account of the impact of any normal adverse weather on any of the Work or on account of the impact of any abnormal adverse weather on Work not on the critical path; (ii) to the extent that a delay occurs concurrently with a delay attributable to the Contractor; or (iii) on account of the delay of any Work not on the critical path.

§ 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.~~Notwithstanding any other provision of the Contract Documents to the contrary, the Contractor

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shall not be entitled to an increase in the Contract Sum or any type of damages on account of a delay in the commencement or progress of Work on the critical path unless (i) the delay is caused by the Owner or (ii) the delay was not authorized or permitted under the Contract.

§ 8.3.4 Claims under this Section 8.3 shall be made in accordance with applicable provisions of Article 15.

...

§ 9.1.2 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed by twenty percent (20%) or more so that application of such unit prices to the actual quantities causes substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

...

Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, and unless a different timeline is specified in the Agreement, the Contractor shall submit a schedule of values to the Architect ~~before the first Application for Payment,~~ within ten (10) days following the date of commencement of the Work, allocating the entire Contract Sum to the various portions of the Work. The schedule of values shall be prepared in the form, and supported by the data to substantiate its accuracy, required by the Architect. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment. Any changes to the schedule of values, including changes to the Contract Sum and changes required by the Architect if the Architect subsequently determines the schedule of values to be in any way unreasonable or inaccurate, shall be promptly submitted to the Architect and supported by such data to substantiate its accuracy as the Architect may require, and unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's subsequent Applications for Payment.

...

§ 9.3.1 ~~At least ten days before the date established for each progress payment,~~ In accordance with the timelines established in the Agreement, 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. The application shall be notarized, if required, and supported by (i) an affidavit that all payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the previous Application for Payment was submitted have been paid or otherwise satisfied; (ii) a current list of the Subcontractors and suppliers showing their respective contract sums, amounts paid, and amounts due; (iii) schedule of all materials and equipment stored on-site; (iv) documentation required for materials and equipment stored off-site; (v) conditional lien waivers and releases from Contractor and from all Subcontractors and suppliers to be paid from the payment resulting from the Application for Payment; (vi) unconditional lien waivers and releases from Contractor and from all Subcontractors and suppliers for which Contractor was required to provide a conditional lien waiver in connection with a prior Application for Payment; and (vii) such other data substantiating the Contractor's right to payment that the Owner or Architect require, such as copies of requisitions, ~~and releases and waivers of liens from Subcontractors and suppliers,~~ and shall reflect retainage if provided for in the Contract Documents.

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§ 9.3.2.1 The Contractor's request for storage of materials and equipment off site shall minimally include:

- **.1** A list of the fabricated materials consigned to the Project (which shall be clearly identified), giving the place of storage, together with copies of invoices and reasons why materials cannot be delivered to the site.
- **.2** Certification that items have been tagged for delivery to the Project and that they will not be used for another purpose.
- **.3** A letter from the Contractor's surety indicating agreement to the arrangements and that payment to the Contractor shall not relieve the Contractor of its responsibility to complete the Work.
- **.4** Evidence of adequate insurance covering the material in storage, which shall name the Owner as an additional insured.
- **.5** Information pertaining to the Contractor's place of storage, the layout and security of the place of storage, and such information that verifies that the materials are securely stored at the place of storage.
- **.6** Subsequent Applications for Payment shall itemize the materials and their cost which were approved on

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previous Applications for Payment and remain in off-site storage.

...

§ 9.4.1 The Architect ~~will, within seven days after receipt of the Contractor's Application for Payment,~~ will either (1) issue to the Owner a Certificate for Payment in the full amount of the Application for Payment, with a copy to the Contractor; or (2) issue to the Owner a Certificate for Payment for such amount as the Architect determines is properly due, and notify the Contractor and Owner of the Architect's reasons for withholding certification in part as provided in Section 9.5.1; or (3) withhold certification of the entire Application for Payment, and notify the Contractor and Owner of the Architect's reason for withholding certification in whole as provided in Section 9.5.1.
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§ 9.5.2 When ~~either party~~ the Contractor disputes the Architect's decision regarding a Certificate for Payment under Section 9.5.1, in whole or in part, ~~that party~~ the Contractor may submit a Claim in accordance with Article 15.

...

§ 9.5.4 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 supplier 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 Contractor shall reflect such payment on its next Application for Payment.~~Contractor disputes a determination by the Architect with regard to a Certificate of Payment, and during any related dispute resolution, litigation, or other proceeding, the Contractor nevertheless shall continue to prosecute the Work.

...

§ 9.6.2 The Contractor shall pay each Subcontractor, no later than ~~seven days~~ the timeline set forth in Ohio Revised Code 4113.61, 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.~~[Intentionally Deleted].
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§ 9.6.8 Provided the Owner has fulfilled its payment obligations under the Contract Documents, the Contractor shall defend and indemnify the Owner from all loss, liability, damage or expense, including reasonable attorney's fees and litigation expenses, arising out of any lien claim or other claim for payment by any Subcontractor or supplier of any ~~tier. Upon receipt of notice of a lien claim or other claim for payment, the Owner shall notify the Contractor. If approved by the applicable court, when required, the Contractor may substitute a surety bond for the property against which the lien or other claim for payment has been asserted.~~tier, including but not limited to claims for unjust enrichment. In the event that the Owner receives a claim affidavit in accordance with Ohio Revised Code Chapter 1311 relating to amounts due and unpaid for labor and work performed and material furnished for the Work, the Owner shall detain the amount due and owing from the Contractor unless and until the claim is released and/or discharged as more particularly set forth in said Chapter 1311. Posting a bond or other security discharging a lien shall not relieve the Contractor of its indemnity obligations in this Section.

...

If the ~~Architect does not issue a Certificate for Payment,~~ Owner, 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,~~ Agreement, the amount certified by the Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days' notice to the Owner and

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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.~~received provided that Contractor shall not stop Work for non-payment if the Owner initiates the payment process for any undisputed amounts due the Contractor.

...

§ 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~~ Documents, including all necessary testing and/or startup, and when all required occupancy permits and any other necessary permits and approvals, if any, have been issued, so that the Owner can occupy or utilize the Work for its intended ~~use.~~use, subject only to the completion or correction of minor items of Work that will not interfere with or hinder the Owner's use of the Work and areas adjacent to the Project site.

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is ~~substantially complete,~~ 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 or correct 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.~~ 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. The Contractor shall pay all costs incurred by the Architect, Owner and Separate Contractors for costs due to excessive inspections without fault of the Architect or Owner. Unless otherwise provided in the Contract Documents, inspections to determine Substantial Completion in excess of one (1) without the fault of the Architect or Owner shall be deemed excessive.

§ 9.8.4 When the Work or designated portion thereof is ~~substantially complete,~~ Substantially Complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion; establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance; and fix the time within which the Contractor shall finish all items on the list accompanying the Certificate (the "punch list"), or, if no timeframe is fixed, then not greater than thirty (30) days from the date of the Certificate. Failure to include an item on the Certificate and punch list does not alter the responsibility of the Contractor to complete or correct deficiencies in the Work in accordance with the Contract Documents. 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 the Certificate. Upon such acceptance, and consent of surety if any, and following certification of an Application for Payment, the Owner shall make payment of retainage ~~applying to the 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.~~as set forth in the Agreement.

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§ 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 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,~~ 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,~~ Substantially Complete, the Contractor shall prepare and

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submit a list to the Architect as provided under Section 9.8.2. Consent of 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.

...

§ 9.9.3 Unless otherwise agreed ~~upon,~~ upon in writing, 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.

...

§ 9.10.1 Upon receipt of the Contractor's 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. 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 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. The Contractor shall pay all costs incurred by the Architect, Owner and Separate Contractors for costs due to excessive inspections without fault of the Architect or Owner. Unless otherwise provided in the Contract Documents, inspections to determine final completion in excess of one (1) without the fault of the Architect or Owner shall be deemed excessive.

§ 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~~ the Project (less amounts withheld by Owner) have been paid or otherwise ~~satisfied,~~ satisfied (unless a different form is agreed to, Contractor shall provide the AIA Document G-706, Contractors Affidavit of Payment of Debts and Claims and AIA Document G-706A, Contractors Affidavit of Release of Liens), (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect, (3) a written statement ~~that the Contractor knows of no reason~~ that the insurance will ~~not~~ be renewable to cover the period required by the Contract Documents, (4) consent of the Contractor's surety, if any, to final payment, (5) documentation of any special warranties, such as manufacturers' warranties or specific Subcontractor warranties, ~~and (6)~~ (6) all documents and items required to be submitted by Contractor in accordance with the Contract Documents which shall include those items set forth in Section 3.11 which have not previously been delivered to Owner, (7) unconditional lien waivers and releases from Contractor and all Subcontractors and suppliers; and (8) if required by the Owner, other data establishing payment or satisfaction of ~~obligations, such as receipts and releases and waivers of liens, claims, security interests, or encumbrances arising out of the Contract,~~ obligations 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, claim, security interest, or encumbrance. If a lien, claim, security interest, or encumbrance 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 the lien, claim, security interest, or encumbrance, including all costs and reasonable attorneys' fees.

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

...

.3 terms of special warranties and guarantees required by the Contract Documents; ~~or~~

.4 audits performed by the Owner, if permitted by the Contract Documents, after final ~~payment.~~payment; or

.5 claims, damages, losses or expenses for indemnification.

...

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The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Contract. The Contractor's safety program shall be written and a copy maintained at the Project site for inspection, upon request. Neither the Owner nor the Architect accept any responsibility or liability for the safety of the Contractor's employees or for enforcing the Contractor's safety program. Additionally, Contractor shall comply with the Owner's rules, regulations, and policies including, but not limited to, the Owner's safety, health, and infection control policies and programs.

...

.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, a Subcontractor, or a Sub-subcontractor; ~~and~~

.3 other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures, benchmarks, monuments, other reference points, and utilities not designated for removal, relocation, or replacement in the course of ~~construction.~~construction; and

.4 construction or operations by the Owner and Separate Contractors.

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§ 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 give Owner and Architect reasonable advance notice thereof and shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

...

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, notice of the 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 and names of witnesses to enable the other party to investigate the matter.

§ 10.2.9 If a Separate Contractor incurs damages resulting from the Contractor's performance of its Work, and the Contractor fails to remedy the damage or to reimburse the Separate Contractor for its damages, then the Owner reserves the right to pay the Separate Contractor suffering the damage and deduct such amounts from the amount due the Contractor.

§ 10.2.10 The Contractor acknowledges that the safety of the public and of the employees, invitees and guests of the Owner is of the utmost importance. While the Contractor is at the Project site, the Contractor will take no action that would jeopardize the safety of the public and of the Owner's employees, invitees or guests and, without the Owner's written approval, shall take no action that would interfere with the Owner's activities. The Owner reserves the right to require the Contractor and its employees to wear identification (subject to applicable safety standards), to stay in designated Work areas at all times while on the Owner's property and to record on a log a person's presence immediately upon entering the Owner's property. The Owner shall have the right to effect the immediate removal of a person from the Project site for failure to wear identification, for being outside a designated work area, for fraternizing with or engaging in any inappropriate behavior directed toward or in the vicinity of employees, invitees or guests of the Owner or for other good cause shown.

§ 10.2.11 The Contractor shall be enrolled in and remain in good standing in the Ohio Bureau of Workers' Compensation Drug-Free Safety Program or a comparable program approved by the Bureau that meets the requirements of Ohio Revised Code 153.03. Contractor shall comply with and shall require its Subcontractors to comply with the Ohio Bureau of Workers' Compensation's Drug-Free Workplace Program requirements under Revised Code 153.03(E), and Contractor shall include language in its subcontractual agreements mandating that each Subcontractor require Sub-subcontractors to similarly comply with the Ohio Bureau of Workers' Compensation's Drug-Free Workplace Program requirements.

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§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials or substances. If the Contractor encounters a hazardous material or substance that is concealed or 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

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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 notify the Owner and Architect of the condition.

§ 10.3.2 Upon receipt of the Contractor's notice, the Owner shall obtain or cause to be obtained 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 the material or substance or who are to perform the task of removal or safe containment of the 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, 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.~~ The Work in the affected area shall be resumed immediately following the occurrence of any one of the following events: (i) the Owner causes remedial work to be performed that results in the absence of the materials or substances or renders the material or substance harmless as evidenced by a written report which is prepared by an environmental consultant retained by Owner, or (ii) the Owner and the Contractor, by written agreement, decide to resume performance of the Work, or (iii) the Work may safely and lawfully proceed, as determined by an appropriate governmental authority. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum ~~shall be increased by~~ equitably adjusted based on the amount of the Contractor's reasonable additional costs of shutdown, delay, and start-up.

§ 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.~~[Intentionally Deleted].

§ 10.3.4 The Owner shall not be responsible under this Section 10.3 for hazardous 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 hazardous 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. Hazardous materials or substances to be used at the Project site by Contractor shall be identified by a Safety Data Sheet. The Contractor shall assemble all of its applicable Safety Data Sheet in a notebook and submit it to the Architect for its information prior to a hazardous material or substance being brought to the Project site. The Contractor shall maintain all Safety Data Sheet notebooks at the Project site for the duration of the Project.

...

§ 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 reimburse the Contractor for all cost and expense thereby incurred.~~[Intentionally Deleted].

...

§ 11.1.1 The Contractor shall purchase ~~and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Contractor shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Owner, Architect, and Architect's consultants shall be named as additional insureds under the Contractor's commercial general liability policy or as otherwise described in the Contract Documents.~~from and maintain in a company or companies rated A- or higher by Best Insurance Reports and lawfully authorized to do business in the

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State of Ohio 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.

§ 11.1.2 The ~~Contractor shall provide surety bonds of the types, for such penal sums, and subject to such terms and conditions as required by the Contract Documents. The Contractor shall purchase and maintain the required bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.~~insurance required by Section 11.1.1 shall include and shall be written for not less than the following, or as required by law, whichever coverage is greater.

.1 Workers' Compensation: Statutory

.2 Employer's Liability: (1) an each-accident limit of not less than $1,000,000, (2) a disease each-employee limit of not less than $1,000,000, and (3) a disease policy limit of not less than $1,000,000;

.3 Commercial General Liability ("CGL"): (1) an each-occurrence limit of not less than $2,000,000, (2) a general-aggregate limit of not less than $2,000,000, and (3) a products and completed-operations aggregate limit of not less than $2,000,000. The CGL insurance shall provide at least equivalent coverage for liability arising from premises, operations, independent contractors, products/completed-operations (shall not exclude coverage to the additional insured(s) for bodily injury or property damage), personal and advertising injury, and liability assumed under an insured contract. The CGL insurance shall not exclude coverage for damage to electronic data. The CGL policy shall be endorsed providing equivalent coverage to provide that the general aggregate limit applies separately to each of the insured's projects;

.4 Automobile Liability: covering all owned, non-owned, and hired vehicles used in connection with the Work: Bodily injury (including death and emotional distress) and property damage with a combined single limit of $1,000,000 each accident;

.5 Umbrella/Excess Liability: Such policies shall be supplemented by an umbrella policy of additional protection in the amount of $5,000,000 aggregate;

.6 If the Contractor is required to furnish professional services as part of the Work, the Contractor shall maintain Professional Liability Insurance covering performance of the professional services, with policy limits of not less than $1,000,000 per claim and $1,000,000 in the aggregate; and

.7 Pollution Liability: If the Work includes environmentally sensitive, hazardous types of activities (such as demolition, exterior insulation finish systems, asbestos abatement, storage-tank removal, or similar activities), or involves hazardous materials, the Contractor shall maintain a contractor's pollution liability policy with (1) a per-claim limit of not less than $1,000,000 and (2) an annual-aggregate limit of not less than $1,000,000, covering the acts, errors and/or omissions of the Contractor for damages (including from mold) sustained by the Owner by reason of the Contractor's performance of the Work. The policy shall have an effective date, which is on or before the date of commencement of the Work.

The Contractor shall maintain required coverages without interruption from the date of commencement of the Work and for not less than five years following Substantial Completion. The Contractor shall pay all deductibles, self-insured retentions, or both contained in the policies of insurance. The Contractor shall continue to provide evidence of coverage to the Owner on an annual basis during the aforementioned period.

§ 11.1.3 ~~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.~~The Contractor shall submit to the Architect and the Owner a copy of certificates of insurance prior to commencement of the Work. Certificates shall include each and every type of coverage specified. Such certificates shall name the Owner and Architect as additional insureds and shall contain a statement that the Owner will be notified 30 days prior to the cancellation of any insurance policy evidenced by this certificate. The additional insureds requirements of this Section shall include completed and ongoing operations and Contractor shall provide additional insured endorsements. An additional certificate evidencing continuation of liability coverage, including coverage for completed and ongoing operations, shall be submitted with the final Application for Payment as required by Section 9.10.2. 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 if and to the extent required to meet the insurance requirements of this Section 11.1. All renewal and replacement policies shall comply with the requirements of this Section 11.1. A failure of the Owner to request a certificate or other evidence of compliance with the insurance requirements or a

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failure of the Owner to identify a deficiency from evidence that is provided shall not be construed as a waiver of the Contractor's obligation to maintain the required insurance.

§ 11.1.4 ~~Notice of Cancellation or Expiration of Contractor's Required Insurance.~~ ~~Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by the Contract Documents, the Contractor shall provide notice to the Owner of such impending or actual cancellation or expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage.~~The Contractor shall cause all Subcontractors to provide Workers' Compensation, Comprehensive General Liability, and Automobile Liability Insurance with commercially reasonable limits and certificates of insurance related thereto. Such certificates shall name the Owner and Architect as additional insureds.

~~§ 11.2 Owner's Insurance~~

§ 11.1.5 The Contractor shall not commence Work under the Contract until the Contractor has obtained and provided proof of all insurance required under this heading.

§ 11.1.6 All liability policies required in this Section 11.1 shall be primary and non-contributory with respect to any other insurance or self-insurance programs that cover the Owner or an additional insured.

§ 11.1.7 If Contractor fails to purchase and/or maintain any insurance required under Section 11.1, the Owner may, but shall not be obligated to, upon seven (7) days written notice to Contractor, purchase such insurance on behalf of the Contractor and shall be entitled to be reimbursed by the Contractor upon demand.

§ 11.1.8 Performance Bond and Payment Bond

§ 11.1.8.1 The Contractor shall furnish bonds as required in the Agreement between Owner and Contractor.

§ 11.1.8.2 The Contractor shall keep the surety informed of the progress of the Work, and, where necessary, obtain the surety's consent to, or waiver of, (i) notice of changes in the Work; (ii) request for reduction or release of retainage; (iii) request for final payment; and (iv) any other item required by the surety. The Owner shall be notified by the Contractor, in writing, of all communications with the surety. The Owner may, in the Owner's sole discretion, inform the surety of the progress of the Work and obtain consents as necessary to protect the Owner's rights, interests, privileges and benefits under and pursuant to any bond issued in connection with the Work. The Contractor shall be notified by the Owner, in writing, of any communications with the surety.

§ 11.1.8.3 If at any time any surety providing bonds for the Project (1) is adjudged bankrupt or has made a general assignment for the benefit of its creditors; (2) has liquidated all assets or has made a general assignment for the benefit of its creditors; (3) is placed in receivership; (4) otherwise petitions a state or federal court for protection from its creditors; or (5) allows its license to do business in Ohio to lapse or to be revoked, then the Contractor shall immediately, but no later than 21 days of any such action listed above, provide the Owner with new bonds in the form and amount required under the Contract.

§ 11.2 Property Insurance

§ 11.2.1 ~~The Owner shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Owner shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located.~~ Unless otherwise provided in the Agreement, 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. 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 or until no person or entity other than the Owner has an insurable interest in the property required by this Section to be covered, whichever is later.

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~~**§ 11.2.2 Failure to Purchase Required Property Insurance.** If the Owner fails to purchase and maintain the required property insurance, with all of the coverages and in the amounts described in the Agreement or elsewhere in the Contract Documents, the Owner shall inform the Contractor in writing prior to commencement of the Work. Upon receipt of notice from the Owner, the Contractor may delay commencement of the Work and may obtain insurance that will protect the interests of the Contractor, Subcontractors, and Sub-Subcontractors in the Work. When the failure to provide coverage has been cured or resolved, the Contract Sum and Contract Time shall be equitably adjusted. In the event the Owner fails to procure coverage, the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent the loss to the Owner would have been covered by the insurance to have been procured by the Owner. The cost of the insurance shall be charged to the Owner by a Change Order. If the Owner does not provide written notice, and the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain the required insurance, the Owner shall reimburse the Contractor for all reasonable costs and damages attributable thereto.~~

~~**§ 11.2.3 Notice of Cancellation or Expiration of Owner's Required Property Insurance.** Within three (3) business days of the date the Owner becomes aware of an impending or actual cancellation or expiration of any property insurance required by the Contract Documents, the Owner shall provide notice to the Contractor of such impending or actual cancellation or expiration. Unless the lapse in coverage arises from an act or omission of the Contractor: (1) the Contractor, upon receipt of notice from the Owner, shall have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by either the Owner or the Contractor; (2) the Contract Time and Contract Sum shall be equitably adjusted; and (3) the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent any loss to the Owner would have been covered by the insurance had it not expired or been cancelled. If the Contractor purchases replacement coverage, the cost of the insurance shall be charged to the Owner by an appropriate Change Order. The furnishing of notice by the Owner shall not relieve the Owner of any contractual obligation to provide required insurance.~~

§ 11.2.1.1 Property insurance shall be on an "all-risk" or equivalent policy form and shall include 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, tornado, flood, windstorm, explosion, breakage of glass, falsework, testing and startup, temporary buildings and structures, materials used in the construction process, hot and cold testing, 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. Coverage shall include a provision to pay the reasonable extra costs of acceleration and expediting temporary and permanent repairs to, or permanent replacement of, damaged property (including overtime wages directly incurred to accelerate restoration or repair of the damaged property, and the extra costs that are directly incurred to rapidly transport materials and supplies necessary to the repair or replacement); soft costs coverage to the extent commercially available to comparable insureds, including the reasonable direct costs incurred by Architect and/or Contractor as a result of a property damage loss covered by the policy; and provisions for mechanical or electrical breakdown, or boiler system testing. Coverage shall be primary to all other applicable insurance. Notwithstanding any of the foregoing, the insurance shall include coverage only for those costs incurred as a direct result of direct physical damage to property otherwise covered by the policy; business income, business interruption, home office overhead, and lost productivity costs of Contractor or any subcontractor at any tier shall not be covered.

§ 11.2.1.2 If the property insurance requires minimum deductibles, the Contractor shall pay costs not covered by the insurance because of such deductibles.

§ 11.2.1.3 This property insurance shall cover portions of the Work stored off the site after written approval of the Owner at the value established in the approval, and also portions of the Work in transit.

§ 11.2.1.4 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 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.

§ 11.2.1.5 The insurance required by this Section 11.2 is not intended to cover machinery, tools, apparatus, scaffolding, hoists, forms, staging, shoring or other equipment owned or rented by the Contractor which are utilized in

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the performance of the Work but not incorporated into the permanent improvements. The Contractor shall, at the Contractor's own expense, provide insurance coverage for owned or rented machinery, tools or equipment.

§ 11.3 ~~Waivers of Subrogation~~**WAIVERS OF SUBROGATION**

The Contractor waives all rights against the Owner and their agents and employees for damages to the extent covered by any insurance, except rights to the proceeds of that insurance. All policies shall accomplish the waiver of subrogation by endorsement or otherwise. Contractor shall require of its Subcontractors, by appropriate written agreements, similar waivers each in favor of the Owner and Contractor; all Sub-subcontractors at every tier shall also be bound by and comply with this same requirement in their respective agreements.

~~**§ 11.3.1** The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents, and employees, each of the other; (2) the Architect and Architect's consultants; and (3) Separate Contractors, 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 those losses are covered by property insurance required by the Agreement or other property insurance applicable to the Project, except such rights as they have to proceeds of such insurance. The Owner or Contractor, as appropriate, shall require similar written waivers in favor of the individuals and entities identified above from the Architect, Architect's consultants, Separate Contractors, subcontractors, and sub-subcontractors. The policies of insurance purchased and maintained by each person or entity agreeing to waive claims pursuant to this section 11.3.1 shall not prohibit this waiver of subrogation. This waiver of subrogation shall be effective as to a person or entity (1) even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, (2) even though that person or entity did not pay the insurance premium directly or indirectly, or (3) whether or not the person or entity had an insurable interest in the damaged property.~~

~~**§ 11.3.2** 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, to the extent permissible by such policies, the Owner waives all rights in accordance with the terms of Section 11.3.1 for damages caused by fire or other causes of loss covered by this separate property insurance.~~

~~**§ 11.4 Loss of Use, Business Interruption, and Delay in Completion Insurance**~~

~~The Owner, at the Owner's option, may purchase and maintain insurance that will protect the Owner against loss of use of the Owner's property, or the inability to conduct normal operations, due to fire or other causes of loss. The Owner waives all rights of action against the Contractor and Architect for loss of use of the Owner's property, due to fire or other hazards however caused.~~

~~**§11.5 Adjustment and Settlement of Insured Loss**~~

~~**§ 11.5.1** A loss insured under the property insurance required by the Agreement 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 11.5.2. The Owner shall pay the Architect and Contractor their just shares of insurance proceeds received by the Owner, and by appropriate agreements the Architect and Contractor shall make payments to their consultants and Subcontractors in similar manner.~~

~~**§ 11.5.2** Prior to settlement of an insured loss, the Owner shall notify the Contractor of the terms of the proposed settlement as well as the proposed allocation of the insurance proceeds. The Contractor shall have 14 days from receipt of notice to object to the proposed settlement or allocation of the proceeds. If the Contractor does not object, the Owner shall settle the loss and the Contractor shall be bound by the settlement and allocation. Upon receipt, the Owner shall deposit the insurance proceeds in a separate account and make the appropriate distributions. Thereafter, if no other agreement is made or the Owner does not terminate the Contract for convenience, the Owner and Contractor shall execute a Change Order for reconstruction of the damaged or destroyed Work in the amount allocated for that purpose. If the Contractor timely objects to either the terms of the proposed settlement or the allocation of the proceeds, the Owner may proceed to settle the insured loss, and any dispute between the Owner and Contractor arising out of the settlement or allocation of the proceeds shall be resolved pursuant to Article 15. Pending resolution of any dispute, the Owner may issue a Construction Change Directive for the reconstruction of the damaged or destroyed Work.~~

§ 11.4 A loss insured under the Owner's property insurance shall be adjusted by the Owner in good faith and made payable to the Owner for the insureds, as their interests may appear. The Contractor shall pay Subcontractors their just

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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-subcontractors in similar manner. The Owner in good faith shall have power to adjust and settle a loss with insurers.

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§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, ~~if, within~~ for a period of 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 any applicable special warranty required by the Contract Documents, any of the Work is found to be~~ thereof, the Contractor shall correct any of the Work that is found defective in workmanship, materials or not in accordance with the requirements of the Contract ~~Documents, the Contractor shall correct it promptly after receipt of 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.~~ Documents. If defective or nonconforming Work becomes apparent within the one-year period, the Owner shall notify the Contractor in writing. Within fourteen (14) days of receipt of said notice, the Contractor shall visit the Project in the company of one or more representatives of the Owner to determine the extent of the defective or nonconforming Work. If the defective or nonconforming Work is considered by the Owner to be an emergency, the Owner may require the Contractor to visit the Project within one (1) calendar day or less of receipt of said notice. The Contractor shall promptly repair or replace the defective or nonconforming Work, including all adjacent Work damaged as a result of such defective or nonconforming Work. The Contractor shall be fully responsible for the cost of temporary materials, facilities, utilities or equipment required during the repair or replacement of the defective or nonconforming Work. If the Contractor fails to correct defective or 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 2.5.

§ 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.~~With respect to items of Work that are corrected, completed or first performed after Substantial Completion but prior to final completion of the Project, including completed punch list items, the one-year period with respect to these items shall commence upon correction or completion of the item.

§ 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.~~One month prior to the end of the one (1) year period, the Contractor shall attend a walk-through of the Project scheduled by the Architect.

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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. The acceptance of nonconforming Work by the Owner shall be by written Change Order.

...

The Contract shall be governed by the ~~law of the place where the Project is located, excluding that jurisdiction's choice of law rules. If the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.~~laws of the State of Ohio. Any suit, which may be brought to enforce any provision of this Agreement or any remedy with respect hereto, shall be brought in the Common Pleas Court of the County where the Project is located which shall have exclusive jurisdiction to the exclusion of all other jurisdictions. The applicable statutes of limitations and repose under Ohio law shall apply to all causes of action between the Owner and Contractor.

...

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§ 13.3.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder are cumulative and shall be in addition to and not a limitation of duties, obligations, rights, and remedies otherwise imposed or available by law.
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§ 13.4.1 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 be present at and shall give the Architect timely notice of when and where tests and inspections are to be ~~made~~ made, including intermediate and final inspections, so that the Architect may be present for such procedures. The Owner shall bear costs of tests, inspections, or approvals that do not become requirements until after bids are received or negotiations concluded. The Owner shall directly arrange and pay for tests, inspections, or approvals where building codes or applicable laws or regulations so require.

...

§ 13.4.3 If procedures for testing, inspection, or approval under Sections 13.4.1 and 13.4.2 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. The Contractor also agrees the cost of testing services required for the convenience of the Contractor in the scheduling and performance of the Work, and the cost of testing services related to remedial operations performed to correct deficiencies in the Work, shall be borne by the Contractor.

...

§ 13.4.7 Any reports or documents resulting from tests, inspections and approvals required under this Section 13.4 shall be submitted to the Owner and Architect.

Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at the rate ~~the parties agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.~~set forth in the Agreement.

§ 13.6 Training Sessions
The Contractor will participate in training sessions for the Owner in cooperation with the Architect, Owner, Owner's personnel and consultants and the Contractor will participate in tests in cooperation with the Architect, Owner, Owner's personnel and consultants to the extent applicable to the Contractor's Work.

§ 13.7 Equal Opportunity
§ 13.7.1 The Contractor shall comply with applicable law regarding equal employment opportunity, including Ohio Revised Code Section 153.59. The Contractor shall cooperate fully with the State's Equal Opportunity Coordinator, with any other official or agency of the state or federal government that seeks to eliminate unlawful employment discrimination, and with all other state and federal efforts to assure equal employment practices under the Contract. The Contractor agrees to the following:

§ 13.7.1.1. That, in the hiring of employees for the performance of Work under the Contract or any Subcontract, Contractor and any Subcontractor or person acting on Contractor's or a Subcontractor's behalf shall not discriminate against any citizen of the state who are qualified and available to perform the services to which the employment relates by reason of race, color, religion, sex, age, disability, military status as defined in section 4112.01 of the Revised Code, veteran status, national origin, ancestry, sexual orientation, gender identity (including gender expression), marital status or genetics; and

§ 13.7.1.2. That Contractor and any Subcontractor or person acting on Contractor's or a Subcontractor's behalf shall not in any manner discriminate against, intimidate, or retaliate against any employee hired for the performance of services under the Contract on account of race, color, religion, sex, age, disability, military status, veteran status, national origin, ancestry, sexual orientation, gender identity (including gender expression), marital status or genetics.

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§ 13.7.2. In the event the Contractor fails to comply with these nondiscrimination clauses, the Contractor shall be subject to the forfeiture requirements of Ohio Revised Code Section 153.60.

§ 13.7.3 Hiring Under State Public Improvement Contracts. Any provision of a hiring hall contract or agreement which obligates the Contractor to hire, if available, only employees referred to the Contractor by a labor organization shall be void as against public policy and unenforceable with respect to employment under any public improvement contract unless at the date of execution of the hiring hall contract or agreement, or within thirty (30) days thereafter, the labor organization has procedures in effect for referring qualified employees for hire without regard to race, color, religion, national origin, military status as defined in Ohio Revised Code Section 4112.01, or ancestry and unless the labor organization includes in its apprentice and journeyperson's membership, or otherwise has available for job referral without discrimination, qualified employees, both whites and non-whites (including African-Americans).

§ 13.8 The table of contents, titles, headings, running headlines and marginal notes contained in the Contract are solely to facilitate reference to various provisions of the Contract Documents and in no way affect, limit or describe or limit the interpretation of the provisions to which they refer.

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§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of ~~30~~ 75 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, 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; or

.2 An act of government, such as a declaration of national emergency, that requires all Work to be stopped; or

.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~~Documents.

.4 ~~The Owner has failed to furnish to the Contractor reasonable evidence as required by Section 2.2.~~[Intentionally Deleted].

...

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon ~~seven~~ thirty days' notice to the Owner and Architect, terminate the Contract provided that the reason for the termination is not cured within the thirty-day period and recover from the Owner payment for Work ~~executed, as well as reasonable~~ executed as of the date of termination, but not overhead and profit on Work not ~~executed, and costs incurred by reason of such termination.~~ executed and not to exceed the Contract Sum (however, if such reason for termination cannot reasonably be cured within the thirty-day period, then Contractor shall not terminate the Contract so long as Owner commences to cure the reason for termination within such thirty-day period and diligently pursues such cure).

~~**§ 14.1.4** If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, or their agents or employees or any other persons or entities performing portions of the Work 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' notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.~~

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.2 fails to make payment to Subcontractors or suppliers in accordance with the respective agreements between the Contractor and the Subcontractors or ~~suppliers;~~Suppliers;

...

.4 otherwise is ~~guilty of substantial~~ in material breach of a provision of the Contract Documents.

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§ 14.2.2 When any of the reasons described in Section 14.2.1 exist, ~~and upon certification by~~ the ~~Architect that sufficient cause exists to justify such action, the~~ Owner 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' notice, ~~terminate employment of the Contractor and may, subject to any prior rights of the surety:~~and provided that the reason for the termination is not cured within the seven-day period, terminate employment of the Contractor and/or exercise the following non-exclusive remedies which will be cumulative:

...

.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~~ general accounting of the costs incurred by the Owner in finishing the Work.

...

§ 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.~~ then Contractor shall be paid for Work that it satisfactorily performed prior to the date of termination but not to exceed such excess unpaid balance. If such costs and damages exceed the unpaid balance, the Contractor and the Contractor's surety 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.

§ 14.2.5 Should the Owner terminate this Agreement for cause under this Section 14.2, but that cause be subsequently found insufficient to support termination, the termination shall be deemed one of convenience under Section 14.4.

§ 14.2.6 If the Contract is terminated for cause, the Contractor's surety may perform the Contract. If the Contractor's surety does not commence performance of the Contract within ten (10) days of the date of Contract termination, the Owner may complete the Work by means the Owner determines appropriate. If the Contractor's surety performs the Work, the provisions of the Contract Documents govern the surety's performance, with the surety in place of the Contractor in all provisions including, but not limited to, provisions for payment for the Work, and provisions of the right of the Owner to complete the Work.

...

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

...

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

§ 14.4.2 Upon receipt of notice from the Owner of such termination for the Owner's convenience, the Contractor shall with respect to the Work that is terminated:

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.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.~~orders; and

.4 deliver to Owner all Project-related documents and work product of Contractor and its Subcontractors related to the Work.

§ 14.4.3 ~~In case of such termination for the Owner's convenience, the Owner shall pay the Contractor for Work properly executed; costs incurred by reason of the termination, including costs attributable to termination of Subcontracts; and the termination fee, if any, set forth in the Agreement.~~If the Contract is terminated in accordance

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with this Section 14.4, the Owner will pay the Contractor, i) for Work performed under the Contract up to the date the notice of termination is received by the Contractor at the rates for Work performed under the Contract, including overhead and profit up to the date of termination and reasonable expenses directly attributable to the termination, but not for overhead or lost profit on unperformed Work, ii) for Work performed at the direction of the Owner on and after the date on which the notice of termination is received by the Contractor, as determined by the procedures applicable to Construction Change Directives, and iii) for Work necessary to protect and preserve the Work, as determined by the procedures applicable to Construction Change Directives. .

§ 14.4.4 The termination of the Contract under this Section 14.4 shall be without prejudice to rights or remedies which exist at the time of termination.

§ 14.5 Contractor Insolvency
§ 14.5.1 The Owner may immediately terminate the Agreement for cause if:

§ 14.5.1.1 the Contractor commences a voluntary case under Title 11 of the United States Code or the corresponding provisions of any successor laws; or

§ 14.5.1.2 any legal entity commences an involuntary case against the Contractor under Title 11 of the United States Code or the corresponding provisions of any successor laws and (1) the case is not dismissed within 60 days after its commencement; or (2) the court before which the case is pending issues an order for relief or similar order approving the case; or

§ 14.5.1.3 a court of competent jurisdiction appoints, or the Contractor makes an assignment of all or substantially all of its assets to, a receiver, trustee, liquidator, or other similar custodian for the Contractor or all or substantially all of the Contractor's assets; or

§ 14.5.1.4 any attachment, execution, or other judicial seizure is levied against all or substantially all of the Contractor's assets; or

§ 14.5.1.5 the Contractor takes any action toward the dissolution or winding up of its business; or

§ 14.5.1.6 the Contractor fails generally to pay its debts as they become due (unless those debts are subject to a good-faith dispute as to liability or amount) or it acknowledges in writing that it is unable to do so.

§ 14.5.2 If the Contractor files a voluntary petition in bankruptcy or has an involuntary petition in bankruptcy filed against it, the Contractor, the Contractor as the debtor-in-possession, or the trustee of the Contractor's bankruptcy estate shall file a motion to assume or reject the Contract under Bankruptcy Code §365, 11 U.S.C. §365, within 20 days after the filing of the voluntary petition or involuntary petition and shall diligently prosecute that motion to conclusion so as to obtain an order granting or denying that motion within 45 days after the filing of the voluntary or involuntary petition.

§ 14.5.3 If the Owner intends to exercise its termination rights under this Section 14.5, the Owner shall notify the Contractor in writing of the Owner's termination of the Contract and the cause(s) for that termination.

§ 14.5.4 The Contractor agrees to the granting of relief from the automatic stay of the Bankruptcy Code, 11 U.S.C. §362(a), to permit the Owner to terminate the Contract for cause in such instance and issue and serve all notices necessary to terminate the Contract or arising out of the termination of the Contract and to take any and all other action necessary to terminate the Contract.
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A Claim is a demand or assertion by ~~one of the parties~~ the Contractor seeking, as a matter of right, payment of money, a change in the Contract Time, 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~~ asserted by the Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the ~~party making the Claim. This Section 15.1.1~~ Contractor. The Contract, including but not limited to this Article 15 does not require the Owner to ~~file a Claim in order to impose liquidated damages~~ make a claim, dispute, demand or assertion against the Contractor for the payment of money, a change in the Contract Time or other relief or in order for the Owner to exercise its rights and remedies

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against the Contractor, including but not limited to the remedying of a Contractor default, the imposition of liquidated damages and binding dispute resolution in accordance with the Contract Documents.

~~**§ 15.1.2 Time Limits on Claims**~~

~~The Owner and Contractor shall commence all Claims and causes of action against the other and arising out of or related to the Contract, whether in contract, tort, breach of warranty or otherwise, in accordance with the requirements of the binding dispute resolution method selected in the Agreement and within the 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 15.1.2.~~

§ 15.1.2 Time Limits on Causes of Action

The Owner and Contractor shall commence all causes of action against the other and arising out of or related to the Contract, whether in contract, tort, breach of warranty or otherwise, in accordance with the requirements of the binding dispute resolution method selected in the Agreement and within the period specified by applicable statute of limitation and repose. The Owner and Contractor waive all causes of action not commenced in accordance with this Section 15.1.2.

§ 15.1.3.1 Time Limit on Claims. Claims by ~~either the Owner or~~ Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the ~~other party~~ Owner 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~~ the Contractor under this Section 15.1.3.1 shall be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after ~~the claimant~~ Contractor first recognizes the condition giving rise to the Claim, whichever is later. Failure to submit proper and timely notice in accordance with this Section shall constitute a waiver and abandonment of the Claim by Contractor.

§ 15.1.3.2 ~~Claims by either the Owner or Contractor,~~ Contractor Claims and claims by the Owner, where the condition giving rise ~~to the Claim~~ is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party. In such event, no decision by the Initial Decision Maker is required.

...

§ 15.1.6.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather ~~conditions~~ conditions, as recorded at the government-controlled weather-recording facility nearest to the Project site, were abnormal for the period of time, could not have been reasonably anticipated, and had an adverse effect on the scheduled construction.

§ 15.1.6.3 The Contractor shall not be entitled to a separate increase in the Contract Time for each one of the number of causes of delay which may have concurrent or interrelated effects on the progress of the Work, or for concurrent delays due to the fault of the Contractor

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

...

.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.~~profit.

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 15.1.7 shall be deemed to preclude assessment of liquidated damages, when applicable, in accordance with the requirements of the Contract ~~Documents.~~Documents, nor shall this Section 15.1.7 apply to a party's gross negligence, willful misconduct or indemnity obligations.

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§ 15.1.8 Substantiation and Certification of Claim

§ 15.1.8.1 Substantiation of Claim. Within fifteen (15) days after the initiation of a Claim by Contractor, the Contractor shall substantiate its Claim by providing the following minimum written information to Owner: (i) a narrative of the circumstances which gave rise to the Claim, including, without limitation, the start date of the event or events and the actual, or anticipated, finish date; (ii) detailed identification of the Work affected by the event giving rise to the Claim; (iii) copies of the Contractor's daily log for each day of impact; (iv) copies of relevant correspondence and other information regarding or supporting Contractor's entitlement; (v) copies of the Contractor's most recent income statement, including segregated general and administrative expenses for the most recent reporting period, and for the period of the Contract, if available, and similar information for any Subcontractor claim included; (vi) if the Claim is for additional cost, the amount of the Claim, the information specified in Section 15.1.5 herein and a statement that the increase requested is the entire increase in the Contract Sum associated with the Claim; (vii) if the Claim is for additional Contract Time, the information specified in Section 15.1.6 herein. Contractor shall also provide such additional information as requested by Owner or Architect to substantiate the Contractor's Claim within ten (10) days following request. The Contractor shall provide the required information in the formats requested, which include both paper and electronic copies. The Contractor's failure to comply with the requirements of this Section shall constitute an irrevocable waiver of the Claim.

§ 15.1.8.2 Certification of Claim. Within fifteen (15) days after the initiation of the Claim by Contractor, the Contractor shall certify its Claim by providing the notarized certification, signed and dated by the Contractor, as follows: "The undersigned Contractor certifies that the Claim is made in good faith; that the supporting data is accurate and complete to the best of the Contractor's knowledge and belief; that the amount requested is a fair, reasonable, and necessary adjustment for which the Contractor believes the Owner is liable; and that the undersigned is duly authorized to certify the Claim on behalf of the Contractor." The Contractor's failure to comply with the requirements of this Section shall constitute an irrevocable waiver of the Claim.

...

§ 15.2.1 Contractor Claims, excluding those where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2 or arising under Sections ~~10.3, 10.4, and 11.5,~~ 10.3 and10.4, 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. If an initial decision has not been rendered within 30 days after the Claim has been referred to the Initial Decision Maker, ~~the party asserting the Claim~~ Contractor may demand mediation and binding dispute resolution without a 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~~ Contractor or a response with supporting data from the ~~other party,~~ Owner, (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.

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§ 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 the 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.~~

...

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

...

§ 15.3.1 ~~Claims, disputes,~~ Disputes, or other matters in controversy between the parties, including a Claim, arising out of or related to the Contract, except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.7, shall be subject to mediation as a condition precedent to binding dispute resolution.

§ 15.3.2 The parties shall endeavor to resolve their ~~Claims~~ disputes or other matters in controversy by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures 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.

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_____

(Signed)

_____

(Title)

_____

(Dated)

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DOCUMENT 00 73 16.02 - CERTIFICATE OF INSURANCE

PRODUCER

INSURED

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW.

COMPANIES AFFORDING COVERAGE

COMPANY LETTER A

COMPANY LETTER B

COMPANY LETTER C

COMPANY LETTER D

COMPANY LETTER E

COVERAGES

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED, NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

CO LTR	TYPE OF INSURANCE	POLICY NUMBER	POLICY EFFECTIVE DATE (MM/DD/YY)	POLICY EXPIRATION DATE (MM/DD/YY)	LIMITS	
GENERAL LIABILITY					GENERAL AGGREGATE	$2,000,000
	COMMERCIAL GENERAL				PRODUCTS-COMP/OP AGG.	$2,000,000
	LIABILITY CLAIMS				PERSONAL & ADV. INJURY	$2,000,000
	MADE ___ OCCUR.				EACH OCCURRENCE	$2,000,000
	OWNER=S &				FIRE DAMAGE (Any one fire)	$1,000,000
	CONTRACTOR=S PROT.				MED. EXPENSE (Any one person)	$10,000
AUTOMOBILE LIABILITY					COMBINED SINGLE LIMIT	$2,000,000
	ANY AUTO				BODILY INJURY (Per person)	
	ALL OWNED AUTOS				BODILY INJURY (Per accident)	
	SCHEDULED AUTOS				PROPERTY DAMAGE	
	HIRED AUTOS					
	NON-OWNED AUTOS					
	GARAGE LIABILITY					
EXCESS LIABILITY					EACH OCCURRENCE	$3,000,000
	UMBRELLA FORM				AGGREGATE	$3,000,000
	OTHER THAN UMBRELLA FORM					
	WORKER=S COMPENSATION				STATUTORY LIMITS	
	AND EMPLOYERS=				EACH ACCIDENT	$1,000,000
	LIABILITY				DISEASE - POLICY LIMIT	$1,000,000
					DISEASE - EACH EMPLOYEE	$1,000,000
OTHER						

DESCRIPTION OF OPERATIONS/LOCATIONS/VEHICLES/SPECIAL ITEMS

ADDITIONAL INSURED

CERTIFICATE HOLDER

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, THE ISSUING COMPANY WILL ENDEAVOR TO MAIL _____ DAYS WRITTEN NOTICE TO THE CERTIFICATE HOLDER NAMED TO THE LEFT, BUT FAILURE TO MAIL SUCH NOTICE SHALL IMPOSE NO OBLIGATION OR LIABILITY OF ANY KIND UPON THE COMPANY, ITS AGENTS OR REPRESENTATIVES.

AUTHORIZED REPRESENTATIVE

_____

END OF DOCUMENT 00 73 16

DIVISION 01

GENERAL REQUIREMENTS

SECTION 01 10 00 - SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes following:
   1. Work covered by Contract Documents.
   2. Type of Contract.
   3. Permits, fees, and notices.
   4. Work under other contracts.
   5. Use of premises.
   6. Owner's right to maintain school operations.
   7. Owner's occupancy requirements.
   8. Work restrictions.
   9. Contractors construction sequence.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

A. Project Identification: Dublin Jerome High School – Weight Room Renovation
   1. Project Location: 8300 Hyland Croy Road, Dublin, Ohio 43016

B. Owner: Dublin City School District Board of Education, 6371A Shier Rings Road, Dublin, Ohio 43016.
   1. Owner's Representative: Elford; Gabi Curphey, PE

C. A/E: Fanning Howey Associates, Inc., 5200 Upper Metro Place, Suite 350, Dublin, Ohio 43017.

D. Work consists of following:
   1. Work includes renovation of existing weight room area (entrance corridor, main weight room, and secondary workout area) to brighten space and support team spirit.

1.3 TYPE OF CONTRACT

A. Project will be constructed under a single prime contract.

1.4 PERMITS, FEES, AND NOTICES

A. Contractor shall secure and pay for permits, inspections, governmental fees, tap-in fees, and licenses necessary for proper execution and completion of Work, which are applicable at time bids are received, unless otherwise noted.
   1. A/E shall assist Owner in applying for "Certificate of Plan Approval" (General Building Permit) typically required by law for projects similar to one for which A/E's services are engaged. Owner will pay associated fees.

B. Inspections of installed work shall be performed by governing authority as arranged for by Contractor. Work shall not be covered until approved.

C. Contractor shall give notices and comply with laws, ordinances, rules, regulations, and orders of public authorities bearing on performance of his Work. If a Contractor observes that Contract Documents are at variances therewith, he shall promptly notify A/E in writing, and necessary changes shall be adjusted by appropriate notification. If a Contractor performs Work knowing it to be contrary to such laws, ordinances, rules, and regulations, and without such notice to A/E, he shall assume full responsibility therefore and shall bear costs attributable thereto.

1.5 WORK UNDER OTHER CONTRACTS

A. Owner intends to complete following items of Work outside provisions of these Contract Documents. Contractor shall not restrict or interfere with Owner's right to Project to accomplish this Work.
   1. Existing school maintenance work.
   2. Fixed and loose weight room equipment and furniture.
   3. Purchase and supplying of certain materials as noted in Project Manual.

1.6 USE OF PREMISES

A. General: Contractor shall have limited use of premises for construction operations as indicated on Drawings by Contract limits and as indicated by requirements of this Section.

B. Use of Site: Limit use of premises to areas within Contract limits indicated. Do not disturb portions of Project site beyond areas in which Work is indicated.
   1. Owner Occupancy: Allow for Owner occupancy of Project site and use by public.
   2. Driveways and Entrances: Keep undesignated driveways, parking area, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use undesignated areas for parking or storage of materials.
      a. Schedule deliveries to minimize use of driveways and entrances.
      b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

C. Use of Existing Building: Maintain existing building in a weathertight condition throughout construction period. Repair damage caused by construction operations. Protect building and its occupants during construction period.

D. Condition of Existing Grounds: Maintain portions of existing grounds, landscaping, and hardscaping affected by construction operations throughout construction period. Repair damage caused by construction operations.

PART 2 - PRODUCTS

2.1 OWNER'S RIGHT TO MAINTAIN SCHOOL OPERATIONS

A. During course of this Project, normal and customary school functions and operations must be maintained. Contract Documents are intended to define a strict separation between school activities of students and staff from activities of construction project.

B. A/E and Owner will not tolerate any visible or audible actions initiated or responded to by any employees of Contractors on this Project toward any students, teachers, or staff members at school system. Violators shall be promptly removed from site.

C. Owner intends to instruct students, teachers, and staff to refrain from communications with Contractor’s personnel working on this Project. All communication with Owner and staff shall be through A/E.

D. Contractors shall expend their best effort toward protection of health, safety, and welfare of occupants on Owner’s property during course of Work on this Project.

E. Contractors and subcontractors shall be subject to such rules and regulations for conduct of Work as Owner may establish. Employees shall be properly and completely clothed while working. Bare torsos, legs, and feet will not be allowed. Possession or consumption of alcoholic beverages or drugs, tobacco, or other noxious behavior on Project site is strictly prohibited. Violators shall be promptly removed from Project site. Smoking is not permitted on school property or within school buildings.

2.2 OWNER'S OCCUPANCY REQUIREMENTS

A. Full Owner Occupancy: Owner will occupy Project site and existing building during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits, unless otherwise indicated.
   1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
   2. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.

B. Owner Limited Occupancy of Completed Areas of Construction: Owner reserves right to occupy and to place and install equipment in completed areas of building, before Substantial Completion, provided such occupancy does not interfere with completion of Work. Such placement of equipment and partial occupancy shall not constitute acceptance of total Work.
   1. A/E will prepare a Certificate of Substantial Completion for each specific portion of Work to be occupied before Owner occupancy.
   2. Obtain a Certificate of Occupancy from authorities having jurisdiction before Owner occupancy.
   3. Before partial Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of building.
   4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of building.

2.3 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.
   1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.

B. On-Site Work Hours: Work shall be generally performed inside existing building during normal business working hours of 7:00 a.m. to 4:00 p.m., Monday through Friday, except otherwise indicated.
   1. Work outside normal business hours must be approved by A/E and Owner at least 24 hours in advance.
      a. No work including work outside normal business hours may be performed without Contractor’s Foreman/Superintendent present.

C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
   1. Notify Owner not less than two days in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without Owner's written permission.

D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.
   1. Notify A/E and Owner not less than two days in advance of proposed disruptive operations.
   2. Obtain A/E’s and Owner’s written permission before proceeding with disruptive operations.

E. Restricted Substances: Use of tobacco products and other controlled substances on Project site is not permitted.

F. Employee Screening: Comply with Owner's requirements regarding drug and background screening of Contractor personnel working on Project site.

1. Maintain list of approved screened personnel with Owner's Representative. Contractor will be responsible for costs associated with background checks charged by Vendor to Contractor.
2. A background inquiry for construction work force is a requirement of construction contract. No one will be permitted to work on school construction projects adjacent to active school facilities without completion of a satisfactory background inquiry.
    a. Documentation shall be submitted within 10 days of Notice to Proceed. Construction work at Project site cannot start without properly screened personnel.

2.4 MISCELLANEOUS PROVISIONS

A. Contractor shall enforce strict discipline and good order among his employees or other persons carrying out Work of his Contract and shall not permit employment of unfit person or persons or anyone not skilled in task assigned to them.

B. When verification of existing dimensions is required, Contractor requiring said verification for construction or fabrication of his material should be Contractor responsible for procurement of field information.

C. Do not scale documents.

D. Contractor shall be responsible for developing and conducting a security program, specifically oriented for protection of – and for preventing of damage, injury, or loss to –Contractor's respective portion of Project site and other property at site or adjacent thereto. This security program shall be acceptable to Owner, and shall remain in effect through Substantial Completion of Project.

2.5 CONTRACTOR'S CONSTRUCTION SEQUENCE

A. Sequence of construction is based upon receiving bids January 20, 2025; beginning Work in April 1, 2026; and Substantial Completion by May 30, 2026. All work to be completed by June 15th, 2026.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 10 00

SECTION 01 23 00 - ALTERNATES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for alternates.

1.2 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on Bid Form for certain work defined in Bidding Requirements that may be added to or deducted from Base Bid amount if Owner decides to accept a corresponding change either in amount of construction to be completed or in products, materials, equipment, systems, or installation methods described in Contract Documents.
   1. Cost or credit for each alternate is net addition to or deduction from Contract Sum to incorporate alternate into Work. No other adjustments are made to Contract Sum.
   2. Alternates described in this Section are part of Work only if enumerated in Agreement.

1.3 PROCEDURES

A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of alternate into Project.
   1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

B. Notification: Immediately following award of Contract, notify each party involved, in writing, of status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates.

C. Execute accepted alternates under same conditions as other work of Contract.

D. Schedule: A Schedule of Alternates is included at end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Alternate No. 01: New RAF-1 flooring
   1. Base Bid: Room 1644, existing flooring to remain
   2. Alternate: Room 1644, remove existing rubber flooring and provide new RAF-1 throughout with new rubber wall base.

B. Alternate No. 02: Storage Cage
   1. Base Bid: Room 1644, existing storage cage to remain.
   2. Alternate: Room 1644, remove existing storage cage and provide new metal stud and gypsum wallboard wall assembly as indicated on the drawings.

C. Alternate No. 03: Personal Record Station
   1. Base Bid: Room 1636, no work.
   2. Alternate: Room 1636, provide metal stud wall, bulkhead (soffit), and lighting at “Personal Record Station” as indicated on the drawings.

D. Alternate No. 04: Acoustical Ceiling System
   1. Base Bid: Existing ceiling panels, grid, and HVAC diffusers and grilles to remain and be painted flat black.
   2. Alternate: Remove and replace existing ceiling system with new suspended acoustical ceiling system (black) as indicated on drawings.

END OF SECTION 01 23 00

SECTION 01 26 00 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies administrative and procedural requirements for handling and processing Contract modifications.

1.2 MINOR CHANGES IN WORK

A. A/E will issue supplemental instructions clarifying contract documents, not involving adjustment to Contract Sum or Contract Time, “Clarification Notice” on form included at end of Part 3.

1.3 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: A/E will issue a detailed description of proposed changes in Work that may require adjustment to Contract Sum or Contract Time. If necessary, description will include supplemental or revised Drawings and Specifications.
   1. Proposal Requests issued by A/E are for information only. Do not consider them instructions either to stop work in progress or to execute proposed change.
   2. Within time specified in Proposal Request or 20 days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to Contract Sum and Contract Time necessary to execute change.
      a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
      b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
      c. Include costs of labor and supervision directly attributable to change.
      d. Include an updated Contractor's Construction Schedule that indicates effect of change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship.

B. Contractor-Initiated Proposals: If latent or unforeseen conditions require modifications to Contract, Contractor may propose changes by submitting a request for a change to A/E.
   1. Include a statement outlining reasons for change and effect of change on Work. Provide a complete description of proposed change. Indicate effect of proposed change on Contract Sum and Contract Time.
   2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
   3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
   4. Include costs of labor and supervision directly attributable to change.
   5. Include an updated Contractor's Construction Schedule that indicates effect of change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship.
   6. Comply with requirements in Division 01 Section "Substitution Procedures" if proposed change requires substitution of one product or system for product or system specified.

C. Proposal Request Form: Use forms provided by hereinafter. Sample copies are included at end of this Section.
   1. Proposal Worksheet Detail: Use forms provided hereinafter.
   2. Proposal Worksheet Summary: Use forms provided hereinafter.

1.4 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Proposal Request, A/E will issue a Change Order for signatures of A/E, Owner, and Contractor on form included hereinbefore.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 26 00

FANNING HOWEY

PROPOSAL REQUEST

Project: Dublin Jerome High School – Weight Room Renovation

Proposal Request No.

From:

To:

Date:

Project No. 225079.00

Owner: Dublin City School District
Board of Education
Dublin, Ohio

Contract For:

This Proposal Request (PR) requests an itemized quotation for changes in the Contract Sum or Contract Time in response to the proposed modifications to the Contract Documents.

Description of Proposed Change:

Attachments:

.

Reason for Change:

Signature: _____ Date: _____

Signed by: _____
Fanning Howey Associates, Inc.

Contractor to complete following sections:

Does Proposed Change involve a change in Contract Sum? ☐ No ☐ Yes [Increase] [Decrease] $_____
Does Proposed Change involve a change in Contract Time? ☐ No ☐ Yes [Increase] [Decrease] Days_____

Attached pages: ☐ Proposal Worksheet Summary_____

☐ Proposal Worksheet Detail _____

Attached Supporting information from: ☐ Contractor ☐ Subcontractor ☐ Supplier

FANNING HOWEY

PROPOSAL WORKSHEET DETAIL

Project Description: _____ Change Order Request No. _____

A/E Project No. _____ Proposal Request No. _____

Re: _____ Date: _____

From (Contractor): _____ To (Architect): _____

SHADED AREAS FOR A/E USE

ADDITIONS

	Ref. No.	Item Description	Quantity		UNIT PRICES Materials		Labor		SUBTOTALS Materials		Labor	
									$ -		$ -	
									$ -		$ -	
									$ -		$ -	
									$ -		$ -	
									$ -		$ -	
		SUBTOTAL							$ -		$ -	

DEDUCTIONS

	Ref. No.	Item Description	Quantity		UNIT PRICES Materials		Labor		SUBTOTALS Materials		Labor	
									$ -		$ -	
									$ -		$ -	
									$ -		$ -	
									$ -		$ -	
									$ -		$ -	
		SUBTOTAL							$ -		$ -	

TOTAL MATERIAL AND LABOR			$ -		$ -	
TOTAL CHANGE REQUESTED		$ -				

Subcontractor's Net:		$ -	
Subcontractor's OH&P:		$ -	
Subcontractor's Bond:		$ -	
Subcontractor's Total:		$ -	
Contractor's OH&P:		$ -	
Contractor's Bond:		$ -	
Insurance:		$ -	
Tax:		$ -	
Worksheet Total:		$ -	

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Architect's Supplemental Instructions

PROJECT: *(name and address)* General - Specifications	**CONTRACT INFORMATION:** Contract For: General Construction Date:	**ASI INFORMATION:** ASI Number: 006 Date:
OWNER: *(name and address)*	**ARCHITECT:** *(name and address)*	**CONTRACTOR:** *(name and address)*

The Contractor shall carry out the Work in accordance with the following supplemental instructions without change in Contract Sum or Contract Time. Proceeding with the Work in accordance with these instructions indicates your acknowledgment that there will be no change in the Contract Sum or Contract Time.
(Insert a detailed description of the Architect's supplemental instructions and, if applicable, attach or reference specific exhibits.)

ISSUED BY THE ARCHITECT:

ARCHITECT *(Firm name)*

SIGNATURE

PRINTED NAME AND TITLE

DATE

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User Notes: (3B9ADA40)

SECTION 01 29 00 - APPLICATIONS FOR PAYMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies administrative and procedural requirements governing contractor's Applications for Payment.
   1. Coordinate Applications for Payment with Schedule of Values, Project Schedule, Submittal Schedule, and List of Subcontracts.
   2. Contractors shall use AIA documents, unless otherwise noted and approved in writing by Owner.
      a. Purchase: www.aiacontracts.org/purchase.
      b. Tech Support: 800-942-7736.

1.2 APPLICATIONS FOR PAYMENT

A. Applications for Payment shall be made in accordance with General Conditions. Payments to Contractor will not be made until final approval by Owner.
   1. Contractors shall present a proposed Application for Payment to A/E at site 10 days prior to date for submission of Application of Payment. After review by A/E a corrected copy will be returned to Contractor within 5 working days.

B. Each Application for Payment shall be consistent with previous applications and payments as certified by A/E and paid for by Owner.
   1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

C. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.

D. Payment-Application Times: The date for each progress-payment is indicated in the Owner/Contractor Agreement. Period of construction work covered by each Application for Payment is period indicated in Agreement.

E. Application Preparation: Complete every entry on form. Include notarization and execution by a person authorized to sign legal documents on behalf of Contractor. A/E will return incomplete applications without action.
   1. Entries shall match data on Schedule of Values and Project Schedule.
   2. Include amounts of Change Orders and Construction Change Directives issued prior to last day of construction period covered by application and include only those fully executed by all parties.

F. Transmittal: Submit signed and notarized Application for Payment to A/E by a method ensuring receipt within 24 hours. One copy shall be complete, including waivers of lien and similar attachments, when required.
   1. Transmit each copy with a transmittal form listing attachments and recording appropriate information related to application, in a manner acceptable to A/E.

G. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.
   1. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
   2. Provide summary documentation for stored materials indicating following:
      a. Value of materials previously stored and remaining stored as of date of previous Application for Payment.

b. Value of previously stored materials put in place after date of previous “Application for Payment” and on or before date of current “Application for Payment”.
c. Value of materials stored since date of previous “Application for Payment” and remaining stored as of date of current “Application for Payment”.

3. Payment for Stored Materials
   a. When Applications for Payment include products stored off project site or stored on project site but not incorporated in Project, for which no previous payment has been requested, a complete description of such product shall be attached to application. Suitable storage which is off project site shall be a bonded warehouse with stored products properly tagged and identifiable for project. Contract Administrator’s written approval shall be obtained before use of an off-site storage area.
   b. If size, quantity, and/or type of material or product is such that a bonded warehouse is deemed unsuitable, then, Contractor may elect to prepay a Subcontractor or Supplier for certain material and products which are to remain on and be stored on subcontractor’s or supplier’s premises until needed by Project. In such event, Contractors shall enter into a security agreement with subcontractor or supplier under which Contractor shall be granted a security interest in and to all such material and products fabricated and/or to be supplied by subcontractor or supplier for this project and stored on subcontractor’s or supplier’s premises. This security agreement shall be a part of financing statement which shall be presented to a filing officer for filing pursuant to Uniform Commercial Code. All expenses incurred in this agreement shall not accrue to Owner, A/E, nor project. A copy of each and every agreement shall be filed with A/E with first Application for Payment which requests payment for such material or products.
   c. All payment requests for off-site stored materials shall be accomplished by attached “Payment Request for Stored Materials” form.
4. Stored Equipment: Each item shall be identified as to manufacturer, model number, and serial number, if applicable, or other identifiers. Each listing shall be accompanied by invoices, shipping tickets, consent of surety, and any other applicable supporting information.
5. Stored Manufactured Building Materials: Each item shall be identified as to type, manufacturer’s number of designation, and shall also list number of cartons and contents therein. Each listing shall also be accompanied by supporting documents including all invoices, shipping tickets, and consent of surety.
6. Stored Fabricated Materials:
   a. A listing specifying number of pieces, items, etc., and marks as may be applicable to particular type of items. Photographs shall accompany request as supporting information.
   b. Payment requests for stored materials not complying with above mentioned requirements will not be approved. Contractors are to notify A/E in ample time to conduct verification procedures. Contractors may not apply cost of materials stored offsite towards a reduction in retention amount.
7. Stored Materials Offsite Insurance Requirements:
   a. In situations where Contractor is requesting payment for purchased materials that are being stored offsite for a specific project, evidence of property insurance shall be furnished as indicated below:
      1) For Builder’s Risk Policy that is in force for projects.
         a) Verify that “off premises” coverage exists and that amount of insurance is adequate to cover cumulative value of stored materials.
         b) Verify that “in transit” coverage exists and that amount of insurance is adequate to cover cumulative value of materials while in transit.
         c) Conform that policy includes Contractor’s interest.
         d) Make sure that Contractor has been notified of its responsibility for applicable policy deductibles.

2) If “off premises” and “in transit” coverage are not included under Builder’s Risk Policy, Contractor shall provide evidence of property insurance.
   a) Evidence of insurance is to be provided.
   b) The top portion of form shall indicate
      .1 Producer (insurance agent)
      .2 Company (insurance company)
      .3 Insured (contractor)
      .4 Policy number
      .5 Effective date
      .6 Expiration date
   c) The following additional information shall be included:
      .1 Description of stored property.
      .2 Store location of insured property.
      .3 Type of policy (fire policy, installation floater, specific risk policy) and perils insured (all-risk).
      .4 Amount of insurance which shall equal or exceed cumulative value of stored materials.
      .5 Deductible
      .6 Cancellation notice of 30 days.
      .7 Additional insured shall include interest of Owner.

H. Waivers of Mechanics Lien: With each Application for Payment, submit waivers of mechanics lien related to Work covered by payment.
   1. Submit partial waivers on each item for amount requested, in previous application, before deduction for retainage, on each item.
   2. When an application shows completion of an item, submit final or full waivers.

I. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include following:
   1. List of subcontractors.
   2. List of principal suppliers and fabricators.
   3. Schedule of Values.
   4. Project Schedule.
   5. Certificates of insurance and insurance policies.

J. Retainage: In general, there will be no reduction of retainage granted to this Project.
   1. Retainage shall only be reduced/returned when value of remaining uncompleted items, is less than an amount equal to 200 percent of the value of each item, as determined by the A/E.
      a. Note: Value shall be determined in part by values indicated in schedule of values, including value of close out documents, i.e. Operation and Maintenance Manuals.

K. Application for Payment at Substantial Completion: Following issuance of Certificate of Substantial Completion, submit an Application for Payment.
   1. Administrative actions and submittals that shall precede or coincide with this application include:
      a. Occupancy permits and similar approvals. Occupancy permit shall be submitted by party responsible for acquiring general building permit.
      b. Warranties (guarantees) and maintenance agreements.
      c. Maintenance instructions.
      d. Final cleaning.
      e. List of incomplete Work, recognized as exceptions to A/E’s Certificate of Substantial Completion.

L. Final Payment Application: Administrative actions and submittals that must precede or coincide with submittal of final Application for Payment include following:
   1. Completion of Project closeout requirements.
   2. Completion of items specified for completion after Substantial Completion.
   3. Ensure that unsettled claims will be settled.
   4. Ensure that incomplete Work is not accepted and will be completed without undue delay.

5. Transmittal of required Project construction records to Owner.

1.3 SCHEDULE OF VALUES

A. Contractor shall coordinate preparation of its Schedule of Values for its part of Work with Project Schedule.
   1. Within 15 days of award of Contract, Contractor shall submit to A/E a Schedule of Values, for approval.

B. Format and Content: Use Project Manual table of contents as a guide to establish format for Schedule of Values. Schedule of Values shall include at a minimum a line item for labor and material costs for each specification section assigned to Contractor. Each work item shall receive its prorated share of profit and overhead, including a line item for closeout. Schedule of Values shall consist of a complete breakdown of Contractor's contract sum showing various items of work, divided so as to facilitate approval of payments to Contractor for Work completed. This schedule when reviewed by A/E and Owner shall be used as basis of approving payments along with establishing percentages of Work complete.
   1. In addition to sections assigned to Contractor as defined above, Contractor shall include following line items on their Schedule of Values (in event of combined contracts, each individual bid package shall be broken out as follows):
      a. Contract Bonds, item shall be included as a material cost.
      b. Mobilization, including permits, item shall be included as a labor cost.
      c. Demobilization, item shall be included as a labor cost.
      d. Insurance: Item shall be included as a material cost.
      e. Submittals (excluding Closeout Submittals) in amount of 2 percent of Contract; however, not less than $1,000 or more than $20,000, item shall be included as a labor cost.
      f. Project Meetings in amount of $250 times anticipated number of meetings Contractor will be required to attend during course of Project, item shall be included as a labor cost.
      g. Daily and final cleanup (in amount of 1 percent of total contract amount). Daily cleanup shall be 80 percent of total with remainder held for final cleanup, item shall be included as a labor cost.
      h. Punch lists in amount of 2 percent of Contract; however, not less than $1,000 minimum and $50,000 maximum, item shall be included as a labor cost.
      i. Closeout submittals in an amount equal to 3 percent of Contract amount; however, not less than $500 or more than $75,000, item shall be included as a material cost.
   2. Provide a breakdown of Contract Sum in sufficient detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Break principal subcontract amounts down into several line items. Schedule of Values shall be coordinated with Construction Schedules such that percentages of Work completed closely relates to values for Work shown on request for payments. At beginning of Project, Contractor shall prepare a schedule of monthly progress payments showing amount Contractor may require for Work proposed to be completed. Purpose of this schedule is to allow Owner to determine what amounts of funds will be required to have available each month during progress of construction for progress payments.
      a. Whenever material allocation exceeds 55 percent of Contract price, Contractor shall provide, upon request, sufficient information to support such higher percentage.
   3. Round amounts to nearest whole dollar. Total shall equal Contract Sum.
   4. Provide a separate line item in Schedule of Values for each part of Work where Applications for Payment may include materials or equipment, purchased or fabricated and stored, but not yet installed.
      a. Differentiate between items stored on-site and items stored off-site. Include requirements for insurance and bonded warehousing, if required.
   5. Provide separate line items on Schedule of Values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of Work.

C. Schedule of Values shall be typed or printed on AIA Documents G702-1992 and G703-1992.

D. Each Schedule of Values shall have Contractor's name, Bid Category name and number, project name and number and shall be dated and signed.

E. Should Schedule of Values be "rejected, resubmit", resubmittal is due within 5 days of receipt of rejected schedule.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

PAYMENT REQUEST FOR STORED MATERIALS

To: _____ Project: _____

From: _____ Contract No. _____

(Name of Contractor)

Payment Application No. _____

Period: From: _____ to _____

In accordance with provisions of "Payment to Contractor" section of contract General Conditions, request is made for payment as "stored materials" for following materials.

Item No.	Qty.	Material Description	Value	Type of Substantiating Evidence of Purchase Attached	Where Stored (*)

AFFIDAVIT:

Materials listed above have been purchased exclusively for use on above referenced project. Material is separated from other like materials and is physically identified as our property for use only on Contract No.:_____. Owner or Owner's authorized representative may enter upon premises for purpose of inspection, checking or auditing, or for any other purpose as it considers necessary. It is expressly understood and agreed that this information and affidavit is furnished to Owner for purpose of obtaining payment of above materials before they are delivered to, or incorporated into, project described above. A revised form showing current status of value of materials for which payment is being requested will be submitted each estimate period.

Signed: _____ Date: _____

(Name of Contractor)

State of _____ County of: _____

Subscribed and sworn to before me this _____ day of _____

Notary Public _____ Commission Expires _____

When stored at a location other than on jobsite or at a fabricator's yard, a bonded warehouse receipt for material and a certificate of insurance showing coverage of materials stored issued in name of Owner, shall accompany request for payment. In case storage location (other than jobsite or fabricator's yard) is Contractor's property, area containing material within fence area is property of Owner. Responsibility for protecting material remains that of Contractor.

Submit this form with each required copy of AIA Document G702. Attach evidence of purchase (and warehousing receipts when required), along with proof of insurance of bonded warehouse to original.

END OF SECTION 01 29 00

SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION

1.1 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, following:
   1. Requests for Interpretation (RFIs).
   2. Project meetings/meetings.
      a. Pre-construction meeting.
   3. Pre-closeout meeting.

1.2 DEFINITIONS

A. Request for Interpretation (RFI): A request from a prime contractor seeking an interpretation or a clarification of some requirement of Contract Documents. Contractor shall clearly and concisely set forth issue for which it seeks clarification or interpretation and why a response is needed. Contractor shall, in written request, set forth its interpretation or understanding of contract's requirements along with reasons why it has reached such an understanding. Responses will not change any requirements of Contract Documents.

1.3 INFORMATIONAL SUBMITTALS

A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of Work, including those who are to furnish products or equipment fabricated to a special design. Include 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.
   4. Submit subcontract list on form hereinafter in the following format:
      a. PDF electronic file.

B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in absence of individuals assigned to Project.
   1. Post copies of list in project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

1.4 REQUEST FOR INTERPRETATION (RFI)

A. General: Immediately on discovery of need for interpretation of Contract Documents, and if not possible to request interpretation at project meetings, Contractor shall prepare and submit an RFI in form specified.
   1. A/E will return RFIs submitted to A/E by other entities controlled by Contractor with no response.
   2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of RFI: Include a detailed, legible description of item needing information or interpretation and following:
   1. Project name.
   2. Project number.
   3. Date.
   4. Name of Contractor.
   5. Name of A/E.

6. RFI number, numbered sequentially.
7. RFI subject.
8. Specification Section number and title and related paragraphs, as appropriate.
9. Drawing number and detail references, as appropriate.
10. Field dimensions and conditions, as appropriate.
11. Contractor's suggested resolution. If Contractor's solution(s) impacts Contract Time or Contract Sum, Contractor shall state impact in RFI.
12. Contractor's signature.
13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
    a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. RFI Forms: Form bound in Project Manual.

D. A/E's Action: A/E will review each RFI, determine action required, and respond. If it is determined that document is not an RFI, it will be returned to Contractor, unreviewed as to content, for resubmittal on proper form and in proper manner. If RFI is determined unnecessary or frivolous, by nature of information clearly indicated in documents, RFI will also be returned with no response. Numerous frivolous RFI that lead to additional compensation to design team shall result in change orders to submitting contractor’s contract. Allow seven working days for A/E's response for each RFI. RFIs received by A/E after 1:00 p.m. will be considered as received following working day. If a longer time is determined necessary, A/E will, within five working days of receipt of request, notify contractor of anticipated response time.
1. The following RFIs will be returned without action:
    a. Requests for approval of submittals.
    b. Requests for approval of substitutions.
    c. Request for approval of Contractor’s means and methods.
    d. Requests for coordination information already indicated in Contract Documents.
    e. Requests for adjustments in Contract Time or Contract Sum.
    f. Requests for interpretation of A/E's actions on submittals.
    g. Incomplete RFIs or inaccurately prepared RFIs.
2. A/E's action may include a request for additional information, in which case A/E's time for response will date from time of receipt of additional information.
3. A/E's action on RFIs that may result in a change to Contract Time or Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 01 Section "Contract Modification Procedures."
    a. If Contractor believes RFI response warrants change in Contract Time or Contract Sum, notify A/E in writing within 10 days of receipt of RFI response.

1.5 PROJECT MEETINGS

A. General: A/E will schedule and conduct meetings and meetings at Project site, unless otherwise indicated.
1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and A/E of scheduled meeting dates and times.
2. Agenda: Prepare meeting agenda. Distribute agenda to all invited attendees.
3. Minutes: A/E will record significant discussions and agreements achieved. Distribute meeting minutes to everyone concerned, including Owner, within three days of meeting.

B. Preconstruction Meeting: A/E will schedule and conduct a preconstruction meeting before starting construction, at a time convenient to Owner and A/E, but no later than 15 days after execution of Agreement.
1. Conduct meeting to review responsibilities and personnel assignments.

2. Attendees: Authorized representatives of Owner, Owner's Commissioning Authority, A/E, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend meeting. Participants at meeting shall be familiar with Project and authorized to conclude matters relating to Work.
3. Agenda: Discuss items of significance that could affect progress, including following:
    a. Tentative construction schedule.
    b. Critical work sequencing and long-lead items.
    c. Designation of key personnel and their duties.
    d. Lines of communications.
    e. Procedures for processing field decisions and Change Orders.
    f. Procedures for RFIs.
    g. Procedures for testing and inspecting.
    h. Procedures for processing Applications for Payment.
    i. Distribution of Contract Documents.
    j. Submittal procedures.
    k. Preparation of record documents.
    l. Use of premises and existing building.
    m. Work restrictions.
    n. Working hours.
    o. Owner's occupancy requirements.
    p. Responsibility for temporary facilities and controls.
    q. Procedures for disruptions and shutdowns.
    r. Parking availability.
    s. Office, work, and storage areas.
    t. Equipment deliveries and priorities.
    u. First aid.
    v. Security.
    w. Progress cleaning.
    x. Fire-prevention plan.
    y. Areas where existing construction is to remain and the required protection.
    z. Hauling routes.
4. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

C. Project Closeout Meeting: A/E will schedule and conduct a Project closeout meeting, at a time convenient to Owner and A/E, when work or designated portion thereof is 70 percent substantially complete, by billing, but no later than 30 days prior to scheduled date of Substantial Completion.
1. Conduct meeting to review requirements and responsibilities related to Project closeout.
2. Attendees: Authorized representatives of Owner, Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend meeting. Participants at meeting shall be familiar with Project and authorized to conclude matters relating to Work.
3. Agenda: Discuss items of significance that could affect or delay Project closeout, including following:
    a. Preparation of record documents.
    b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
    c. Submittal of written warranties.
    d. Requirements for preparing operations and maintenance data.
    e. Requirements for delivery of material samples, attic stocks, and spare parts.
    f. Requirements for demonstration and training.
    g. Preparation of Contractor's punch list.
    h. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
    i. Submittal procedures.
    j. Responsibility for removing temporary facilities and controls.
4. Minutes: A/E will record and distribute meeting minutes.

D. Progress Meetings: A/E will conduct progress meetings at biweekly intervals.
   1. Attendees: In addition to representatives of Owner and A/E, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at meeting shall be familiar with Project and authorized to conclude matters relating to Work.
      a. Contractor is required to attend progress meetings, unless previously excused by A/E. Contractor failing to be represented at project meetings, when specifically requested, will be taken into consideration when A/E is considering payment applications for approval. Contractor may be charged $250.00 for each unexcused absence, from meetings in which they are requested to attend. A deduct Change Order for these changes will be issued prior to contract closeout. This in no way relieves Contractors for coordination due to lack of attendance. Punitive damage claims shall be in addition to fees charged.
   2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
      a. Contractor's Construction Schedule: Review progress since last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within Contract Time.
         1) Review schedule for next period.
      b. Review present and future needs of each entity present, including following:
         1) Interface requirements.
         2) Sequence of operations.
         3) Status of submittals.
         4) Deliveries.
         5) Off-site fabrication.
         6) Access.
         7) Temporary facilities and controls.
         8) Progress cleaning.
         9) Quality and work standards.
         10) Status of correction of deficient items.
         11) Field observations.
         12) Status of RFIs.
         13) Status of proposal requests.
         14) Pending changes.
         15) Status of Change Orders.
         16) Pending claims and disputes.
         17) Documentation of information for payment requests.
         18) Review Closeout Submittals Log
   3. Minutes: A/E will record and distribute meeting minutes to each party present and to parties requiring information.
      a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 31 00

REQUEST FOR INTERPRETATION

FANNING HOWEY

Project:	Dublin Jerome High School – Weight Room Renovation	Fanning Howey RFI No. Contractor RFI No.) Date
Project No.:	225079.00	Response Requested by date
To:		Reference Specification Section (if applicable)
From:		Drawing No. (if applicable)

Request for Interpretation (RFI): A request from Construction Manager or contractor seeking an interpretation or a clarification of some requirement of Contract Documents. Clearly and concisely set forth issue for which it seeks clarification or interpretation and why a response is needed. On this form, set forth its interpretation or understanding of contract's requirements along with reasons why it has reached such an understanding. Responses will not change any requirements of Contract Documents.

Information Requested:

Proposed Solution(s):

Response:

Signature: _____ Date: _____

Proposal Request Issued: ☐ Yes ☐ No

Note: This is not an authorization to proceed if contract time or amount is affected.

SUBCONTRACTORS AND MAJOR MATERIAL SUPPLIERS LIST

FANNING HOWEY

Project: Dublin Jerome High School – Weight Room Renovation

From (Contractor): _____

Date: _____

To (A/E): _____

A/E Project Number: 225079.00

Contract For: _____

List Subcontractors and Major Material Suppliers proposed for use on this Project as required by the Construction Documents. Attach supplemental sheets if necessary.

Section Number	Section Title	Firm	Address	Phone Number (Fax Number)	Contact

☐ Attachments

Signed by: Date:

Copies: ☐ Owner ☐ Consultants ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ File

SECTION 01 32 00 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for documenting progress of construction during performance of Work, including following:
   1. Startup Construction Schedule.
   2. Contractor's Construction Schedule.
   3. Construction schedule updating reports.
   4. Daily construction reports.
   5. Material location reports.
   6. Site condition reports.
   7. Use of site plan.

1.2 SUBMITTALS

A. Format for Submittals: Submit required submittals in following format:
   1. PDF electronic file.

B. Startup Construction Schedule

C. Contractor's Construction Schedule: Submit copies of schedule, large enough to show entire schedule for entire construction period.

D. Construction Schedule Updating Reports: Submit with Applications for Payment.

E. Daily Construction Reports: Submit at weekly intervals.

F. Material Location Reports: Submit at weekly intervals.

G. Field Condition Reports: Submit at time of discovery of differing conditions.

H. Unusual Reports: Submit at time of unusual event.

1.3 STARTUP CONSTRUCTION SCHEDULE

A. Gantt-Chart Schedule: Submit startup horizontal Gantt-type construction schedule within seven days of date established for the Notice to Proceed.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with continuous vertical line. Outline significant construction activities for first 30 days of construction. Include skeleton diagram for the remainder of the work and a cash requirement prediction based on indicated activities.

1.4 CONTRACTOR'S CONSTRUCTION SCHEDULE (GANTT CHART)

A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal Gantt-chart-type, Contractor's Construction Schedule within 30 days of date established for Notice to Proceed. Base schedule on Division 01 Section “Summary” article “Contractor’s Construction Sequence”.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.
   1. For construction activities that require 3 months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

C. Contractor's Construction Schedule Updated: At monthly intervals, update schedule to reflect actual construction progress and activities.
   1. Revise schedule immediately after each meeting.

1.5 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording following information concerning events at Project site:
   1. List of subcontractors at Project site.
   2. Approximate count of personnel at Project site.
   3. Equipment at Project site.
   4. Material deliveries.
   5. Accidents.
   6. Meetings and significant decisions.
   7. Unusual events (refer to special reports).
   8. Stoppages, delays, shortages, and losses.
   9. Emergency procedures.
   10. Orders and requests of authorities having jurisdiction.
   11. Change Orders received and implemented.
   12. Construction Change Directives received and implemented.
   13. Services connected and disconnected.
   14. Equipment or system tests and startups.
   15. Partial Completions and occupancies.
   16. Substantial Completions authorized.

B. Material Location Reports: At monthly intervals, prepare and submit 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. Indicate the following categories for stored materials:
   1. Material stored prior to previous report and remaining in storage.
   2. Material stored prior to previous report and since removed from storage and installed.
   3. Materials stored following previous report and remaining in storage.

C. Site Condition Reports: Immediately on discovery of a difference between field conditions and Contract Documents, prepare and submit a detailed report. Submit with a request for interpretation. Include a detailed description of differing conditions, together with recommendations for changing Contract Documents.

1.6 PROJECT USE OF SITE PLAN

A. Contractor shall confine operations at site to areas within areas indicated and as approved on use of site plan, and as permitted by law, ordinances, and permits. Site shall not be unreasonably encumbered with materials, products, or construction equipment.

B. Contractor in reviewing his use of site shall include access to proposed building for construction purposes, storage of materials and products, parking, where possible, for employees, temporary facilities including offices, storage, and workshop sheds or portable trailers, and unloading space.
   1. Indicate staff and student access routes; zoning of building areas; temporary exists to eliminate dead-end corridors during construction.
      a. Indicate how mechanical systems air handling units are zoned and ductwork routed, so construction can be isolated without affecting air distribution in occupied areas.
      b. Indicate routing of existing electrical feeders and switchgear to ensure occupied spaces have continuous power sourcing.
      c. Indicate where temporary partitions will be used to protect students.
      d. Designate staging areas protected from students and public.

C. Where a temporary fence is indicated to be provided, Contractor shall show any additional area needed in Contractor's use of site beyond that which may be indicated on Drawings. Where additional fencing is required, such fencing shall be included at no additional cost to Owner.
   1. Construction fencing to separate areas from students, staff and visitors.

D. Owner will indicate which portions of existing parking lot and nonpaved areas can be used for construction activities. Damage to existing parking lot or unpaved areas shall be paid for by Contractor responsible for damage.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
   1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with report of each such meeting.
   2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
   3. As Work progresses, indicate Actual Completion percentage for each activity.

B. Distribution: Distribute copies of approved schedule to A/E, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
   1. Post copies in Project meeting rooms and temporary field offices.
   2. When revisions are made, distribute updated schedules to same parties and post in same locations. Delete parties from distribution when they have completed their assigned portion of Work and are no longer involved in performance of construction activities.

END OF SECTION 01 32 00

SECTION 01 33 00 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

B. Section Includes:
   1. Submittal schedule requirements.
   2. Administrative and procedural requirements for submittals.

1.2 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require A/E's responsive action. Action submittals are those Submittals indicated in individual specification sections as “Action Submittals”.

B. Informational Submittals: Written and graphic information and physical samples that do not require A/E's responsive action. Submittals may be rejected for not complying with requirements. Information Submittals are those submittals indicated in individual Specification Sections as “Quality Assurance/Control Submittals” or “Informational Submittals”.

C. Closeout Submittals: Written and graphic information and physical extra stock items required at or near completion of a project. Requirements for these submittals are included in the General Conditions of the contract and Division 01 Section “Closeout Procedures”.

D. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.

E. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.3 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. A/E's Digital Data Files: Electronic copies of CAD Drawings of Contract Drawings may be provided by A/E for Contractor's use in preparing submittals.
   1. A/E may furnish Contractor one set of digital data drawing files of Contract Drawings for use in preparing Shop Drawings and Project Record Drawings.
      a. A/E makes no representations as to accuracy or completeness of digital data drawing files as they relate to Contract Drawings and Project Record Drawings.
      b. Contractor shall execute a data licensing agreement in form of AIA Document C106, Digital Data Licensing Agreement.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
   1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
   2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of Work are indicated on approved submittal schedule.
   3. Submit action submittals and informational submittals required by same Specification Section as separate packages under separate transmittals.

4. Coordinate transmittal of different types of submittals for related parts of Work so processing will not be delayed because of need to review submittals concurrently for coordination.
    a. Where submission of samples, shop drawings, or other items are required from suppliers or subcontractors, it shall be responsibility of Contractor for whom subcontractor is executing Work to see that submittal items required are complete and properly submitted, and corrected and resubmitted on time and in order required so as not to delay progress of Work. Submittals shall be made through Contractor. Submittals shall include sufficient detail to determine that contractor clearly understands requirements of Contract Documents.
    b. Contractors on this Project shall provide submittals in accordance with requirements of this Section. Where a submittal is required by a Contractor but assistance needed from others, Contractors shall participate and cooperate to expedite each submittal. 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.
    c. A/E reserves right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on A/E's receipt of submittal. No extension of Contract Time will be authorized because of failure to transmit submittals enough in advance of Work to permit processing, including resubmittals.
    1. Initial Review: Allow 14 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. A/E will advise Contractor when a submittal being processed must be delayed for coordination.
    2. Resubmittal Review: Allow 14 days for review of each resubmittal.
    3. Submittals Not Required: A/E will send a transmittal indicating submittals were “not required for review”. All copies of submittals may be disposed of by A/E.

D. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:
    1. Assemble complete submittal package into a single bookmarked file with links enabling navigation to each item.
    2. Each submittal shall be transmittal separately and shall cover only as specification section.
    3. Name file with submittal number or other unique identifier, including revision identifier.
        a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-061000.01.A).
    4. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by A/E.
    5. Transmittal Form for Electronic Submittals: Use Software-generated form from electronic project management software or electronic form acceptable to A/E containing following information.
        a. Project name.
        b. Date.
        c. Name and address of A/E.
        d. Name of Contractor.
        e. Name of firm or entity that prepared submittal.
        f. Name of subcontractor, manufacturer and supplier.
        g. Category and type of submittal
        h. Submittal purpose and description.
        i. Number and title of appropriate Specification Section.
        j. Specification paragraph number or drawing designation and generic name for each of multiple items.
        k. Drawing number and detail references, as appropriate.

l. Location(s) where product is to be installed, as appropriate.
m. Related physical samples submitted directly.
n. Indication of full or partial submittal
o. Transmittal number
p. Submittal and transmittal distribution record.
q. Remarks.
r. Other necessary identification.

6. Include following information as keywords in electronic file metadata:
   a. Project name.
   b. Number and title of appropriate Specification Section.
   c. Manufacturer name.
   d. Product name.

E. Options: Identify options requiring selection by A/E.

F. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's Letterhead, record relevant information, requests for data, revisions other than those requested by A/E on previous submittals, and deviations from requirements in Contract Documents, including minor variations and limitations. Include same identification information as related submittals.

G. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
   1. Note date and content of previous submittal.
   2. Note date and content of revision in label or title block and clearly indicate extent of revision.
   3. Resubmit submittals until they are marked with approval notation from A/E's action stamp.

H. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

I. Use for Construction: Use only final submittals that are marked "No Exceptions Taken" or "Note Markings" from A/E's action stamp.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES, GENERAL

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections. Submit electronic submittals in one of following formats as agreed upon in Preconstruction Conference.
   1. Submit electronic submittals via email as PDF electronic files.
      a. A/E will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
   2. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Division 01 Section "Closeout Procedures."
   3. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
      a. Provide a digital signature with digital certificate on electronically-submitted certificates and certifications where indicated.
      b. Provide a notarized statement on original paper copy certificates and certifications where indicated.
   4. Test and Inspection Reports Submittals: Comply with requirements specified in Division 01 Section "Quality Requirements."

B. Electronic submittals will only be accepted in an unchangeable electronic format such as pdf. Fire formats such as MS Word, MS Excel, AutoCAD dwg or dwf, are considered unacceptable as original file submitted could be accidentally altered from originators intended document. These file types will be rejected by A/E.

C. Fanning Howey File Transfer Site (Newforma Info Exchange): This shall be the primary means of electronic submittals for the Project. The Info Exchange Project website does not have file size restrictions. External team members will be added to the Project Team and are granted access to the Fanning Howey Newforma Info Exchange project website. Invitations will be emailed to external team members for setting-up login information. Once access is gained, external team members will be able to upload submittals and check status of pending submittals.
   1. Info Exchange Submittals are sent to A/E via.04submittal@fanninghowey.com.
      a. E-mails sent directly to Fanning Howey staff will be rejected.
   2. Transmittal is required as stated hereinbefore.
   3. A Newforma Info Exchange submittal should only include a single submittal and PDF file per Specification Section.

2.2 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 or system. Product data includes printed information, such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams, and performance curves.
   1. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products that are not required, mark copies to indicate applicable information. Contractor must annotate information. Highlighting choices or striking out products or options not required is acceptable. Product data unmarked by Contractor may be returned unreviewed by A/E. Include following information, as applicable:
      a. Manufacturer's product specifications
      b. Manufacturer's installation instructions
      c. Standard color charts
      d. Manufacturer's catalog cuts
      e. Compliance with specified trade association standards.
      f. Compliance with recognized testing agency standards.
      g. Application of testing agency labels and seals.
      h. Notation of dimensions verified by field measurement.
      i. Notation of coordination requirements.
      j. Availability and delivery time information.
   2. For equipment, include following in addition to above, as applicable.
      a. Wiring diagrams showing factory-installed wiring.
      b. Printed performance curves.
      c. Operational range diagrams.
      d. Clearances required to other construction, if not indicated on accompanying shop drawings.
   3. Do not submit Product Data until compliance with requirements of Contract Documents has been confirmed. Submit before or concurrent with Samples and Shop Drawings.
      a. Preliminary Submittal: Submit a preliminary single copy of Product Data where selection of options is required.
   4. Distribution: Furnish copies of final submittal to installers, subcontractors, suppliers, manufacturers, fabricators, and others required for performance of construction activities. Show distribution on transmittal forms.
      a. Do not proceed with installation until a copy of Product Data is in Installer's possession.
      b. Do not permit use of unsubmitted copies of Product Data in connection with construction.

5. In compliance with OSHA Hazard Communication Standard (1910.1200, 08-24-1987) Contractors shall post at site MSDS (Material Safety Data Sheets) for ALL products classified as hazardous that their firm has knowledge that they will be furnishing, using, or storing on jobsite during duration of this Project in accordance with OSHA standards. At completion of project, Contractor shall turn their "MSDS" information directly over to Owner with a receipt for Owner to sign. A copy of signed receipt only shall be submitted to A/E.
    a. Material Safety Data Sheets (MSDS) shall not be submitted to A/E for review. Material Safety Data Sheets submitted to A/E will be removed or crossed out with no action taken.
6. Submit product data in following format:
    a. PDF electronic file.

C. Shop Drawings: Prepare project specific information, drawn accurately to scale. Do not base shop drawings on reproductions of Contract Documents or standard printed data, unless submittal based on A/E's digital data drawing files is otherwise permitted.
1. Contractor shall perform no portion of Work requiring submittal and review of shop drawings, product data, samples or similar submittals until A/E has approved respective submittal. Such Work shall be in accordance with approved submittals.
2. Submit newly prepared information drawn accurately to scale. Highlight, encircle, or otherwise indicate deviations from Contract Documents. Do not reproduce Contract Documents or copy standard information as basis of Shop Drawings. Standard information prepared without specific reference to Project is not a Shop Drawing.
3. Shop drawings are drawings, diagrams, illustrations, schedules, performance charts, brochures, and other data that are prepared by Contractor or subcontractor, manufacturer, supplier, or distributor to illustrate some portion of Work. Do not base shop drawings on reproduction of Contract Documents.
    a. Advertising brochures will not be accepted as shop drawings.
    b. Erection and setting drawings as referred to in these Specifications will be considered as shop drawings and shall be submitted along with detailed shop drawings.
    c. Where schedules are required to indicate locations, they shall be submitted as part of shop drawings package for that item.
    d. Shop drawings and schedules shall repeat identification shown on Contract Drawings.
    e. Contractor shall check all shop drawings, samples and other submittals and submit them to A/E utilizing a Transmittal Form, giving his approval and/or comments and suggestions. Failure to use a Transmittal Form will result in submittals being returned “without action”.
    f. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information as applicable:
        1) Identification of products and materials included by sheet and detail number
        2) Compliance with specified standards
        3) Notation of coordination requirements
        4) Notation of dimensions established by field measurements
        5) Fabrication and installation drawings
        6) Roughing-in and setting diagrams
        7) Wiring diagrams showing field installed wiring, including power, signal, and control wiring
        8) Shop work manufacturing instructions
        9) Templates and patterns
        10) Schedules
        11) Design calculations
        12) Seal and signature of professional engineer, if specified.
        13) Relationship and attachment to adjoining construction clearly indicated.

4. Preparation of Submittals: Provide permanent marking on each submittal to identify project, date, Contractor, Subcontractor, submittal name, and similar information to distinguish it from other submittals. Show Contractor's executed review and approval marking and provide space for A/E's "action" marking. Package each submittal appropriately for transmittal and handling.
5. By approving and submitting shop drawings, Contractor thereby represents that they have determined and verified field measurements, field construction criteria, materials, catalog numbers, and similar data, and that they have checked and coordinated each shop drawing with requirements of Work and of Contract Documents prior to submitting to A/E.
6. Contractor shall make corrections required by A/E and shall resubmit shop drawings until appropriately marked. Contractor shall direct specific attention in writing or on resubmitted shop drawings to revisions other than corrections requested by A/E on previous submissions.
7. A/E will review shop drawings only for conformance with design concept of Project and with information given in Contract Documents. A/E's review of a separate item shall not indicate review of an assembly in which item functions.
8. A/E's review of shop drawings shall not relieve Contractor of responsibility for any deviation from requirements of Contract Documents unless Contractor has informed A/E in writing of such deviation at time of submission and A/E has given written approval to specific deviation, nor shall A/E's action relieve Contractor from responsibility for errors or omissions in shop drawings.
    a. A/E's review of such submittals is not conducted for purpose of determining accuracy and completeness of other details such as dimensions and qualities, or for substantiating instructions or performance of equipment or systems, all of which remain responsibility of Contractor as required by Contract Documents. A/E's review shall not constitute approval of safety precautions or, unless orwise specifically stated by A/E, of any construction means, methods, techniques, sequences, or procedures. A/Es approval of a specific item shall not indicate approval of an assembly of which it is a component.
9. Notations and remarks added to shop drawings by A/E are to ensure compliance to Drawings and Specifications and do not imply a requested or approved change to contract cost.
10. Should deviations, discrepancies, or conflicts between shop and contract drawings and Specifications be discovered, either prior to or after review, Contract Documents shall control and be followed.
11. Submit shop drawings in following format:
    a. PDF electronic file.
12. Where resubmittal is required, submit same number of copies as initial submittal.
13. Shop drawings not requested by A/E shall be returned without action.

D. Samples for Initial Selection: Prepare physical units of materials or products, including following:
1. Contractor shall submit to A/E samples to illustrate materials or workmanship, colors, and textures, and establish standards by which Work will be judged.
    a. Transmit samples that contain multiple, related components such as accessories together in one submittal package.
2. Provide corresponding electronic submittal of sample transmittal, digital image file illustrating sample characteristics, and identification information for record.
3. Identification: Attach label on unexposed side of samples that includes following:
    a. Generic description of sample.
    b. Product name and name of manufacturer.
    c. Sample source.
    d. Number and title of applicable specification section.
4. Samples for Initial Selection: Submit manufacturer's color published charts consisting of units or sections of units showing full range of colors, textures, and patterns available. Reproductions, facsimiles, or copies will be rejected.

a. Number of Samples for Initial Selection: Submit two full sets of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line, unless otherwise noted.

2.3 INFORMATIONAL/QUALITY ASSURANCE/CONTROL SUBMITTALS

A. General: Prepare and submit informational submittals required by other Specification Sections.

B. Samples for Verification: Submit full size units or Samples of size indicted, prepared from same material to be used for Work, cured and finished in manner specified, and physically identical with material or product proposed fur use, and that show full range of color and texture variations expected. Sample include, but are not limited to, 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.
   1. Number of Samples for Verification: Submit 1 set of samples. A/E will retain sample sets, unless otherwise noted.
      a. Contractor shall receive written notification.
   2. Provide corresponding electronic submittal of sample transmittal, digital image file illustrating sample characteristics, and identification information for record.
   3. Disposition: Maintain sets of approved samples at project site, available for quality control comparisons throughout course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
      a. Samples that may be incorporated into Work are indicated in individual Specification Sections. Such samples must be in an undamaged condition at time of use.
      b. Samples not incorporated into Work, or otherwise designated as Owner's property, are property of Contractor.
   4. Identification: Permanently attach label on unexposed side of Samples that include following:
      a. Product name and submittal number.
      b. Generic description of sample.
      c. Product name and name of manufacturer.
      d. Sample source.
      e. Number and title of applicable Specification Section.
      f. Specification paragraph number and generic name of each item.
   5. Materials shall not be ordered until final review is received in writing from A/E. Materials shall be furnished, equal in every respect to reviewed samples. Where color or shade cannot be guaranteed, manufacturer shall indicate maximum deviation. Work shall be in accordance with final reviewed samples.

C. 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 A/Es and Owners, and other information specified.

D. 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 assumption 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.

E. Certificates:
   1. Certificates and Certification Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.
   2. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements.

3. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements in Contract Documents and, where required, is authorized for this specific project.
4. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements. Include evidence of manufacturing experience where required.
5. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements.

F. Test and Research Reports
1. 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.
2. 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.
3. 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.
4. 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.
5. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements. 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.
    a. Test reports shall be no older than 15 months, unless otherwise noted or approved by A/E.
6. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include following information:
    a. Name of evaluation organization.
    b. Date of evaluation.
    c. Time period when report is in effect.
    d. Product and manufacturers' names.
    e. Description of product.
    f. Test procedures and results.
    g. Limitations of use.

G. 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 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

H. Manufacturer's Field Reports: Prepare written information documenting factory authorized service representative's tests and inspections. Include 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.

I. Material Safety Data Sheets (MSDSs) or Safety Data Sheets (SDS): Submit information directly to Owner; do not submit to A/E.
1. This information relates directly to construction safety, which is sole responsibility of Contractor.
2. MSDS or SDS shall not be submitted to A/E for review.
3. MSDS or SDS submitted to A/E will be either removed or crossed out of submittal with no action taken.

J. Coordination Drawings: Comply with requirements specified in Division 1 Section “Project Management and Coordination”.

K. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for Work and their intended location. Include following information in tabular form:
1. Type of product. Include unique identifier for each product indicated in Contract Documents.
2. Manufacturer and product name, and model number if applicable.
3. Number and name of room or space.
4. Location within room or space.
5. Submit product schedule in following format:
a. PDF electronic file.

L. Contractor's Construction Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation."

M. Application for Payment: Comply with requirements specified in Division 01 Section "Payment Procedures."

N. Schedule of Values: Comply with requirements specified in Division 01 Section "Payment Procedures."

O. Subcontractors and Major Material Suppliers List: Comply with requirements specified in Division 01 Section “Project Management and Coordination”.

2.4 CLOSEOUT SUBMITTALS

A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals.
1. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements in Division 01 Section “Closeout Procedures”.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Action and Informational/Quality Assurance/Control Submittals: Review each submittal and check for coordination with other Work of Contract and for compliance with Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to A/E.

B. Project Closeout and Maintenance/Material Submittals: Refer to requirements in Division 01 Section "Closeout Procedures."

C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with Contract Documents.

3.2 A/E'S ACTION

A. General: A/E will not review submittals that do not bear Contractor's approval stamp and will return them without action.

B. Action Submittals: A/E will review each submittal, make marks to indicate corrections or modifications required, and return it. A/E will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.
   1. Shop drawings will be marked as follows: Contractor shall take the following action for each respective marking:
      a. "REVIEWED" – Contractor shall make and distribute copies.
      b. “FURNISH AS CORRECTED” – Final Release; Contractor may proceed with fabrication, taking into account the necessary corrections on submittal or attached and with Contract Documents.
      c. "REVISE AND RESUBMIT" - Contractor may proceed with fabrication, taking into account the necessary corrections. Corrected shop drawings shall be resubmitted before fabrication of this work is complete to obtain a different action marking. Do not allow drawings marked "Resubmit" to be used in connection with installation of the Work.
      d. "REJECTED" - Contractor will be required to resubmit shop drawings in their entirety. No fabrication or installation shall be started until shop drawings so marked have been completely revised, resubmitted, and marked by A/E according to preceding Paragraphs a., b., or c.
      e. “SUBMIT SPECIFIED ITEM” – Contractor shall not submit substitutions in Shop Drawings. Submittal is rejected. Submit specified item.
      f. “NOT REQUIRED FOR REVIEW (INFORMATIONAL) – Contractor shall submit Information Submittals for A/E records only.

C. Informational/Quality Assurance/Control Submittals: A/E will review each submittal and will not return it, or will return it if it does not comply with requirements. A/E will forward each submittal to appropriate party.

D. Partial submittals prepared for a portion of Work will be reviewed when use of partial submittals has received prior approval from A/E.

E. Incomplete submittals are not acceptable, will be considered nonresponsive, and will be returned without review.

F. Submittals not required by Contract Documents may not be reviewed and may be discarded.

END OF SECTION 01 33 00

AIA® Document C106™ – 2022

Digital Data Licensing Agreement

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

BETWEEN the Party transmitting Digital Data ("Transmitting Party"):
(Name, address, and contact information, including electronic addresses)

Fanning Howey Associates, Inc.

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

and the Party receiving the Digital Data ("Receiving Party"):
(Name, address, and contact information, including electronic addresses)

for the following Project:
(Name and location or address of the Project)

Project No.

for the following Digital Data ("Digital Data"):
(Identify below, in detail, the information created or stored in digital form that the Parties intend to be subject to this Agreement.)

EXAMPLE: Revit Models for use on the Project, during construction operations.

The Transmitting Party and Receiving Party agree as follows.

TABLE OF ARTICLES

1 GENERAL PROVISIONS

2 TRANSMISSION OF DIGITAL DATA

3 LICENSE CONDITIONS

4 LICENSING FEE OR OTHER COMPENSATION

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User Notes: (1819046264)

ARTICLE 1 GENERAL PROVISIONS

§ 1.1 The purpose of this Agreement is to grant a license from the Transmitting Party to the Receiving Party for the Receiving Party's use of Digital Data and to set forth the license terms.

§ 1.2 This Agreement is the entire and integrated agreement between the Parties. Except as specifically set forth herein, this Agreement does not create any other contractual relationship between the Parties.

§ 1.3 Confidential Digital Data is Digital Data containing confidential or business proprietary information that the Transmitting Party designates as "confidential."

ARTICLE 2 TRANSMISSION OF DIGITAL DATA

§ 2.1 The Transmitting Party grants to the Receiving Party a nonexclusive limited license to use the Digital Data solely and exclusively for the uses, and in accordance with the terms, set forth in Article 3.

§ 2.2 Only the Receiving Party is permitted to access and use the Digital Data. Unlicensed and unauthorized access or use by third parties is strictly prohibited except as set forth in Section 2.4.1.

2.2.1 The Receiving Party is permitted to share the Digital Data identified with other parties, contracted for work on the indicated Project. All parties receiving the Digital Data are bound by this same Licensing Agreement provisions.

§ 2.3 The transmission of Digital Data constitutes a warranty by the Transmitting Party to the Receiving Party that the Transmitting Party is the copyright owner of the Digital Data or otherwise has permission to transmit the Digital Data to the Receiving Party for its use on the Project in accordance with the terms and conditions of this Agreement.

§ 2.4 Where the Transmitting Party has designated information furnished pursuant to this Agreement as "confidential," the Receiving Party shall keep the information confidential and shall not disclose it to any other person or entity except as set forth in Section 2.4.1.

§ 2.4.1 The Receiving Party may disclose Confidential Digital Data after seven (7) days' notice to the Transmitting Party where disclosure is required by law, including a subpoena or other form of compulsory legal process issued by a court or governmental entity, or by court or arbitrator(s) order. The Receiving Party may also disclose Confidential Digital Data to its employees, consultants, sureties, subcontractors and their employees, sub-subcontractors, and others who need to know the content of such information solely and exclusively for the Project and who agree to maintain the confidentiality of such information.

§ 2.5 By transmitting Digital Data, the Transmitting Party does not convey any ownership right in the Digital Data or in the software used to generate the Digital Data. Unless otherwise granted in a separate license, the Receiving Party's right to use, modify, or further transmit Digital Data is specifically limited to those uses, and in accordance with the terms, set forth in Article 3, and nothing contained in this Agreement conveys any other right to use the Digital Data.

§ 2.6 To the fullest extent permitted by law, the Receiving Party shall indemnify and defend the Transmitting Party from and against all claims arising from or related to the Receiving Party's modification to, or unlicensed use of, the Digital Data.

§ 2.7 Transmission of the Digital Data does not abridge or extinguish the Transmitting Party's rights, including, to the extent applicable, exclusive ownership interest, in such information under all applicable state, federal, and international laws including, without limitation, laws governing the protection of copyrights and intellectual property.

§ 2.8 The provisions of this Article 2 shall survive the termination of this Agreement.

ARTICLE 3 LICENSE CONDITIONS

§ 3.1 The Receiving Party may use and rely upon the Digital Data to the extent set forth in this Article 3. *(Choose only one option below.)*

[X] **§ 3.1.1** The Digital Data is transmitted solely for the Receiving Party's information. Receiving Party acknowledges that any use of the Digital Data shall be at Receiving Party's sole risk. The Receiving Party accepts the Digital Data "as is" without any warranty or representations from the Transmitting

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User Notes: (1819046264)

Party as to whether the Digital Data is accurate, complete, or fit for use as intended by the Receiving Party. The Receiving Party is solely responsible for verifying whether the Digital Data is accurate, complete, or fit for the Receiving Party's intended use.

3.1.1.1 The Receiving Party agrees not to reuse these electronic files in whole or in part, for any purpose other than for the Project identified. The Receiving Party further agrees to waive all claims against the Transmitting Party resulting in any way from any unauthorized changes to or reuse of the electronic files for any other project by anyone other than the Transmitting Party.

3.1.1.2 The Receiving Party is aware that differences may exist between the electronic files delivered and the printed hard copy Contract Documents. In the event of a conflict between the signed and sealed Contract Documents prepared by the Transmitting Party and electronic files, the signed and sealed hard copy Contract Documents shall govern.

[ ] **§ 3.1.2** Other:
(Identify terms, permitted uses, or other conditions related to the Digital Data.)

.

§ 3.2 If no specific terms or uses are selected or set forth in Section 3.1, then the Receiving Party may use the Digital Data at its sole risk pursuant to the terms and conditions set forth in Section 3.1.1.

ARTICLE 4 LICENSING FEE OR OTHER COMPENSATION

The Receiving Party agrees to pay the Transmitting Party the following fee or other compensation for the Receiving Party's use of the Digital Data:
(State the fee, in dollars, or other method by which the Receiving Party will compensate the Transmitting Party for the Receiving Party's use of the Digital Data.)

$0.00

This Agreement is entered into as of the day and year first written above and terminates one year from said date, except as set forth below.
(Indicate when this Agreement will terminate, if other than one year from the date it was entered into, and other conditions related to termination.)

TRANSMITTING PARTY *(Signature)*	**RECEIVING PARTY** *(Signature)*
FANNING/HOWEY ASSOCIATES, INC.	*[INSERT NAME OF RECEIVING COMPANY*
(Printed name and title)	*(Printed name and title)*

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Certification of Document's Authenticity

AIA® Document D401™ – 2003

I, , hereby certify, to the best of my knowledge, information and belief, that I created the attached final document simultaneously with this certification at 11:02:54 ET on 03/15/2024 under Order No. 2114457273 from AIA Contract Documents software and that in preparing the attached final document I made no changes to the original text of AIA® Document C106™ – 2022, Digital Data Licensing Agreement,other than changes shown in the attached final document by underscoring added text and striking over deleted text.

_____

(Signed)

_____

(Title)

_____

(Dated)

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SECTION 01 42 00 - REFERENCES

PART 1 - GENERAL

1.1 DEFINITIONS

A. General: Basic Contract definitions are included in Conditions of Contract.

B. "Approved": When used to convey A/E's action on Contractor's submittals, applications, and requests, "approved" is limited to A/E's duties and responsibilities as stated in Conditions of Contract.

C. "Directed": A command or instruction by A/E. Other terms including "requested," "authorized," "selected," "approved," "required," and "permitted" have same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within construction industry that control performance of Work.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

H. "Provide": Furnish and install, complete and ready for intended use.

I. "Project Site": Space available for performing construction activities. Extent of Project site is shown on Drawings and may or may not be identical with description of land on which Project is to be built.

1.2 INDUSTRY STANDARDS

A. Applicability of Standards: Unless Contract Documents include more stringent requirements, applicable construction industry standards have same force and effect as if bound or copied directly into Contract Documents to extent referenced. Such standards are made a part of Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of Contract Documents, unless otherwise indicated.

C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with Contract Documents.
   1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 42 00

SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Provide temporary facilities as specified and as indicated on Drawings, in accordance with Contract Documents.
   1. Installing and maintain such temporary facilities shall remove from premises temporary work erected at completion of Project, or when requested to do so by A/E. Temporary structures and facilities become property of party furnishing them. Leave premises clean and in acceptable conditions as approved by A/E.

1.2 DEFINITIONS

A. Permanent Enclosure: As determined by A/E, permanent or temporary roofing is complete, insulated and watertight; exterior walls are insulated and weathertight; and all openings are closed with permanent construction or substantial temporary closures.

1.3 USE CHARGES

A. General: Installation and removal of and use charges for temporary facilities shall be included in Contract Sum, unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner, A/E, testing agencies, and authorities having jurisdiction.

B. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

C. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.4 INFORMATIONAL/QUALITY ASSURANCE/CONTROL SUBMITTALS

A. Site Utilization Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel, vehicle circulation, including construction site entrance.

B. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.
   1. Fire-Protection Plan: Prepare a written plan for preventing fires during Work, including placement of fire extinguishers, fire blankets, rag buckets, and other fire-control devices during each phase or process. Coordinate plan with Owner's fire-protection equipment and requirements.

C. Dust-Control and HVAC-Control Plan: Submit coordination drawing and narrative that indicates dust-control and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include following:
   1. Locations of dust-control partitions at each phase of work.
   2. HVAC system isolation schematic drawing.
   3. Location of proposed air filtration system discharge.
   4. Waste-handling procedures.
   5. Other dust-control measures.

D. Noise and Vibration Control Plan: Identify construction activities that might impact the occupancy and use of existing spaces within the building or adjacent existing buildings, whether occupied by others, or occupied by Owner. Include the following:
   1. Methods used to meet the goals and requirements of Owner.
   2. Concrete cutting method(s) to be used.
   3. Location of construction devices on the site.
   4. Show compliance with the use and maintenance of quieted construction devices for the duration of the Project.
   5. Indicate activities that may disturb building occupants and that are planned to be performed during non-standard working hours as coordinated with Owner.

1.5 QUALITY ASSURANCE

A. Regulations: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction

B. Standards: Comply with NFPA 241 “Standard for Safeguarding Construction, Alternations, and Demolition Operations”, ANSI A10 Series Standards for “Safety Requirements for Construction and Demolition,” and NECA Electrical Design Library “Temporary Electrical Facilities”.
   1. Electrical Service: Comply with NEMA, NECA, and UL standards and regulations for temporary electric service. Install service in compliance with NFPA 70 “National Electric Code”.

C. Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.

D. Accessible Temporary Egress: Comply with applicable provisions in U.S. Architectural and Transportation Barriers Compliance Board’s ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.6 PROJECT CONDITIONS

A. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Relocate temporary services and facilities as work progresses. Do not overload facilities or permit them to interfere with progress. Take necessary fire prevention measures. Do not allow hazardous, dangerous, or unsanitary conditions, or public nuisances to develop or persist onsite.

B. Temporary Utilities: Prepare a schedule indicating dates for implementation and termination of each temporary utility. At earliest feasible time, when acceptable to Owner, change over from use of temporary service to use of permanent service.
   1. Temporary Use of Permanent Facilities: Installer of each permanent service shall assume responsibility for operation, maintenance, and protection of that permanent service during its use as a construction facility before Owner’s acceptance, regardless of previously assigned responsibilities.

C. Conditions of Use: Following conditions apply to use of temporary services and facilities by all parties engaged in Work:
   1. Keep temporary services and facilities clean and neat.
   2. Relocate temporary services and facilities as required by progress of work.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide new materials. If acceptable to A/E, Contractor may use undamaged, previously used materials in serviceable condition. Provide materials suitable for use intended.

2.2 EQUIPMENT

A. General: Provide new equipment. If acceptable to A/E, Contractor may use undamaged, previously used equipment in serviceable condition. Provide equipment suitable for use intended.

B. Fire Extinguishers: Provide hand carried, portable, UL rated; Class A fire extinguishers for temporary offices and similar spaces. In other locations, provide hand carried, portable, UL rated, Class ABC, dry chemical extinguishers or a combination of extinguishers of NFPA recommended classes for exposures.
   1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

C. Air Filtration Units: HEPA primary and secondary filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

2.3 TEMPORARY FACILITIES

A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature control, and foundations adequate for normal loading.

B. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
   1. Store combustible materials apart from building.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve project adequately and result in minimum interference with performance of Work. Relocate and modify facilities as required.

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

C. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.
   1. Prior to commencing work, isolate the HVAC system in area where work is to be performed.
      a. Disconnect supply and return ductwork in work areas.
      b. Maintain negative air pressure within work area, using HEPA-equipped air-filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.
   2. Maintain dust partitions during the work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust-containment devices.
   3. Perform daily construction cleanup and final cleanup using approval, HEPA filter-equipped vacuum equipment.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing services.
   1. Arrange with utility company, Owner, and existing users for time where service can be interrupted, if necessary, to make connections for temporary services.

B. Water Service and Distribution
   1. Owner will make provisions for use of existing water facilities at Project site and shall designate location where service will be provided. Contractor shall provide own means of conveying water from designated location, as approved by Owner.
      a. Owner will pay cost of water used on Project.

C. Temporary Electric Power
   1. Owner will make provisions for use of existing service at Project site and shall designate location where service will be provided. Contractor shall provide own means of extending electrical service from designated location, as approved by Owner. Maintain equipment in condition acceptable to Owner.
      a. Owner will pay for cost of electrical energy used on Project.

D. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
   1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

E. Heating and Cooling, General: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment from that specified that will not have a harmful effect on completed installations or elements being installed.
   1. 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.
   2. Maintain a relative humidity between 30 and 50 percent in permanently enclosed portions of building for normal construction activities.
   3. Maintain a healthy working environmental with carbon monoxide levels within OSHA guidelines.

F. Heating System - Existing Building
   1. Existing building heating system shall remain "in-service" throughout construction of new addition. Owner shall pay for services, maintenance, and fuel for existing facility during construction.
   2. In event existing building heating system is specified to be modified, added to, or replaced in part or total, then Contractor shall comply with requirements of Method 1.
   3. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.
      a. Prior to commencing work, isolate the HVAC system in area where work is to be performed in accordance with approved coordination drawings.
         1) Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
         2) Maintain negative air pressure within work area using HEPA-equipped air filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.
      b. Maintain dust partitions during Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust containment devices.
      c. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.

G. Ventilation and Humidity Control
1. Provide and pay for ventilation and humidity control of enclosed space for workmen in accordance with applicable laws. Provide ventilation, air conditioning, and humidity control of enclosed space as required to facilitate drying of plaster, poured decks and floors, or other materials requiring ventilation in accordance with manufacturer's directions and as required to attain proper moisture levels within building including materials, surfaces and ambient air for installation and application of interior materials and equipment. Provide temporary ventilation and humidity control to protect installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
2. If permanent ventilation and air conditioning system is used, assume full responsibility for maintenance of permanent equipment and shall keep system clean, furnish and change filters as needed, and turn complete new heating-ventilation system over to Owner in a clean condition when project is completed. Permanent equipment shall not be used for temporary ventilation unless maintained and operated as follows:
a. Return air ducts shall not be used.
b. Supply air to each unit shall be filtered.
c. Filters shall be constantly checked and changed when necessary.
d. Operation of permanent equipment for ventilation shall not negate Owner's one year warranty specified to commence on date of Substantial Completion.

H. Temporary Telephones: Use of Wifi cell phone system is acceptable, if can be maintained.

I. Electronic Communication Service: Contractor shall provide temporary electronic communication service, including electronic mail, in common use facilities. Provide secure Wi-Fi wireless connection to internet with provisions for access by A/E.
1. Provide a T-1 line, cable or DSL in primary field office.

J. Temporary Toilet Facilities
1. Provide, at beginning of Work, and shall maintain an approved chemical type toilet as required by law and in quantity needed for proper servicing of Project. Temporary toilets shall be for use by trades on job. Place in an approved location.
a. Provide toilet tissue and similar disposable materials for each facility.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with following:
1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.

B. Field Offices and Storage Sheds
1. Not required. Approval of Contractor and Owner is required if subcontractor wishes to provide a construction office for his own use.
2. Mobile offices or storage facilities may be supplied by subcontractors, if approved by A/E. Remove from and clean premises when directed by A/E.
3. No signs will be allowed to be erected on site or on building unless approved by Owner.

C. Temporary Roads and Paving
1. Existing drives and parking areas as indicated on Drawings and as directed by Owner, shall be used as access drives, staging, and parking areas for construction.
a. Contractor shall be held responsible for damage to existing surfaces resulting from operations relative to Work being performed under this Contract; and shall repair damaged areas to their original condition, as approved by A/E, at no additional cost to Owner.

D. Traffic Controls: Comply with requirements of authorities having jurisdiction.
   1. Protect existing site improvements to remain including curbs, pavement, and utilities.
   2. Maintain access for fire fighting equipment and access to fire hydrants.

E. Parking: Use designated areas of Owner's existing parking areas for construction personnel.

F. Project Signs: Unauthorized signs are not permitted.
   1. Temporary Signs: Provide signs as required to inform public and individuals seeking entrance to Project.
      a. Provide temporary, directional signs for construction personnel and visitors.

G. Waste Disposal Services
   1. Contractor shall provide (for life of Project) and pay for dumpster type rubbish container adequately sized for waste, debris, and rubbish generated.
      a. Contractor shall dispose of container contents weekly or at more frequent intervals if required by inadequate container capacity.
      b. Shall erect suitable, closed, relatively dust free chutes for use by all trades during demolition and remodeling. No material or debris will be permitted to drop free.
   2. Collection and Disposal of Waste: Collect waste from construction areas and elsewhere daily. Comply with requirements of NFPA 241 for removal of combustible waste material and debris. Enforce requirements strictly. Do not hold materials more than 7 days during normal weather or 3 days when temperature is expected to rise above 80 degrees F. Handle hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing properly. Dispose of material lawfully.

H. Temporary First Aid Facilities
   1. Contractor and subcontractor shall provide first aid facilities as required by federal, state, county, and municipal safety regulations.

3.4 SECURITY AND PROTECTION FACILITIES

A. Temporary Partitions: Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise.
   1. Construct dustproof, floor-to-ceiling partitions of not less than nominal 4 inch studs, 2 layers of 6 mil polyethylene sheets, inside and outside temporary enclosure.
   2. Insulate partitions 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. Weatherstrip openings.

B. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.
   1. Prohibit smoking in construction areas. Comply with additional limits on smoking specified in other sections.
   2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
   3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
   4. Sprinklers: Where sprinkler protection exists and is functional, maintain it without interruption while operations are being performed. If operations are preformed close to sprinklers, shield them temporarily with guards.
      a. Remove temporary guards at end of work shifts, whenever operations are paused, and when nearby work is complete.

C. Safety and Health Regulations for Construction
   1. These Construction Documents and construction hereby contemplated shall be governed by applicable provisions of Federal, State and local regulations for construction safety in State in which project is located.
      a. Contractor shall be responsible for safety and health of persons and property affected by Contractor's performance of Work including work performed by his subcontractors. This requirement shall apply continuously during entire contract period and shall not be limited to normal working hours.
      b. Contractor shall designate a qualified safety and health representative to be responsible for administration of Contractor's Safety and Health program.
   2. Contractor shall be responsible for compliance with above aforesaid safety and health regulations for construction as applicable to Contractor's Contract and Contractor's construction means and methods. Contractor shall be liable for violations as may be cited or charged against Contractor by authorities governing safety and health regulations for construction.
      a. A/E and Owner shall not be responsible for construction means and methods and shall not be responsible for construction safety.
   3. Barricades
      a. Contractor shall provide and pay for temporary construction barricades as required for safety and security for his specified portion of Work.
         1) Erect barricades as required by applicable laws at slab edges, slab openings, and other building hazards.
   4. Where appropriate and needed, provide lighting, including flashing red or amber lights.

D. Environmental Protection
   1. In order to prevent and to provide for abatement and control of environmental pollution arising from construction activities of Contractor and his subcontractors in performance of this Contract, they shall comply with applicable federal, state, and local laws, and regulations concerning environmental pollution control and abatement as well as specific requirements stated elsewhere in Contract Documents.
   2. No Contractor shall pollute water resources with fuels, oils, bitumen, calcium chloride, acids or harmful materials. It is responsibility of each Contractor to investigate and comply with applicable federal, state, county, and municipal laws concerning pollution of rivers and streams.
   3. Contractor will be required to minimize dispersed dust at required excavations, embankments, stockpiles, haul roads, permanent access roads, plant sites, waste areas, borrow areas, and other work areas on or off site to minimize dispersed dust.

E. Security Enclosure and Lockup
   1. Install substantial temporary doors or enclosure of partially completed areas of construction. Provide locking entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Cost to be included in Contractor’s Base bid.
      a. Storage: Where materials and equipment must be stored, and are of value or attractive for theft, provide a secure lockup.

F. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

3.5 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage caused by freezing temperatures and similar elements.
   1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24 hour basis where required to achieve indicated results and to avoid possibility of damage.

2. Prevent water filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.

C. Temporary Facility Changeover: Except for using permanent fire protection as soon as available, do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
   1. Materials and facilities that constitute temporary facilities are property of Contractor.
   2. At Substantial Completion, clean and renovate permanent facilities used during construction period. Comply with final cleaning requirements in Division 01 Section “Closeout Procedures”.

END OF SECTION 01 50 00

SECTION 01 60 00 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products.
   1. It is intent of Specifications and Drawings to accomplish a complete and first-grade installation executed by competent and experienced workmen.
   2. Equipment, specialties, and similar items shall be checked for compliance and approved prior to installation. Contractors are cautioned that work or equipment installed without approval is subject to condemnation, removal, and subsequent replacement with an approved item without extra remuneration.

1.2 DEFINITIONS

A. Products: Items purchased for incorporating into Work, whether purchased for Project or taken from previously purchased stock. Term "product" includes terms "material," "equipment," "system," and terms of similar intent.
   1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of Contract Documents.
   2. New Products: Items that have not previously been incorporated into another project or facility, except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise. Products salvaged or recycled from other projects are not considered new products.
   3. Comparable Product: Product that is to have indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by Contract Documents and proposed by Contractor.

C. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by words "basis of design," including make or model number or other designation, to establish significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers.

1.3 SUBMITTALS

A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
   1. Substitution Request Form: Use facsimile of form provided at end of Section.
   2. Documentation: Show compliance with requirements for substitutions and following, as applicable:
      a. Statement indicating why specified material or product cannot be provided.
      b. Coordination information, including a list of changes or modifications needed to other parts of Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
      c. Detailed comparison of significant qualities of proposed substitution with those of Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.

d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
e. Samples, where applicable or requested.
f. List of similar installations for completed projects with project names and addresses and names and addresses of A/Es and owners.
g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
h. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
i. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for Work, including effect on overall Contract Time. If specified product or method of construction cannot be provided within Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.
j. Cost information, including a proposal of change, if any, in Contract Sum.
k. Contractor's certification that proposed substitution complies with requirements in Contract Documents and is appropriate for applications indicated.
l. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. A/E's Action: If necessary, A/E will request additional information or documentation for evaluation within 7 days of receipt of a request for substitution. A/E will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.
   a. Form of Acceptance: Change Order.
   b. Use product specified if A/E cannot make a decision on use of a proposed substitution within time allocated.

B. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 01 Section "Submittal Procedures." Show compliance with requirements.

1.4 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.

B. Delivery and Handling:
1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to ensure compliance with Contract Documents and to ensure that products are undamaged and properly protected.

C. Storage:
1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.

3. Store products that are subject to damage by elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Store cementitious products and materials on elevated platforms.
5. Store foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
7. Protect stored products from damage and liquids from freezing.

D. Contractor shall be responsible for materials he orders for delivery to jobsite. Responsibility includes, but is not limited to, receiving, unloading, storing, protecting, and setting in place; ready for final connections.
1. Owner will not be responsible for deliveries related to construction or operation of Contractor. Owner cannot sign delivery forms for Contractor.

E. Contractors shall insure that products are delivered to Project in accordance with Construction Schedule of Project. In determining date of delivery, sufficient time shall be allowed for shop drawings and sample approvals, including possibility of having to resubmit improperly prepared submittals or products other than those specified and necessary fabrication or procurement time along with delivery method and distance involved.

1.6 WARRANTIES

A. Specific warranties or bonds called for in Contract Documents, in addition to that falling under general warranty as set forth in General Conditions, shall be furnished in accordance with requirements of Specifications.
1. Owner’s Recourse: Expressed warranties made to Owner are in addition to implied warranties and shall not limit duties, obligations, rights, and remedies otherwise available under law. Expressed warranty periods shall not be interpreted as limitations on time in which Owner can enforce such other duties, obligations, rights, or remedies.
a. Rejection of Warranties: Owner reserves right to reject warranties and to limit selection to products with warranties not in conflict with requirements of Contract Documents.

B. Contractor shall and does hereby agree to warrant for a period of one year, or for longer periods, where so provided in Specifications, as evidenced by date of Substantial Completion issued by A/E, products installed under Contract to be of good quality in every respect and to remain so for periods described herein.

C. Should defects develop in previously mentioned Work within specified periods, due to faults in products or their workmanship, Contractor hereby agrees to make repairs and do necessary Work to correct defective Work to A/E's satisfaction, in accordance with General and Supplementary Conditions. Such repairs and corrective Work, including costs of making good other Work damaged by or otherwise affected by making repairs or corrective Work, shall be done without cost to Owner and at entire cost and expense of Contractor within 30 days after written notice to Contractor by Owner.
1. Related Damages and Losses: When correcting failed or damaged warranted construction, remove and replace construction that has been damaged as a result of such failure or must be removed and replaced to provide access for correction of warranted construction.
2. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate warranty by written endorsement. Reinstated warranty shall be equal to original warranty with an equitable adjustment for depreciation.

D. Nothing herein intends or implies that warranty shall apply to Work that has been abused, neglected, or improperly maintained by Owner or his successor in interest.

E. Where service on products is required under this Article, it shall be promptly provided when notified by Owner and no additional charge shall be made, unless it can be established that defect or malfunctioning was caused by abuse or accidental damage not to be expected under conditions of ordinary wear and tear.

F. In event movement in adjoining structure or components causes malfunctioning, Contractor responsible for original installation of adjoining structure or components shall provide such repair, replacement, or correction necessary to provide for proper functioning to bring equipment back into same operating condition as approved at completion of building.

G. Manufacturer and supplier expressly warrants that each item of equipment furnished by him and installed in this Project is suitable for application shown and specified in Contract Documents and includes features, accessories, and performing characteristics listed in manufacturer's catalog in force on date bids are requested for Work. This warranty is intended as an assurance by manufacturer that his equipment is not being misapplied and is fit and sufficient for service intended. This warranty is in addition to and not in limitation of other warranties or remedies required by law or by Contract Documents. It shall be responsibility of Contractor for particular equipment to obtain this warranty in writing.

H. In case Contractor fails to do Work so ordered, Owner may have Work done and charge cost thereof against monies retained as provided for in Agreement and, if said retained monies shall be insufficient to pay such cost or if no money is available, Contractor and his Sureties shall agree to pay to Owner cost of such Work.

I. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of Contract Documents.
   1. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
   2. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

J. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.
   1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
   2. Specified Form: When specified forms are included with Specifications, prepare a written document using appropriate form properly executed.
   3. Refer to Divisions 02 through 49 Sections for specific content requirements and particular requirements for submitting special warranties.

K. Submittal Time: Comply with requirements in Division 01 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with 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 right to limit selection to products with warranties not in conflict with requirements of Contract Documents.

4. Where products are accompanied by term "as selected," A/E will make selection.
5. Where products are accompanied by term "match sample," sample to be matched is A/E's.
6. Descriptive, performance, and reference standard requirements in Specifications establish "salient characteristics" of products.

B. Product Selection Procedures:
1. Product: Where Specifications name a single product and manufacturer, provide named product that complies with requirements.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by named manufacturer or source that complies with requirements.
3. Products: Where Specifications include a list of names of both products and manufacturers, provide one of products listed that complies with requirements.
   a. Restricted List: Where specifications include a list of names of both manufacturers and products, provide one of products listed that complies with requirements. Substitutions for Contractor's convenience will not be considered after award, unless otherwise noted.
4. Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of manufacturers listed that complies with requirements.
   a. Restricted List: Where specifications include a list of manufacturer's names, provide a product by one of manufacturers listed that complies with requirements. Substitutions for Contractor's convenience will not be considered, unless otherwise indicated.
5. Product Options: Where Specifications indicate that sizes, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide specified product or system. Comply with provisions in Part 2 "Product Substitutions" Article for consideration of an unnamed product or system.
6. Basis-of-Design Product: Where Specifications name a product and include a list of manufacturers, provide specified product or a comparable product by one of other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on product named. .
7. Visual Matching Specification: Where Specifications require matching an established Sample, select a product that complies with requirements and matches A/E's sample. A/E's decision will be final on whether a proposed product matches.
   a. If no product available within specified category matches and complies with other specified requirements, comply with provisions in Part 2 "Product Substitutions" Article for proposal of product.
8. Visual Selection Specification: Where Specifications include phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product that complies with other specified requirements.
   a. Standard Range: Where Specifications include phrase "standard range of colors, patterns, and textures" or similar phrase, A/E will select color, pattern, density, or texture from manufacturer's product line that does not include premium items.
   b. Full Range: Where Specifications include phrase "full range of colors, patterns, textures" or similar phrase, A/E will select color, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 PRODUCT SUBSTITUTIONS

A. Timing: A/E will consider requests for substitution if received within 60 days after Notice to Proceed. Requests received after that time may be considered or rejected at discretion of A/E.

B. Conditions: A/E will consider Contractor's request for substitution when following conditions are satisfied. If following conditions are not satisfied, A/E will return requests without action, except to record noncompliance with these requirements:

1. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to A/E for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
2. Requested substitution does not require extensive revisions to Contract Documents.
3. Requested substitution is consistent with Contract Documents and will produce indicated results.
4. Substitution request is fully documented and properly submitted.
5. Requested substitution will not adversely affect Contractor's Construction Schedule.
6. Requested substitution has received necessary approvals of authorities having jurisdiction.
7. Requested substitution is compatible with other portions of Work.
8. Requested substitution has been coordinated with or portions of Work.
9. Requested substitution provides specified warranty.
10. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

2.3 PROTECTION

A. Contractor shall protect building elements and products subject to damage. Should workmen or other persons employed or commissioned by a Contractor be responsible for damage, entire cost of repairing said damage shall be assumed by that individual Contractor. Should damage be done by a person or persons not employed or commissioned by a Contractor, respective Contractors shall make repairs and charge cost to guilty person or persons. Affected Contractors shall be responsible for collecting such charges. If person or persons responsible for damage cannot be discovered, respective Contractor shall make full and satisfactory repairs, and cost of Work shall be prorated against Contractor.

B. Contractor shall protect their products prior to installation and final acceptance. Storage shall be dry, clean, and safe. Materials or equipment damaged, deteriorated, rusted, or defaced due to improper storage shall be repaired, refinished, or replaced, as required by A/E. Products lost through theft or mishandling shall be replaced by Contractor without cost to Owner.

2.4 ACCEPTANCE OF EQUIPMENT OR SYSTEMS

A. Owner will not accept start of warranty period on systems or equipment until Substantial Completion is issued to respective Contractor(s) for Owner's occupancy of building, in part or whole. Contractor shall make such provisions as required to extend manufacturer's warranty from time of initial operation of systems or equipment until Substantial Completion is given in writing.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 60 00

SUBSTITUTION REQUEST
(After the Bidding Phase)

FANNING HOWEY

Project: Dublin Jerome High School
Hitting Facility Renovation

To: _____

_____

Re: _____

From: _____

Date: _____

A/E Project Number: 225079.00

Contract For: _____

Specification Title: _____ Description: _____

Section: _____ Page: _____ Article/Paragraph: _____

Proposed Substitution: _____

Manufacturer: _____ Address: _____ Phone: _____

Trade Name: _____ Model No.: _____

Installer: _____ Address: _____ Phone: _____

History: ☐ New product ☐ 2-5 years old ☐ 5-10 yrs old ☐ More than 10 years old

Differences between proposed substitution and specified product: _____

_____

_____

☐ Point-by-point comparative data attached

Reason for not providing specified item: _____

_____

Similar Installation:

Project: _____ Architect: _____

Address: _____ Owner: _____

_____ Date Installed: _____

Proposed substitution affects other parts of Work: ☐ No ☐ Yes; explain _____

_____

Savings to Owner for accepting substitution: _____ ($ _____).

Proposed substitution changes Contract Time: ☐ No ☐ Yes [Add] [Deduct] _____ days.

Supporting Data Attached: ☐ Drawings ☐ Product Data ☐ Samples ☐ Tests ☐ Reports ☐ _____

SUBSTITUTION REQUEST
(Continued)

FANNING HOWEY

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Cost data as stated above is complete. Claims for additional costs related to accepted substitution which may subsequently become apparent are to be waived.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.
- Coordination, installation, and changes in the Work as necessary for accepted substitution will be complete in all respects.

Submitted by: _____

Signed by: _____

Firm: _____

Address: _____

_____

Telephone: _____

Attachments: _____

_____

_____

_____

A/E's REVIEW AND ACTION

☐ Substitution approved - Make submittals in accordance with Specification Section 01330.
☐ Substitution approved as noted - Make submittals in accordance with Specification Section 01330.
☐ Substitution rejected - Use specified materials.
☐ Substitution Request received too late - Use specified materials.

Signed by: _____ Date: _____
(Project Manager)

Additional Comments: ☐ Contractor ☐ Subcontractor ☐ Supplier ☐ Manufacturer ☐ A/E ☐ _____

_____

_____

_____

_____

_____

_____

SECTION 01 73 00 - EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes general procedural requirements governing execution of Work including, but not limited to, following:
   1. General installation of products.
   2. Starting and adjusting.
   3. Protection of installed construction.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: Existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify existence and location of mechanical and electrical systems and other construction affecting Work.
   1. Before construction, verify location and points of connection of utility services.

B. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
   1. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
   2. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
   3. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.

C. Written Report: Where a written report listing conditions detrimental to performance of Work is required by other Sections, include following:
   1. Description of Work.
   2. List of detrimental conditions, including substrates.
   3. List of unacceptable installation tolerances.
   4. Recommended corrections.

D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Field Measurements: Take field measurements as required to fit Work properly. Recheck measurements before installing each product. Where portions of Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying Work.

B. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

C. Review of Contract Documents and Field Conditions: Immediately on discovery of need for clarification of Contract Documents, submit a Request for Interpretation to A/E. Include a detailed description of problem encountered, together with recommendations for changing Contract Documents.

3.3 INSTALLATION, GENERAL

A. Locate Work and components of Work accurately, in correct alignment and elevation, as indicated.
   1. Make vertical work plumb and make horizontal work level.
   2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
   3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
   4. Maintain minimum headroom clearance of 8 feet occupied spaces and 90 inches in unoccupied spaces, unless otherwise indicated on Drawings.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at time and under conditions that will ensure best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy of type expected for Project.

E. Sequence Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

G. Templates: Obtain and distribute to parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of Work.
   1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by A/E.
   2. Allow for building movement, including thermal expansion and contraction.
   3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
   4. Electrical wiring and associated metallic conduit shall not be embedded within roof assemblies or placed directly below roof decks. Electrical wiring or metallic conduit located near roof assemblies shall be positioned and supported at least 10 inches away from bottom side of metal roof deck or other substrate to which a roof system has been or will be applied.
   5. Suspension wires, straps, chains, and metal framing such as those used to support following shall not be attached to or through steel roof decks.
      a. Bulkheads.
      b. Suspended ceilings.
      c. Fire-suppression systems.
      d. Ductwork.
      e. Lighting.
      f. Similar items.

I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for best visual effect. Fit exposed connections together to form hairline joints.

J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.4 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Manufacturer's Field Service: Inspect field-assembled components and equipment installation. Comply with qualification requirements in Division 01 Section "Quality Requirements."

3.5 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Protection of Existing Items: Provide protection and ensure that existing items to remain undisturbed by construction are maintained in condition that existed at commencement of the Work.

C. Comply with manufacturer's written instructions for temperature and relative humidity.

D. Protect roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
   1. Protect new roof areas where continued construction traffic is anticipated.
      a. Loosely lay 1-inch minimum thick, molded expanded polystyrene (MEPS) insulation over roofing membrane in areas indicated. Loosely lay 15/32-inch plywood or OSB panels over MEPS. Extend MEPS past edges of plywood or OSB panels a minimum of 1 inch.
         1) Protection sheet or mat: provide a sacrificial layer of matching membrane sheet extending minimum 6 inches beyond insulation in all directions or a woven or nonwoven polypropylene, polyolefin, or polyester fabric, water permeable and resistant to UV degradation, type and weight as recommended by roofing system manufacturer for application.
      b. Limit traffic and material storage to areas of roofing that have been protected.

END OF SECTION 01 73 00

SECTION 01 73 29 - CUTTING AND PATCHING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes procedural requirements for cutting and patching.

1.2 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other Work.

B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

C. Cutting and patching performed during manufacture of products or during initial fabrication, erection, or installation processes is not considered to be "cutting and patching" under this definition. Drilling of holes to install fasteners and similar operations are also not considered to be "cutting and patching".

1.3 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.
   1. Structural Elements: When cutting and patching structural elements, notify A/E of locations and details of cutting and await directions from A/E before proceeding. Shore, brace, and support structural element during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.

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 result in increased maintenance or decreased operational life or safety. Operating elements include following:
   1. Primary operational systems and equipment.
   2. Fire-suppression systems.
   3. Control systems.
   4. Communication systems.
   5. Electrical wiring systems.
   6. Fire detection and alarm systems.

C. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related components in a manner that could change their load-carrying capacity that results in reducing their capacity to perform as intended, or that result in increased maintenance or decreased operational life or safety. Miscellaneous elements include following:
   1. Water, moisture, or vapor barriers.
   2. Membranes and flashings.

D. 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 exterior or in occupied spaces in a manner that would, in A/E's opinion, reduce building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

E. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

1.4 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to fullest extent possible.
   1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 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 in-place finishes or primers.
   2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

B. Temporary Support: Provide temporary support of Work to be cut.

C. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

D. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Division 01 Section "Summary."

E. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.

3.3 CUTTING AND PATCHING

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at earliest feasible time, and complete without delay.
   1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
   2. Do not use cutting torches.
   3. Contractor shall be responsible for cutting, fitting, and patching that may be required to complete his Work.

4. Cutting and patching of concrete floors and decks shall be performed in neat and workmanlike manner, using a coring machine. Contractor for such work must form openings over 6-inch diameter. After coring, each Contractor shall pack and grout openings around sleeves or Work penetrating floor or deck which he is furnishing.
5. No Contractor shall do cutting that may impair strength of building or its components. No holes except for small screws or bolts may be drilled in beams or other structural members for purpose of supporting, routing, or attaching Work without obtaining prior approval from A/E.
    a. Provide temporary support of work to be cut.
6. Refer to other Sections of these Specifications for specific cutting and patching requirements and limitations applicable to individual units of Work.
7. Unless otherwise specified, requirements of this Section apply to Mechanical and Electrical Work.

B. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from exposed or finished side into concealed surfaces.
3. Concrete or Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
    a. CMU Removal: Remove units that are damaged or require removal to accommodate new work. Carefully remove entire units joint to joint, without damaging surrounding masonry in a manner that permits replacement with full size units.
        1) Support and protect remaining masonry that surrounds removal area. Maintain reinforcement and adjoining construction in an undamaged condition.
        2) Clean surrounding removal areas by removing mortar, dust, and loose particles in preparation for replacement.
    b. After coring, Contractor shall pack and grout openings around sleeves or work penetrating floor or deck.
4. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.

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.
1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
    a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    b. Restore damaged pipe covering to its original condition.
3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

a. Where patching occurs in a painted surface, apply primer and intermediate paint coats over patch and apply final paint coat over entire unbroken surface containing patch. Provide additional coats until patch blends with adjacent surfaces.
b. Patch Floor: Mix and apply underlayment components according to manufacturer's written instructions.
1) Refer to Division 03 Section “Cast-In-Place Concrete” for patching concrete.
c. Patch CMU: Replace damaged or removed units into bonding and coursing pattern of existing. Lay replacement units with completely filled bed, head, and collar joints. Butter ends with sufficient mortar to fill head joints and shove into place.
1) Refer to Division 04 Section “Unit Masonry” for masonry work installation requirements.

4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
a. Cut, patch, and repair plaster as necessary to accommodate new work and to restore to match adjacent undisturbed surfaces. Repair or replace work to eliminate evidence of new work.
b. Refer to Division 09 Section "Acoustical Panel Ceilings" for replacement of acoustical ceilings.

D. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION 01 73 29

SECTION 01 74 00 - PROGRESS CLEANING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes general procedural requirements governing execution of Work including, but not limited to, following:
   1. Progress cleaning.

1.2 PURPOSE – DAILY/PROGRESS CLEANING

A. Define and emphasize responsibility of Contractor to remove his rubbish and debris from construction site to guard against fire and safety hazards as well as to provide a more efficient construction operation. If this cleaning is not performed to satisfaction of Owner and A/E, it will be performed for Contractor at his expense, cost of which will be deducted by Change Order prior to final payment.

1.3 PURPOSE - ROUTINE CLEANING

A. Each Friday afternoon, and more often if necessary, Contractor shall perform an overall clean up of entire site, including a broom cleaning of appropriate surfaces. Remove rubbish and debris from building site to rubbish collection location promptly upon its accumulation and in no event later than Contractor's regular Friday general clean up.

1.4 RUBBISH CONTAINMENT

A. Refer to Division 01 Section “Temporary Facilities and Controls” for requirements.

1.5 SAFETY REQUIREMENTS

A. Hazards Control
   1. Store volatile wastes in covered metal containers, and remove from premises daily.
   2. Prevent accumulation of wastes that create hazardous conditions.
   3. Provide adequate ventilation during use of volatile or noxious substances.

B. Conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws.
   1. Do not burn or bury rubbish and waste materials on project site.
   2. Do not dispose of volatile wastes such as mineral spirits, oil, or paint thinner in storm or sanitary drains.
   3. Do not dispose of wastes into streams or waterways.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use only cleaning materials recommended by manufacturer of surface to be cleaned.
   1. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finish surface.

PART 3 - EXECUTION

3.1 DAILY/PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.
   1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
   2. Do not hold materials more than 7 days during normal weather or 3 days if temperature is expected to rise above 80 deg F.
   3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
      a. Use containers intended for holding waste materials of type to be stored.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to level of cleanliness necessary for proper execution of Work.
   1. Remove liquid spills promptly.
   2. Where dust would impair proper execution of Work, broom-clean or vacuum entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through remainder of construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not fall on wet, newly painted or finished surfaces.

3.2 ROUTINE CLEANING

A. Employ experienced workmen for cleaning.

B. Remove dirt, mud, and other foreign materials from sight exposed interior and exterior surfaces.

C. Weekly, or at more frequent intervals, if work activities justify same, perform following cleaning. This includes all dirt, dust, and debris not identifiable as part of a Contract. Broom clean floor and paved surfaces; rake clean other surfaces of ground.

D. Maintain cleaning throughout duration of Project.

E. Should Contractor fail in performance of this Work, Owner may perform such Work in accordance with General Conditions.

F. Compliances: Comply with governing regulations and safety standards for cleaning operations. Remove waste materials from site and dispose of lawfully.

END OF SECTION 01 74 00

SECTION 01 77 00 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, following:
   1. Inspection procedures.
      a. Prerequisites to Substantial Completion.
      b. Prerequisites to Final Payment.
   2. Warranties.
      a. Correction of work period.
   3. Final cleaning.
   4. Corrections/Punch List/List of Incomplete Items.
   5. Record documents.
   6. Maintenance and operating manuals
   7. Instructions to Owner’s personnel
   8. Repair of work

1.2 SUBMITTALS

A. Action Submittals
   1. Contractor’s List of Incomplete Items: Initial submittal of Substantial Completion.
   2. Certified List of Incomplete Items: Final submittal at Final Completion.

B. Closeout Submittals
   1. Certificate of Release: From authorities having jurisdiction.
   2. Certificate of Insurance: For continued coverage.
   3. Record Drawings: Comply with following:
      a. Number of Copies: Submit PDF electronic files of scanned record prints and one set(s) of prints.
      b. Print each drawing, whether or not changes and additional information were recorded.

1.3 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's Corrections/Punch List), indicating value of each item on list and reasons why Work is incomplete.

B. Submittals Prior to Substantial Completion: Complete following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
   1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
   2. Submit closeout submittals, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
   3. Submit closeout submittals specified in individual Divisions 02 through 33 Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
   4. Submit maintenance material submittals specified in individual Divisions 02 through 33 Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Owner. Label with manufacturer's name and model number where applicable.

a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Owner's signature for receipt of submittals.

5. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
6. Certification:
   a. Submit certification stating that no materials containing more than 1 percent asbestos were incorporated into the work.
   b. Plumbing Contractor shall submit certification stating that no flux or solder used for drinking water piping contains more than 0.2 percent lead, and lad content shall not exceed a weighted average of more than 0.25 percent in the wetted surface material in accordance with requirements of EPS's "Safe Drinking Water Act" (SDWA).

C. Procedures Prior to Substantial Completion: Complete following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
1. Advise Owner of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Division 01 Section "Demonstration and Training."
6. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
7. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
8. Complete final cleaning requirements, including touchup painting.
9. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection for Substantial Completion a minimum of 14 days prior date work will be substantially complete. On receipt of request, A/E will either proceed with inspection or notify Contractor of unfulfilled requirements. A/E will prepare Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by A/E, that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when Work identified in previous inspections as incomplete is completed or corrected.
   a. If more than one reinspection is necessary, Contractor shall be charged $500.00 for each reinspection when work is found not to be substantially complete.
2. Results of completed inspection will form basis of requirements for Final Completion.

1.4 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining date of Final Completion, complete following:
1. Submit a final Application for Payment according to Division 01 Section "Payment Procedures."
2. Submit certified copy of A/E's Substantial Completion inspection list of items to be completed or corrected (Corrections/Punch List), endorsed and dated by A/E. Certified copy of list shall state that each item has been completed or otherwise resolved for acceptance.
3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.

B. Inspection: Submit a written request for final inspection for acceptance a minimum of 10 days prior to date work will be completed and ready for final inspection and tests. On receipt of request, A/E will either proceed with inspection or notify Contractor of unfulfilled requirements. A/E will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
   1. Reinspection: Request reinspection when Work identified in previous inspections as incomplete is completed or corrected.
      a. For all additional reinspections, Contractor shall be charged $500.00 per occurrence.

1.5 LIST OF INCOMPLETE ITEMS (CORRECTIONS/PUNCH LIST)

A. Prior to A/E's preparation of a Corrections/Punch List, Contractor, shall prepare an initial Corrections/Punch List on job for use by his employees and subcontractors and for use by other Contractors and for use by A/E to facilitate completion of Work.

B. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside limits of construction.
   1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
   2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
   3. Include following information at top of each page:
      a. Project name.
      b. Date.
      c. Name of A/E.
      d. Name of Contractor.
      e. Page number.
   4. Submit list of incomplete items in the following format:
      a. PDF Electronic File: A/E will return annotated file.

C. Upon receipt of initial Corrections/Punch List, A/E will inspect Work to determine if work is substantially complete. Following inspection, A/E will issue a supplement to Contractor’s list of a Final Corrections/Punch List.

D. At time A/E commences Substantial Completion Inspection, if A/E discovers excessive additional items requiring completion or correction, A/E may decline to continue inspection, instructing Contractor as to general classification of deficiencies which must be corrected before A/E will resume Substantial Completion Inspection. If Contractor fails to pursue Work so as to make it ready for Substantial Completion Inspection in a timely fashion, A/E shall, after notifying Contractor, conduct inspections and develop a list of items to be completed or corrected. This list of items shall be furnished to Contractor who shall proceed to correct such items within 21 days. A/E will conduct additional inspections as required to determine that Work is ready for Substantial Completion Inspection. A/E will invoice Owner for $500.00 per reinspection.

E. Time fixed by A/E for completion of all items on Final Corrections/Punch List shall not be greater than 21 days. Contractor shall complete items on list within such 21 day period. Contractor shall begin completion and correction and correction activities within 7 days of receipt of lists and complete all activities within 21 day period specified. If Contractor fails to do so, Owner in its discretion may perform Work by itself or others and cost thereof shall be charged against Contractor. If more than one inspection by A/E for purpose of evaluating corrected work is required by subject list of items to be completed or corrected, it will be performed at cost of $500.00 per inspection and deducted from Contractor’s Contract.
   1. A/E will reinspect work, upon request by Contractor or within 21 days, if items required for Substantial Completion have been completed a certificate for Substantial Completion will be issued.

F. Deferred Items: With approval of Owner, A/E, upon reinspection, items of Work that cannot be completed within 21 days or because of seasonal conditions, such as bituminous paving or landscaping, or if Owner has a schedule conflict, payment will be released to Contractor less twice cost of completing remaining work as determined by A/E.

1.6 SUBMITTAL OF PROJECT WARRANTIES

A. Submittal Time: Submit written warranties on request of A/E for designated portions of Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.

B. Organize warranty documents into an orderly sequence based on table of contents of Project Manual.

C. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
   1. Submit by email to A/E, unless otherwise noted.

D. Provide additional copies of each warranty to include in operation and maintenance manuals.

1.7 CORRECTION OF WORK PERIOD (WARRANTY)

A. One month prior to expiration of one year correction of work period (warranty), A/E will schedule a walk through to see if additional Work by Contractor is needed to make good on warranties. An itemized list will be furnished to Contractor for corrective or replacement work.
   1. Walk through will be attended by A/E and Owner.

B. This Work shall be completed immediately by Contractor(s) after receiving notification.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
   1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:
      a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
      b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
      c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.

d. Remove tools, construction equipment, machinery, and surplus material from Project site.
e. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
f. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
g. Clean flooring, removing debris, dirt, and staining; clean in accordance with manufacturer's instructions.
h. Vacuum and mop concrete.
i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
k. Remove labels that are not permanent.
l. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
o. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particular matter on inspection.
    1) Clean HVAC system in compliance with NADCA ACR. Provide written report on completion of cleaning.
p. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
q. Clean strainers.
r. Leave Project clean and ready for occupancy.

C. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

3.2 PROJECT RECORD DOCUMENTS

A. Project Record Documents include drawings and product data.

B. Contractor shall update "Project Record Documents" on separate blue or black line prints set aside especially for this purpose on job. Drawings shall incorporate all changes made in Work of respective trades during construction period. Such changes shall be indicated at time they occur.

C. Each of these project record drawings shall be clearly marked "Project Record Document"; maintained in good condition; available for observation by A/E; and shall not be used for construction purposes. Mark these drawings to show actual installation where installation varies from installation shown originally. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later. Items required to be marked include, but are not limited to, following:
1. Dimensional changes to Drawings.
2. Significant detail not shown in original Contract Documents including Change Orders or Construction Change Directives.

3. Location of internal utilities and appurtenances concealed in building structures, referenced to visible and accessible features of structures.
4. When elements are placed exactly as shown on Drawings, so indicate; otherwise show changed location.
5. Revisions to details shown on Drawings.
6. Revisions to routing of piping and conduits.
7. Revisions to electrical circuiting.
8. Actual equipment locations.
9. Duct size and routing.
10. Changes made following A/E's written orders.
11. Details not on original Contract Drawings.

D. Record Drawings: Comply with following:
1. Number of Copies: Submit copies of record drawings as follows:
a. Submit PDF electronic files of scanned record prints and three set(s) of prints.
b. Print each drawing, whether or not changes and additional information where recorded.

E. Recording and Maintenance: Submit a copy of all final submittals.
1. Recording: Maintain one copy of each submittal during construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.
2. Maintenance of Record Drawings, Product Data, Shop Drawings, and Samples: Store in field office or designated safe location apart from Contract Documents used for construction. Do not use record documents for construction purposes. Maintain record documents in good order in a clean, dry, legible condition, protect from deterioration and loss. Provide access to project record documents for A/E's reference during normal working hours.

3.3 MAINTENANCE AND OPERATING MANUALS

A. At time that Contractor's pay application reaches 75 percent complete, Contractor shall submit to A/E copy of a rough draft of the table of contents for a comprehensive Maintenance and Operating Manual presenting complete directions and recommendations for proper care and maintenance of visible surfaces as well as maintenance and operating instructions for equipment items which he has provided.
1. Submit only table of contents to A/E for review.

B. Operating instructions shall include necessary printed directions for correct operations, adjustment, servicing, and maintenance of movable parts. Also included shall be suitable parts lists, final shop drawings, and diagrams showing parts location and assembly, and information specified in individual Specification Sections and following:
1. Emergency instructions.
2. Copies of specific warranties.
3. Wiring diagrams.
4. Recommended maintenance procedures and turn around times.
5. Inspection and system test procedures.
6. Precautions against improper maintenance and exposure.

C. For each titled item or work portion, manual must provide names, addresses, and phone numbers of following parties:
1. Contractor/installer
2. Manufacturer
3. Nearest dealer/supplier
4. Nearest agency capable of supplying parts and service

D. For each manual label on front cover or spine shall indicate following information:
1. Project name and address
2. Owner's name

3. Name and address of A/E
4. Name and address of Contractor
5. Date of submission

E. Upon A/E's approval and prior to issuance of final payments, Contractor shall submit corrected and completed maintenance manuals to A/E.

F. Manuals, Electronic Files: Submit manuals in form of a multiple file composite electronic PDF file for each manual type required.
1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Enable bookmarking of individual documents based upon file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel upon opening file.

3.4 INSTRUCTIONS FOR OWNER'S PERSONNEL

A. Arrange for each Installer of equipment that requires regular maintenance and noted in technical sections, to meet with Owner’s personnel to provide instruction in proper operation and maintenance. Provide instruction by manufacturer’s representatives if Installers are not experienced in operation and maintenance procedures. Include a detailed review of following items:
1. Maintenance manuals
2. Record documents
3. Spare parts and materials
4. Tools
5. Lubricants
6. Fuels
7. Identification systems
8. Control sequences
9. Hazards
10. Cleaning
11. Warranties and bonds
12. Maintenance agreements and similar continuing commitments

B. As part of instruction for operating equipment, demonstrate following procedures:
1. Startup
2. Shutdown
3. Emergency operations
4. Noise and vibration adjustments
5. Safety procedures
6. Economy and efficiency adjustments
7. Effective energy utilization

3.5 REPAIR OF WORK

A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.

B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
   1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
   2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.
      a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
   3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
   4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 01 77 00

DIVISION 02

EXISTING CONDITIONS

SECTION 02 41 19 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Demolition and removal of selected portions of building as required to accommodate new work.

1.2 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

1.3 COORDINATION

A. Arrange selective demolition schedule so as not to interfere with Owner’s operations.

1.4 PREINSTALLATION MEETINGS

A. Pre-demolition Meeting: Conduct meeting at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."
   1. Inspect and discuss condition of construction to be selectively demolished.
   2. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
   3. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
   4. Review areas where existing construction is to remain and requires protection.
   5. Review and finalize protection requirements.
   6. Review procedures for noise control and dust control.
   7. Review storage, protection, and accounting for items to be removed for salvage or reinstallation.

1.5 CLOSEOUT SUBMITTALS

A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals.
   1. Inventory: After selective demolition is complete, submit a list of items that have been removed and salvaged.

1.6 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
   1. Comply with requirements specified in Division 01 Section "Summary."

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
   1. Owner will remove items indicated before selective demolition.

C. Notify A/E of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
   1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify A/E and Owner. Owner will remove hazardous materials under a separate contract, unless otherwise noted.

E. Storage or sale of removed items or materials on-site is not permitted.

F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
   1. Maintain fire-protection facilities in service during selective demolition operations.
      a. Exception: Provide alternative means of fire protection during demolition of existing limited-areas fire-suppression system[s].

PART 2 - PRODUCTS

2.1 PEFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations at authorities having jurisdiction.

B. Standards: Comply with ANSI/ASSP A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected.

B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as indicated in Project Record Documents.

C. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

D. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.

E. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to A/E.

3.2 PREPARATION

A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
   1. Provide protection to ensure safe passage of people around selective demolition aera and to and from occupied portions of building.
   2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surface and new construction, to prevent water leakage and damage to structure and interior areas.
   3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
   4. Cover and protect furniture, furnishings, and equipment that have not been removed.
   5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Division 01 Section “Temporary Facilities and Controls”.

B. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location and reinstalled in their original locations after selective demolition operations are complete.

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems: Maintain services/systems indicated to remain and protect them against damage during selective demolition operations.
   1. Comply with requirements for existing services/systems interruptions specified in Division 01 Section "Summary."
   2. Maintain fire-protection facilities in service during selective demolition operations.

3.4 SALVAGE/REINSTALL

A. Removed and Salvaged Items:
   1. Clean salvaged items.
   2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
   3. Store items in a secure area until delivery to Owner.
   4. Transport items to Owner's storage area designated by Owner.
   5. Protect items from damage during transport and storage.

B. Removed and Reinstalled Items:
   1. Clean and repair items to functional condition adequate for intended reuse.
   2. Pack or crate items after cleaning and repairing. Identify contents of containers.
   3. Protect items from damage during transport and storage.
   4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

3.5 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction. Use methods required to complete the Work within limitations of governing regulations and as follows:
   1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
   2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
   3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
   4. Do not use cutting torches.
   5. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
   6. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
   7. Dispose of demolished items and materials promptly.

B. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by A/E, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.6 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI-WP and its Addendum.
   1. Remove residual adhesive and prepare substrate for new floor coverings by one of the methods recommended by RFCI, unless otherwise noted.
      a. Do not utilize chemical agents.

2. Refer to Division 09 Section “Existing Substrate Preparation for Floor Finishes” for additional requirements.

B. Fluorescent light fixture components shall be removed and recycled/incinerated as follows:
1. Remove and store non-leaking non-electronic ballasts in sealed or labeled metal drums.
2. Remove and store leaking non-electronic ballasts in separate sealed and labeled metal drums.
3. Remove and store fluorescent lamps in cardboard lamp boxes labeled “Mercury Lamps for Recycling.” Lamps shall remain intact.
4. Lamps and ballasts shall be transported to an EPA approved recycler. Non-electronic ballasts shall be incinerated. All other components may be recycled.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.8 CLEANING/PATCHING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

B. Repair demolition performed in excess of that required. Return structures, substrates, and surfaces to remain to condition existing prior to commencement of selective demolition work. Repair adjacent construction or surfaces soiled or damaged by selective demolition work.
1. Refer to Division 01 Section “Cutting and Patching”.

END OF SECTION 02 41 19

07
DIVISION

SECTION 07 84 13 – PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Tested or engineering judgment based firestopping materials and systems to retain the integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke, and/or hot gases through penetrations. Section includes firestopping for the following:
   1. Penetrations in horizontal assemblies, including through fire resistance rated floor and roof construction including both empty openings and openings containing cables, pipes, ducts, conduits, and other penetrating items.
      a. Water tight firestop systems for penetrations in fire-resistance-rated floor assemblies.
   2. Penetrations through fire resistance rated walls and partitions including both empty openings and openings containing cables, pipes, ducts, conduits, and other penetrating items.
   3. Penetrations through smoke barriers and construction enclosing compartmentalized areas involving both empty openings and openings containing penetrating items.
   4. Penetrations through partitions that are not required to be fire-resistance-rated due to the presence of automatic fire-extinguishing systems – but are still required to resist the passage of smoke.
   5. Exposed penetration firestopping systems.

B. Related Work: Examine Contract Documents for requirements that affect Work of this Section. Other Specification Sections that relate directly to Work of this Section include, but are not limited to:
   1. Division 07 Section “Joint Sealants” for joint sealants used at penetrations through non-fire-resistance-rated construction.
   2. Division 09 Section "Interior Painting" for paint requirements.
   3. Division 22 and 23 Sections specifying duct and piping penetrations.
   4. Division 26, 27, and 28 Sections specifying cable and conduit penetrations.

1.2 DEFINITIONS

A. Firestopping: Material or combination of materials to retain integrity of fire rated construction by maintaining an effective barrier against the spread of flame, smoke, and gases through penetrations in fire rated wall and floor assemblies.
   1. Exception: When used in non-fire-resistance-rated partitions firestopping shall be applied to the exposed face of mineral wool, glass fiber, or other approved non-rigid materials to maintain an effective resistance to the passage of smoke.

B. Through-Penetration Firestop Systems: An assemblage of specific materials or products that are designed, tested and fire-resistance-rated to resist for a prescribed period of time the spread of fire, the passage of hot gases, and the transfer of heat through penetrations.

C. Through-Penetration Firestop Devices: Factory built products designed to resist fire spread. Complete when delivered to site ready for installation.

D. Assembly: Particular arrangement of materials specific to a given type of construction described or defined in referenced documents.

E. Engineering Judgment: Evaluations that are developed by a manufacturer for a new firestop system that complies with similar UL approved designs or tests that are acceptable to the code enforcing authorities.

F. Intumescent: Materials that expand with heat to seal around objects threatened by fire.

G. Penetration: Opening or foreign material passing through a floor, wall or ceiling barrier such that the full thickness of the rated material(s) is breached either in total or in part.

H. Sleeve: Metal fabrication or pipe section that is part of a system that extends through a barrier.

I. Annular Space: The opening around the penetrating item. Since the penetrating item cannot be perfectly centered in the hole, the annular space has a minimum and maximum dimension.

J. Approved: Acceptable to the code official or authority having jurisdiction.

K. F-Rating: The time period that the through-penetration firestop system limits the spread of fire through the penetration when tested in accordance with ASTM E 814.

L. Fire Barrier: A fire-resistance-rated wall assembly of materials designed to restrict the spread of fire in which continuity is maintained.

M. Fire Partition: A vertical assembly of materials designed to restrict the spread of fire in which openings are protected. Fire partitions are used as wall assemblies to enclose corridors.

N. Fire Wall: A fire-resistance-rated wall having protected openings, which restricts the spread of fire and extends continuously from the foundation to or through the roof, with sufficient structural stability under fire conditions to allow collapse of construction on either side without collapse of the wall. A fire wall is commonly used to divide a structure into separate buildings – or to separate a new addition from the existing portion of a structure.

O. Fireblocking: Building materials installed to resist the free passage of flame, gases, heat, smoke, and other products of combustion to other areas of the building through concealed spaces. The term “draftstopping” is also used to define building materials installed to resist the movement of smoke, gases, and flames to other areas – but through relatively larger concealed spaces. Examples of fireblocking materials include – but are not limited to – the following:
   1. 2-inch nominal lumber.
   2. Two thicknesses of 1-inch nominal lumber with broken lap joints.
   3. One thickness of 0.75-inch particleboard with backed-up joints.
   4. Gypsum board.
   5. Cement fiber board.
   6. Batt-type or roll-type blankets of mineral wool, glass fiber, or other approved non-rigid materials installed in such a manner as to be securely retained in place. Loose-fill insulation material shall not be used as a fireblock unless specifically tested in the form and manner intended for use to demonstrate its ability to remain in place and to retard the spread of fire and hot gases.

P. Horizontal Assembly: A fire-resistance-rated floor or roof assembly of materials designed to restrict the spread of fire in which continuity is maintained.

Q. L-Rating: The quantitative indication of a through-penetration firestop system’s ability to resist the passage of smoke when tested in accordance with UL 2079.

R. Membrane-Penetration: An opening made through one side (wall, floor or ceiling membrane) of an assembly.

S. Smoke Barrier: A continuous membrane, either vertical or horizontal, such as a wall, floor, or ceiling assembly, that is designed and constructed to restrict the movement of smoke.

T. Smoke Partition: A non-fire-resistance-rated wall designed to resist the spread of fire and the unmitigated movement of smoke for an unspecified period of time. A smoke partition is not required to be continuous through ceilings and other concealed spaces.

U. T-Rating: The time period that the penetration firestop system, including the penetrating item, limits the maximum temperature rise to 325 degrees Fahrenheit (163 degrees Celsius) above its initial temperature through the penetration on the non-fire side when tested in accordance with ASTM E 814.

V. Through-Penetration: An opening that passes through an entire assembly.

1.3 REFERENCES

A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirement shall govern.
   1. American Society for Testing and Materials (ASTM).
      a. E 84 Test Method for Surface Burning Characteristics of Building Materials.
      b. E 119 Test Method for Fire Tests of Building Construction and Materials.
      c. E 136 Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 deg. F.
      d. E 814 Fire Tests of Through-Penetration Fire Stops.
      e. E 1349 Cyclic Movement and Measurement Minimum and Maximum Joint Widths.
      f. E 1966 Test Method for Resistance of Building Joint.
      g. E 2174 Standard Practice for On-Site Inspection of Installed Fire Stops.
      h. E 2307 Standard Test Method for Determining the Fire Endurance of Perimeter Fire Barrier Systems Using the Intermediate – Scale, Multi-Story Test Apparatus (ISMA).
      i. E 2393 Standard Practice for On-Site Inspection of Installed Fire Stop Joint Systems.
   2. Factory Mutual (FM) Approvals: FM Approval Standard of Firestop Contractors – Class 4991.
   3. Firestop Contractors International Association (FCIA): MOP – FCIA Firestop Manual of Practice.
      a. FM Approval Standard of Firestop Contractors – Class 4991.
   4. International Firestop Council (IFC):
      a. Ref. 1 Recommended IFC Guidelines for Evaluating Firestop Engineering Judgments (April 2001).
      b. Ref. 2 Inspectors Field Pocket Guide.
      c. Ref. 3 IFC Recommended Guidelines for Performing Destructive Testing for Installed Penetration Firestop Systems, Fire Resistive Joint Systems, or Perimeter Fire Barrier Systems.
   5. National Fire Protection Association (NFPA):
      a. NFPA 70 – National Electric Code.
      b. NFPA 101 – Life Safety Code.
      c. NFPA 221 – Fire Walls and Fire Barriers.
      d. NFPA 251 – Fire Tests of Building Construction and Materials.
   6. Underwriters Laboratories, Inc. (UL):
      a. UL 263 Fire Tests of Building Construction and Materials.
      b. UL 723 Surface Burning Characteristics of Building Materials.
      c. UL 1479 Fire-Tests of Through-Penetration Fire Stops.
      d. UL Building Materials Directory:
         1) Through-Penetration Firestops Systems (XHEZ).
         2) Firestop Devices (XHJI).
         3) Forming Materials (XHKU).
         4) Wall Opening Protective Materials (CLIV).
         5) Fill, Void or Cavity Materials (XHHW).
   7. International Building Code (IBC 2015)

1.4 SEQUENCING

A. Coordinate this Work as required with work of other trades. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.

1. Coordinating Work: Coordinate construction of openings and penetrating items to ensure that designated through-penetration firestop systems are installed per specified requirements.
2. Schedule firestopping after installation of penetrants but prior to concealing the openings.

B. Do not cover up those firestopping installations that will become concealed behind other construction until Owner's inspection agency and authorities having jurisdiction, if required, have examined each installation.

C. Notify Owner’s testing agency at least seven days in advance of penetration firestopping installations; confirm dates and times on day preceding each series of installations.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Meeting: Conduct meeting at Project Site.

1.6 ACTION SUBMITTALS

A. Product Data: For each product type.
1. Manufacturer's specifications and technical data for each material including the composition and limitations, documentation of UL or other nationally recognized independent testing laboratories firestop systems to be used, and manufacturer's installation instructions. Product characteristics, typical uses, installation procedures, performance, and limitation criteria.
   a. Unlisted Firestopping Systems: Obtain an Engineering Judgement (EJ) from firestopping manufacturer where no UL, FM Approvals, or other listed assembly is available for particular firestop configuration. Follow International Firestop Council (IFC) recommended guidelines for evaluating firestopping systems in EJ’s.
2. Storage and handling requirements and recommendations.

B. Through-Penetration Firestop System Location Plan and Schedule (All Prime Contractors): Indicate locations of each through-penetration firestop system, along with the following information:
1. Types of penetrating items.
2. Types of constructions penetrated, including fire-resistance ratings and, where applicable, thicknesses of construction penetrated.
3. Through-penetration firestop systems for each location identified by firestop design designation of qualified testing and inspecting agency.
   a. Systems shall be submitted and reference system numbers in the UL Fire Reference Directory or Online Certification Directory, under product categories XHEZ, XHDG, or XHBN.
   b. Engineering Judgments: Where project conditions require modification to a qualified testing and inspecting agencies illustration for a particular penetration firestopping system, submit illustration, with modifications marked, approved by penetration firestopping system manufacturers fire protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly. Obtain approval of authorities having jurisdiction prior to submittal. Engineering judgement must include both project name and contractor’s name who will install firestop system as described in document.

1.7 INFORMATIONAL/QUALITY ASSURANCE/CONTROL SUBMITTALS

A. Qualification Data: For firms and persons specified in the “Quality Assurance” article, to demonstrate their capabilities and experience, include a list of names and addresses of completed projects, A/E’s and Owners, and other information specified.

B. Listed System Designs: For each penetration firestopping system, for tests performed by a qualified testing agency.

1.8 CLOSEOUT SUBMITTALS

A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION or INFORMATIONAL SUBMITTALS.
   1. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.9 QUALITY ASSURANCE

A. Qualifications
   1. Installer Qualifications: Engage an experienced Installer (including individual trades people such as: electrical, mechanical, insulators, etc.) who is qualified by having at least 3 firestop projects similar in type and size to that of this project and has the necessary experience, staff, and training to install manufacturer's products per specified requirements, plus the following:
      a. Acceptable to or licensed by state or local authority, where applicable.
      b. Establish a record of successful in-service experience with firestop systems or completion of manufacturer's certified product installation training.
      c. A supplier's willingness to sell its firestopping products to the Contractor or to an Installer engaged in does not in itself confer qualification on the buyer. Each individual engaged in performing the firestopping work shall have a certification card from the manufacturer acknowledging their completion of the manufacturer's firestop installation training.
      d. Any firm that has been approved by FM according to FM 4991, "Approval of Firestopping Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractors Program Requirements" shall be acceptable as well.
   2. Single Source Responsibility: Obtain through-penetration firestop systems for kind of penetration and construction condition indicated from a single manufacturer.
      a. Materials of different manufacturer than allowed by the testing and listed system shall not be intermixed in the same firestop system or opening.
      b. Tested and listed, classified firestop systems are to be used. If another manufacturer has a tested and listed system, then that system shall be used prior to an Engineering Judgement (EJ) or Equivalent Fire Resistance Rated Assembly (EFRRA).
   3. Manufacturer Qualifications: Entity that has received UL's "Firestop Movement Certification," which demonstrates that manufacturer's firestopping products designated with M-Ratings are based on exposure to cyclic movement and UL 1479 fire test evaluation when tested in accordance with ASTM E3037.
   4. Provide firestopping products containing no detectable asbestos as determined by the method specified in 40 CFR Part 763, Subpart F, Appendix A, Section 1, "Polarized Light Microscopy" or ASTM D6620.
   5. Do not use any product containing solvents that require hazardous waste disposal or which after curing dissolve in water.

B. Regulatory Requirements
   1. Proposed firestop materials and methods shall conform to applicable governing codes having local jurisdiction.
   2. Meet requirements of ASTM E814, UL1479, UL2079, or ASTM E2307 tested assemblies that provide a fire rating equal to that of construction being penetrated and other ASTM Standards as applicable for the installation.
      a. ASTM E84 "Test Method for Surface Burning Characteristics of Building Materials."
      b. ASTM E119 "Test Methods for Fire Tests of Building Construction and Materials."
   3. Fire-Test-Response Characteristics: Provide through-penetration firestop systems that comply with the following requirements and those specified in "Performance Requirements" article:

a. A qualified testing and inspection agency shall perform firestopping tests. A qualified testing and inspecting agency is UL or another agency performing test and follow-up inspection services for firestop systems acceptable to authorities having jurisdiction.
b. Through-penetration firestop systems are identical to those tested per ASTM E 814. Provide rated systems complying with the following requirements:
1) Through-penetration firestop system products bear classification marking of qualified testing and inspecting agency.
2) Through-penetration firestop systems correspond to those indicated by reference to through-penetration firestop system listed by the following:
a) UL in "Fire Resistance Directory".
b) Intertek ETL SEMKO in its “Directory of Listed Building Products”.
c) FM Global in its “Building Materials Approved Guide”.

4. For those firestop applications that exist for which no tested system is available through a manufacturer, an engineering judgment derived from similar system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineer judgment drawings must follow requirement set forth by the International Firestop Council (September 7, 1994, as may be amended from time to time).

C. Field Constructed Mockup: Prior to installing firestopping, erect mockups for each different firestop system indicated to verify selections made and to demonstrate qualities of materials and execution. Building mockups to comply with the following requirements, using materials indicated for final installations.
1. Locate mockups on site in locations indicated or, if not indicated, as directed by A/E. Include mockup for each type of system.
2. Notify A/E in advance of the date and times when mockups will be installed.
3. Build mockup of each penetration firestopping system type required for Project, including supporting construction substrates, attachments, and accessories.
4. Where one penetration firestopping system type may be used for different penetrating items or in different wall or floor constructions, install one assembly for each different combination.
5. Obtain A/E and AHJ’s acceptance of mockups before start of Work.
6. Retain and maintain mockups during construction in an undisturbed condition as a standard for judging completed unit of Work. Accepted mockups in an undisturbed condition at time of Substantial Completion may become part of completed unit of work.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver firestopping undamaged products to project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer; date of manufacturer; lot number; shelf life, if applicable; qualified testing and inspecting agency's classification marking applicable to Project; curing time; and mixing instructions for multicomponent materials.
1. Comply with recommended procedures, precautions, or remedies described in material safety data sheets as applicable.

B. Store and handle firestopping materials to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

C. Do not use damaged or expired materials.

1.11 PROJECT CONDITIONS

A. Environmental Conditions: Do not install firestopping when ambient or substrate temperatures are outside limits permitted by firestopping manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Install and cure penetration firestopping materials or manufacturer’s written instructions using natural means of ventilation or, where this is in adequate, forced-air circulation.

C. Ventilation: Ventilate firestopping per firestopping manufacturers' instructions by natural means or, where this is inadequate, forced air circulation.

D. Existing Conditions: Verify the condition of the substrates and correct unsatisfactory conditions before installing products. Follow manufacturers' instructions.

E. Protection: Provide masking and drop cloths to prevent contamination of adjacent surfaces, if required.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products from one of the manufacturers specified.
1. Hilti Inc.
2. Specified Technologies, Inc., (STI)
3. 3M Fire Protection Products
4. Balco; a CSW Industrials Company
5. Tremco, Inc.; Tremco Fire Protection Systems Group
6. STC Sound Control
7. Grabber Construction Products
8. HOLDRITE, a division of Reliance Worldwide Corporation
9. Passive Fire Protection Partners
10. NUCO Inc.
11. Everkem Diversified Products, Inc.
12. International Fireproof Technology Inc.
13. Roxtec Inc.
14. Unique Fire Stop Products
15. FireShield; Fire Rated Solutions LLC

B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The "Substitution Request Form" and complete technical data for evaluation must accompany requests for A/E's approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

C. Obtain joint firestop systems for each type of joint opening indicated from a single manufacturer.

2.2 SYSTEM DESCRIPTION

A. General, Through-Penetration Firestop Systems: For penetrations through the following fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Systems shall once installed to the tested and listed system or engineered judgment become firestop systems that are produced to resist the spread of fire, and the passage of smoke through breaches, gaps, openings, in fire-resistance, rated and smoke resistant assemblies according to requirements indicated.
1. Fire-resistance-rated walls including fire walls, fire partitions, fire barriers, and smoke barriers as indicated on "Code Drawing."
2. Fire-resistance-rated horizontal assemblies including floors, floor/ceiling assemblies, and ceiling membranes of roof/ceiling assemblies as indicated on "Code Drawing."
3. Install complete through penetration firestop systems that have been tested and/or listed by recognized testing agencies per ASTM E814 or UL 1479 fire tests in a configuration that is representative of site conditions.
4. Provide firestop products that are flexible enough to allow for pipe vibration in a through penetration application.

5. Provide products that are compatible with each other, with the substrates forming openings, and with the items, if any, penetrating the firestopping, under the conditions represented by this Project, based on testing and field performance demonstrated by manufacturer.
6. For firestopping exposed to view, traffic, moisture, and physical damage, provide firestop systems for these conditions that meet conditions expected as communicated through construction documents.
7. Provide products that meet the intent of the state of local and LEED guidelines on volatile organic compounds (VOC).

B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per ASTM E 814 or UL 1479:
1. F-Rated Through-Penetration Firestop Systems: Provide through-penetration firestop systems with F ratings indicated as determined per ASTM E814, UL 1479 but not less than that equaling or exceeding the fire resistance rating of the constructions penetrated.
2. T-Rated Through-Penetration Firestop Systems: Provide through-penetration firestop systems with T ratings, in addition to F ratings, as determined per ASTM E814 and ASTM E119, where indicated and where systems protect penetrating items exposed to contact with adjacent materials in occupiable floor areas. T-rated assemblies are required where specified by codes or where the following conditions exist:
   a. Where firestop systems protect penetrations located outside of wall cavities.
   b. Where firestop systems protect penetrations located outside fire resistive shaft enclosures.
   c. Where firestop systems protect penetrations located in construction containing doors required to have a temperature rise rating.
   d. Where firestop systems protect penetrating items larger than a 4-inch diameter nominal pipe or 16 square inch in overall cross sectional area.
3. L-Rated Systems: Provide firestop systems with L-ratings indicated, as determined per ASTM UL1479, where systems maintain a barrier to smoke at:
   a. Penetrations.
   b. Connections with other surfaces.
   c. Separations required to permit building movement.
   d. Sound or vibration absorption, and.
   e. Other construction gaps.
4. For firestopping exposed to traffic, moisture, and physical damage, provide products that do not deteriorate when exposed to these conditions and will meet load requirements.
   a. For piping penetrations for plumbing and wet pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
   b. For floor penetrations with annular spaces exceeding 4 inches in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved either by installing floor plates or by other means.
   c. For penetrations involving insulated piping, provide through-penetration firestop systems not required removal of insulation.
5. For through-penetration firestop systems exposed to view, provide products with flame spread of less than 25 and smoke developed ratings of less than 450, as determined per ASTM E 84.
6. W-Rated of Class 1 when tested in accordance with UL Water Leakage Test for systems tested and listed in accordance with ANSI/UL 1479, where indicated or required by authority having jurisdiction.
7. For piping penetration for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
8. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

2.3 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics:
1. Perform penetration firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.

2. Test per testing standards referenced in “Penetration Firestopping Systems” article. Provide rated systems complying with the following requirements:
    a. Penetration firestopping systems installed with products bearing the classification marking of a qualified product certification agency in accordance with listed system designs published by a qualified testing agency.
        1) UL in its “Fire Resistance Directory”.
        2) Intertek Group in its “Director of Listed Building Products”.
        3) FM Approval in its “Approval Guide”.

B. Provide components for each penetration firestopping system that, upon curing do not re-emulsify, dissolve, leach, break down, or otherwise deteriorate over time from exposure to atmospheric moisture, sweating pipes, ponding water, or other forms of moisture characteristics during and after construction.

C. Provide components for each penetration firestopping system that to not contain ethylene glycol.

D. Provide components for each penetration firestopping system that are sufficiently flexible to accommodate movement, such as pipe vibration, water hammer, thermal expansion, and other normal building movement without damage.

E. Provide components for each penetration firestopping system that are appropriately tested for the thickness and type of insulation utilized.

2.4 PENETRATION FIRESTOPPING, GENERAL

A. Penetration Firestopping Systems: Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.
    1. Systems listed by approved testing agencies, may be used, providing they conform to the construction type, penetrant type, annular space requirements and fire rating involved in each separate instance.

B. Penetrations in Fire-Resistance-Rated Walls: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
    1. Fire-resistance-rated walls include fire walls, fire-barrier walls, smoke-barriers, and fire partitions.
    2. F-Rating: Not less than the fire-resistance rating of constructions penetrated.
    3. Membrane Penetrations: Install recessed fixtures such that the required fire resistance will not be reduced.

C. Penetrations in Horizontal Assemblies: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
    1. Horizontal assemblies include floors, floor/ceiling assemblies, and ceiling membranes of roof/ceiling assemblies.
    2. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.
    3. T-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
        a. Those within the cavity of a wall.
        b. Floor, tub, or shower drains within a concealed space.
        c. 4 inch or smaller metal conduct penetrating directly into metal-enclosed electrical switchgear.

D. Penetrations through Smoke Barriers, Smoke Partitions, and partitions that enclose that are not required to be fire-resistance-rated due to the presence of automatic fire-extinguishing systems – but are still required to resist the passage of smoke: Provide penetration firestopping with ratings determined per UL 1479.
   1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at 0.30-inch wg at both ambient and elevated temperatures and no more than 50-cfm cumulative total for any 100 sq.ft. at both ambient and elevated temperatures.

E. Mold Resistance: Provide penetration firestopping with mold and mildew resistance rating of 0 as determined by ASTM G 21.

F. Firestopping materials are either “cast-in-place” (integral with concrete placement) or “post installed”. Provide cast-in-place firestop devices prior to concrete placement.

G. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
   1. Verify sealant complies with the testing and product requirements of the California Department of Public Health’s “Standard Method for Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers.”

H. Sustainability Materials: Transparency; manufacturers will be given preference when they provide documentation to support sustainable requirements for the following:
   1. Building Life-Cycle Impact Reduction.
   2. Building Product Disclosure and Optimization – Environmental Product Declarations (EPD).
   3. Building Product Disclosure and Optimization – Sourcing of Raw Materials.
   4. Building Product Disclosure and Optimization – Material Ingredients.

I. Sustainable Design Requirements:
   1. Low-Emitting Materials: Penetration firestopping sealants and sealant primers shall comply with the testing and product requirements of the California Department of Health Services’ “Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers.”
   2. Recycled Content: Wool-fiber insulation and steel collars and sleeves shall have a recycled content plus one-half of pre-consumer recycled content not less than 20 percent.

J. Accessories: Provide components for each penetration firestopping systems, including primers and forming materials, that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated, including but not limited to:
   1. Permanent forming/damming/backing materials, including the following:
      a. Slag-wool-fiber or rock-wool-fiber insulation.
      b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
      c. Fire-rated form board.
      d. Fillers for sealants.
   2. Temporary forming materials
   3. Substrate primers
   4. Collars
   5. Steel sleeves

2.5 FILL MATERIALS

A. Use only firestop products that have been UL 1479, ASTM E 814, or UL 2079 tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.

B. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket. Cast-in-place devices for use with only noncombustible penetrants shall be red in color.

C. Fire Rated Cable Management Devices: Factory-assembled round metallic sleeve device for use with cable penetrations, containing an integrated smoke seal fabric membrane that can be opened and closed for re-penetration.

D. Drop-In Firestop Devices: Factory-assembled devices for use with combustible or noncombustible penetrants in cored holes within concrete floors. Device shall consist of galvanized steel sleeve lined with an intumescent strip, an extended rectangular flange attached to one end of the sleeve for fastening to concrete floor, and neoprene gasket.

E. Latex Sealants: Simple-component latex formulations that do not pre-emulsify after cure during exposure to moisture.

F. Acrylic Sprayable Mastic: Acrylic (water) based sprayable fire-rated mastic containing no halogens, solvents, or asbestos.

G. Firestop Collars/Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

H. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced intumescent elastomeric sheet bonded to galvanized-steel sheet.

I. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.

J. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side for use around combustible penetrants.

K. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a non-shrinking, homogeneous mortar.

L. Pillows/Blocks/Plugs: Intumescent flexible block/plug suitable for reuse in re-penetration of openings. Blocks shall allow up to 12 inches of unreinforced annular space. Compressible, removable, and reusable intumescent pillows encased in fire-retardant polyester or glass-fiber cloth. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.

M. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, non-shrinking foam.

N. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:
   1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and other surfaces, unless indicated firestop system limits use to nonsag grade for both opening conditions.

O. Fire-Rated Cable Sleeve Kits: Complete kits designed for new or existing cable penetrations through walls to accept standard accessories.

P. Thermal and Endothermic Wraps: Flexible, insulating, and fire-resistant protective wraps tested and listed for up to 2-hour fire-ratings in accordance with ASTM E814 or UL 1479; for protecting membrane penetrations of utility boxes, critical electrical circuits, communications lines, and fuel lines, and for thermal barrier and circuit integrity protection in accordance with ASTM E1725 or UL 1724.

Q. Fire-Rated Cable Sleeve Kits: Complete kits designed for new or existing cable penetrations through walls which accept standard accessories.

R. Fire-Rated Cable Pathways: Single or gangable device modules composed of a steel raceway with integral intumescent material and required no additional action in the form of plugs, twisting closure, putty, pillows, sealant, or otherwise to achieve fire and air-leakage ratings.
   1. Fire-rated cable pathway devices are the preformed product for data, video, and communications cable penetrations. Install these devices in locations where frequent cable moves, add-ons, and changes will occur. Such devices must be:
      a. Capable of retrofit around existing cables.
      b. Designed so that two or more devices can be ganged together.
      c. Maintenance-free so no action is required to activate the smoke- and fire-sealing mechanism.
   2. Where fire-rated cable pathway devices are not practical, openings within walls and floors designed to accommodate data, video, and communications cabling must be provided with re-enterable products specifically designed for retrofit, such as retrofit dev ices for cable bundles, firestopping putty, plugs, or pillows.

S. Retrofit Device for Cable Bundles: Factor-made, intumescent, collar-like device for firestopping existing over-filled cable sleeves and capable of being installed around projecting sleeves and cable bundles.

T. Wall-Opening Protective Materials: Intumescent, non-curing putty pads or self-adhesive inserts for protection of electrical switch and receptacle boxes.

U. Fire-Rated HVAC Retaining Angles: Steel angle system with integral intumescent firestop gasket for use around rectangular steel HVAC ducts without fire dampers.

V. Firestop Plugs: Flexible, re-enterable, intumescent, foam-rubber plug for use in blank round openings and cable sleeves.

W. Fire-Rated Cable Grommet: Molded two-piece grommet made of plenum-grade polymer and foam inner coarse for sealing small cable penetrations in gypsum walls up to 1/2 inch diameter.

X. Closet Flange Gasket: Molded, single-component, flexible, intumescent gasket for use beneath a water closet (toilet) flange in floor applications.

2.6 MIXING

A. Penetration Firestopping Materials: For those products requiring mixing before application, comply with through-penetration firestop system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of firestopping. Do not proceed with installation until unsatisfactory conditions have been corrected.
   1. Verify penetrations are properly sized and in suitable condition for application of materials.
   2. Conduct tests according to firestop systems manufacturer’s written recommendations to verify that substrates are free of oil, grease, rolling compounds, incompatible primers, loose mill scale, dirt or other foreign substances capable of impairing bond of fire resistive materials.

3. Verify objects penetrating firestop materials, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
4. Verify substrates are not obstructed by ducts, piping, equipment, and other suspended construction that will interfere with applying fire resistive materials.

B. Verify that environmental conditions are safe and suitable for installation of firestop materials.

C. Do not proceed with installation of firestop system until the Contractor in a manner acceptable to the A/E has corrected unsatisfactory conditions.

3.2 PREPARATION

A. Surface Cleaning: Clean out openings immediately prior to installing firestopping to comply with recommendations of firestopping manufacturer and the following requirements:
1. Remove all foreign materials from surfaces of openings and from penetrating items that could interfere with adhesion of firestopping.
2. Clean openings and penetrating items to produce clean, sound surfaces capable of developing optimum bond with firestopping. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form release agents from concrete.
4. Do not apply firestopping and smoke seals to surfaces previously painted or treated with sealers, curing compounds, water repellent or other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.

B. Verify that field dimensions are as tested and listed, classified systems, Engineering Judgments, EFRRA's and as recommended by the manufacturer's installation instructions.

C. Priming: Prime substrates where recommended in writing by through-penetration firestop system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

D. Ensure that anchoring devices, back-up materials, clips, sleeves, and supports and other related materials used in the actual fire tests are provided.

E. Masking Tape: Use masking tape to prevent through-penetration firestop systems from contacting adjoining surfaces that will remain exposed on completion of work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestop system materials. Remove tape as soon as possible without disturbing firestop systems seal with substances.

3.3 INSTALLING THROUGH-PENETRATION FIRESTOPS

A. General: Comply with the "Performance Requirements" in Part 1 and the through-penetration firestop manufacturer's installation instructions and drawings pertaining to products and applications indicated.
1. Coordinate with other trades to assure that all pipes, conduit, cable, and other items, which penetrate fire rated construction, have been permanently installed prior to installation of firestop assemblies.
2. Schedule the Work to assure that partition and all other construction that conceals penetrations are not erected prior to the installation of firestop and smoke seals.

B. Install forming/damming materials and other accessories of types required to support fill materials during their application and in the position needed to produce the cross sectional shapes and depths required to achieve fire ratings of designated through- penetration firestop systems.
1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.

C. Install fill materials for through-penetration firestop systems by proven techniques to produce the following results:
   1. Completely fill voids and cavities formed by openings, forming materials, accessories, and penetrating items to achieve required fire-resistance ratings.
   2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
   3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.
   4. Where through-penetration firestops are indicated to be watertight, they shall meet UL Water Leakage Test – Class I requirements for systems tested and listed in accordance with the criteria of ASTM E814 (UL1479) Standard Test Method for Fire Tests of Through-Penetration Fire Stops. W Rated – Class I requirements include a minimum water column exposure of 3 feet for 72 hours prior to the standard time/temperature curve for the fire test.
   5. Through Penetration Sealants with a Fungicide. Sealants must meet the requirements of ASTM G21 Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

3.4 IDENTIFICATION

A. Penetration Identification: Identify penetration firestop systems with pressure-sensitive, self-adhesive, preprinted vinyl labels or with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of firestopping edge so labels will be visible to anyone seeking to remove penetrating items or firestop systems use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
   1. The words "Warning – Through-Penetration Firestop System – Do Not Disturb. Notify Building Management of Any Damage".
   2. Contractor's name, address, and phone number.
   3. Through-penetration firestop system designation of applicable testing and inspecting agency.
   4. Date of installation.
   5. Through-penetration firestop system manufacturer's name.
   6. Installer's name.

B. Wall Identification: In addition to identification of firestop systems, fire walls, fire barriers, fire partitions, smoke barriers and smoke partitions or any other wall required to have protected openings or penetrations shall be effectively and permanently identified with signs or stenciling. Such identification shall:
   1. Be located in accessible concealed floor, floor-ceiling, or attic spaces at 15 feet from end of wall; and
   2. Be repeated at intervals not exceeding 30 feet measured horizontally along the wall or partition; and
   3. Include lettering not less than 3 inches in height, incorporating the suggested wording: "FIRE AND/OR SMOKE BARRIER – PROTECT ALL OPENINGS." Other wording must be pre-approved by Authorities with Jurisdiction.

3.5 CLEANING AND PROTECTION

A. Clean off excess fill materials and sealants adjacent to openings as work progresses by methods and with cleaning materials approved by manufacturers of firestopping products and of products in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce through-penetration firestop system complying with specified requirements.

3.6 FIELD QUALITY CONTROL

A. Owner will engage a qualified testing agency to perform tests and inspections in accordance with ASTM E2174.

B. Keep areas of work accessible until inspection by applicable code authorities.

C. Inspection of through-penetration firestopping shall be performed in accordance with ASTM E 2174, “Standard Practice for On-Site Inspection of Installed Fire Stops” or other recognized standard. Inspection shall be one of the following:
   1. The inspector shall be on-site during installation and randomly witness a minimum of 10 percent of each type of fire stop being installed (ASTM E2173; 10:12:1).
   2. The inspector shall conduct a post-installation inspection, which shall require destructive type verification of the fire stop and repair of the fire stop. A minimum of 2 percent, but not less than one penetration, of each type of fire stop shall be inspected per 10,000 feet inspection area (E2173 10:12:2).

D. Where deficiencies are found or penetration firestopping is damaged or removed because of testing, repair or replace penetration firestopping to comply with requirements.

E. Proceed with enclosing penetration firestopping with other construction only after inspection reports are issued and installations comply with requirements.

END OF SECTION 07 84 13

SECTION 07 92 00 – JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes joint sealants for the applications indicated in the Joint-Sealant Schedule at the end of Part 3.
   1. Latex joint sealants

1.2 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate installation of joint sealants with cleaning of joint sealant substrates and other operations that may impact installation or finished joint sealant work.

1.3 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product indicated, including backing materials.

B. Samples for Verification: For each type and color of joint sealant required, provide Samples with joint sealants in 1/2-inch-wide joints formed between two 6-inch-long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

C. Joint-Sealant Schedule.

1.4 CLOSEOUT SUBMITTALS

A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals.
   1. Warranties: Special warranties specified in this Section.
      a. Manufacturer’s special warranties.
      b. Installer’s special warranties.

1.5 WARRANTY

A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: 2 years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer's standard form in which silicone sealant manufacturer agrees to furnish silicone joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: 5 years from date of Substantial Completion.

C. Special warranties specified in this Article exclude deterioration or failure of elastomeric joint sealants from the following:
   1. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.
   2. Disintegration of joint substrates from natural causes exceeding design specifications.
   3. Mechanical damage caused by individuals, tools, or other outside agents.
   4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

2.2 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.

B. Liquid-Applied Sealants: Comply with ASTM C920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C920 classifications for type, grade, class, and uses related to exposure and joint substrates.

C. Colors of Exposed Joint Sealants: As selected by A/E from manufacturer's full range, unless otherwise noted.

2.3 SILICONE JOINT SEALANTS

A. Single-Component, Nonsag, Silicone Joint Sealant: ASTM C920, Type S, Grade NS, Class 100/50, for Use NT.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. 790 or NS Parking Structure Sealant; DuPont Corporation.
      b. SilPruf LM SCS2700; GE Construction Sealants; Momentive Performance Materials, Inc.
      c. 301 NS, 311 NS, 890NST, or 890FTS; Pecora Corporation.
      d. Sikasil WS-290 or Sikasil 728 NS; Sika Corporation.
      e. Spectrem 1 or Spectrem 800; Tremco Incorporated.
      f. ADSEAL LM 4600 Series; ADFAST.

B. Single-Component, Nonsag, Silicone Joint Sealant: ASTM C920, Type S, Grade NS, Class 50, for Use NT.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. 756 SMS, 791, 795, or 995; DuPont Corporation.
      b. SilGlaze II SCS2800, SilPruf NB SCS9000, or SilPruf SCS2000; GE Construction Sealants; Momentive Performance Materials, Inc.
      c. PCS; Pecora Corporation.
      d. Whitford Worldwide; PSI-641; Polymeric Systems, Inc.
      e. Sikasil WS-295 or Sikasil N+; Sika Corporation.
      f. Spectrem 2 or 3; Tremco Incorporated.
      g. ADSEAL Production 4580 Series; ADFAST.

C. Multiple-Component, Nonsag, Silicone Joint Sealant: ASTM C920, Type M, Grade NS, Class 50, for Use NT.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. 890FTS-TXTR; Pecora Corporation.
      b. Sikasil WS-295 FPS; Sika Corporation.
      c. Spectrem 4-TS; Tremco Incorporated.

2.4 BUTYL JOINT SEALANTS

A. Butyl-Rubber-Based Joint Sealants: ASTM C 1311.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Chem-Calk 300; Bostik, Inc.
      b. BC-158; Pecora Corp.
      c. General Purpose Butyl Sealant; Tremco Incorp.
      d. B-100 Butyl Rubber Sealant; ADCO.

2.5 LATEX JOINT SEALANTS

A. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF or better.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Sonolac; MBCC Group.
      b. Chem-Calk 600; Bostik, Inc.
      c. AC-20+ Silicone; Pecora Corporation.
      d. SM 8200; Schnee-Morehead, Division, ITW.
      e. Tremflex 834; Tremco Incorporated.
      f. 950A Siliconized Acrylic Latex Caulk; Sherwin-Williams.
      g. Titebond Kitchen and Bath Sealant; Franklin International.
      h. ADSEAL DWM 1090; ADFAST.

B. Paintable Mildew-Resistant Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF or better.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Sonolac; MBCC Group.
      b. AC-20+Silicone; Pecora Corporation.
      c. Sherwin-Williams:
         1) Powerhouse 1110A Siliconized Acrylic Latex Sealant.
         2) White Lightning Kitchen and Bath Latex Ultra Sealant.
      d. Tremflex 834; Tremco.

2.6 JOINT-SEALANT BACKING

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

2.7 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Perform preparation in accordance with manufacturer’s instructions and ASTM C1193.

B. Joint Priming: Prime joint substrates, where recommended in writing 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.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

1. Mix and apply multi-component sealants in accordance with manufacturer's printed instructions.
2. Apply joint sealants prior to applying penetrating water repellents. Joint sealants need to cure 7 days prior to application of penetrating masonry sealers.

B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

3.4 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur. Remove excess sealant using materials and methods approved by sealant manufacturer that will not damage joint substrate materials.
1. Remove masking tape immediately after tooling joint without disturbing seal.
2. Remove excess sealant from surfaces while stile uncured.

3.5 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.6 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application (JS-A): Exterior joints in vertical surfaces and non-traffic horizontal surfaces.
1. Joint locations such as, but not limited to:
    a. Perimeter joints between masonry, concrete, and frames of doors, windows, storefronts, louvers, and similar openings.
    b. Exterior joints between dissimilar materials where the joining of the two surfaces leaves a gap between the meeting materials or components as may be dictated by various methods of construction to make building watertight.
    c. Other joints as indicated on Drawings.
2. Provide one of the following acceptable sealants as approved by manufacturer for substrates and uses indicated:
    a. Neutral-Curing Silicone Joint Sealant:
        1) Single-Component, Nonsag: ASTM C920, Type S, Grade NS, Class 100/50, for Use NT.
        2) Single-Component, Nonsag: ASTM C920, Type S, Grade NS, Class 50, for Use NT.
        3) Multi-Component, Nonsag: ASTM C920, Type S, Grade NS, Class 50, for Use NT.
3. Color: Custom color to match A/E’s sample of adjacent materials.

B. Joint-Sealant Application: Interior joints in vertical surfaces not subject to movement.
1. Joint locations such as, but not limited to:
    a. Interior perimeter joints of exterior openings.
    b. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
    c. Interior joints between dissimilar materials where a gap is created where materials meet, unless otherwise noted.
2. Provide the following acceptable sealants as approved by manufacturer for substrates and uses indicated:
    a. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF or better.
3. Color: As selected by A/E from manufacturer’s full range.

C. Joint-Sealant Application: Mildew-resistant interior joints in painted vertical surfaces and horizontal non-traffic surfaces.
   1. Joint locations such as, but not limited to:
      a. Joints where countertops or backsplashes intersect painted walls.
      b. For interior joints in painted vertical and horizontal surfaces where incidental food contact may occur.
   2. Provide the following acceptable sealants as approved by manufacturer for substrates and uses indicated:
      a. Mildew-Resistant Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF or better.
   3. Color: As selected by A/E from manufacturer's full range of colors.

D. Joint-Sealant Application: Exterior joints under metal thresholds and saddles, sill plates, or as bedding sealant for sheet metal flashing and frames of metal or wood.
   1. Provide one of the following acceptable sealants as approved by manufacturer for substrates and use indicated.
      a. Neutral-Curing Silicone Joint Sealant:
         1) Single-Component, Nonsag: ASTM C920, Type S, Grade NS, Class 100/50, for Use NT.
         2) Single-Component, Nonsag: ASTM C920, Type S, Grade NS, Class 50, for Use NT.
         3) Multi-Component, Nonsag: ASTM C920, Type M, Grade NS, Class 50, for Use NT.
      b. Urethane Joint Sealant:
         1) Single-Component, Nonsag: ASTM C920, Type S, Grade NS, Class 25 or 35, for Use NT.
         2) Single-Component, Nonsag, Traffic-Grade: ASTM C920, Type S, Grade NS, Class 25, for Use T.
      c. Butyl-rubber based sealant.
   2. Color: Not applicable.

END OF SECTION 07 92 00

DIVISION 08 OPENINGS

SECTION 08 14 16 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Factory-preparation of wood doors for hardware specified in Division 08 Section “Door Hardware”.
   2. Doors shall be factory-finished, unless otherwise noted.
   3. Full-glass full-warranty doors.

1.2 ACTION SUBMITTALS

A. Product Data: Submit door manufacturer's product data, specifications, and installation instructions for each type of wood door, including door construction description and WDMA I.S.1-A and AWS classifications.
   1. Include details of core and stile construction, trim for openings and louvers (if any), and similar components.
   2. Include factory-finishing specifications.
   3. Include manufacturers technical data for glass and glazing material required including installation and maintenance instructions.

B. Shop Drawings: Indicate locations, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:
   1. Door schedule indicating door location, type, size, fire protection rating, and swing.
   2. Door elevations, dimension, and locations of hardware, lite and louver cutouts, and glazing thickness.
   3. Dimensions and locations of blocking for hardware attachment.
   4. Dimensions and locations of mortises and holes for hardware.

C. Samples for Verification: Factory finishes applied to actual door materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide set of 3 samples showing typical range of color and grain to be expected in the finished work.

1.3 CLOSEOUT SUBMITTALS

A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals.
   1. Cleaning Instructions: Submit manufacturer’s cleaning instructions for doors.
   2. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

A. Comply with the applicable requirements of the following standards unless otherwise indicated:
   1. ANSI/WDMA I.S. 1, "Industry Standard for Wood Flush Doors," published by Window and Door Manufacturers Association (WDMA), formerly the National Wood Window and Door Association (NWWDA).

B. Openings shall be provided to conform to the Americans with Disabilities Act Accessibility Guidelines (ADAAG) and State and Local Regulations. Where, in the opinion of the supplier/manufacturer, openings do not conform, notify the A/E.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect wood doors during transit, storage, and handling to prevent damage, soiling, and deterioration. Comply with requirements of referenced ANSI standard and recommendations of WDMA pamphlet "How to Store, Handle, Finish, Install, and Maintain Wood Doors," as well as with manufacturer's instructions.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until conditions for temperature and relative humidity have been stabilized and will be maintained in storage and installation areas during the remainder of the construction period to comply with requirements of the referenced quality standard for Project's geographical location.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form, signed by manufacturer, installer, and contractor, in which manufacturer agrees to repair or replace doors that are defective in materials or workmanship, have warped (bow, cup, or twist) more than 1/4 inch in a 42 by 84 inch section, or show telegraphing of core construction in face veneers exceeding 0.01 inch in a 3 inch span.
   1. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
   2. Warranty shall be in effect during the following period of time from date of Substantial Completion.
      a. Interior Solid-Core Interior Doors: Full Life of Original Installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to 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 one of the manufacturers specified.
      a. Masonite Architectural (EPD)
      b. Lambton Doors (EPD)
      c. Oregon Door
      d. Oshkosh Door Company
      e. VT Industries, Inc. (EPD)
      f. Five Lakes Manufacturing
      g. Wilsonart LLC

B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. Requests for A/E's approval must be accompanied by the "Substitution Request Form" and complete technical data for evaluation. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

C. Source Limitations: Obtain doors from a single manufacturer to ensure uniformity in quality of appearance and construction.

2.2 DOOR CONSTRUCTION, GENERAL

A. Quality Standard: In addition to requirements specified, comply with WDMA I.S.1-A, "Architectural Wood Flush Doors".
   1. Contract Documents contain selections chosen from options in quality standard and additional requirements beyond those of quality standard. Comply with those selections and requirements in addition to quality standard.

B. WDMA I.S.1-A Performance Grade: Extra Heavy Duty.

C. Structural-Composite-Lumber-Core Doors:
   1. Structural Composite Lumber: WDMA I.S.10.
      a. Screw Withdrawal, Face: 700 lbf (3100 N).
      b. Screw Withdrawal, Edge: 400 lbf (1780 N).

D. Regulatory Requirements:
   1. Safety Glazing: Category II materials complying with testing requirements in 16 CFR 1201 and ANSI Z97.1.
      a. Subject to compliance with requirements, permanently mark safety glazing with certification label of Safety Glazing Certification Council (SGCC) or another certification agency acceptable to authorities having jurisdiction.
         1) Identification on tempered glass shall include the words “Tempered Safety Glass”.

2.3 VENEERED-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Solid-Core Doors, General: Match existing.
   1. ANSI/WDMA I.S. 1A Grade: Custom (Grade A faces).
   2. Species: Red oak, unless otherwise required to match existing.
   3. Faces: Single-ply wood veneer not less than 1/50 inch thick.
   4. Cut: Plain sliced (flat sliced).
   5. Match between Veneer Leaves: Slip match.
   6. Assembly of Veneer Leaves on Door Faces: Running match.
   7. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
   8. Exposed Vertical Edges: Solid wood of same species as faces or a compatible species-edge Type A.
   9. Core:
      a. Doors with Exit Devices, Doors with Light Openings and Doors with Louvers (and where otherwise noted): Provide structural composite lumber core (SCLC).
         1) Lock-to-lite-cutout shall not be less than 1 1/2 inches.
   10. Construction: Five plies. Stiles and rails are bonded to core, then abrasive-plane entire unit before veneering. Faces are bonded to core using a hot press.
      a. Seven plies will not be acceptable.
   11. Adhesives: Type 1 in accordance with WDMA T.M.6.

B. Nonrated and 20 Minute Rated Full-Glass Full-Warranty Doors:
   1. Provide faces and grade to match doors as specified first paragraph of this Article.
   2. Core Construction: Engineered Hardwood Composite Lumber (LSL) Core.
   3. Door Thickness: 1-3/4 inch.
   4. Core/Edge Innerface: Bonded.
   5. Top rail and vertical stiles shall be a minimum 6 inches wide and bottom rail shall be a minimum of 10 inches wide.
   6. Lock-to-Lite Cutout (minimum): 1-1/2 inch.
   7. Stile and Rail Edges:
      a. Top and Bottom Rails: Mill-option hardwood.
      b. Vertical Stiles: Provide veneered edges to conceal crossband edges.

2.4 GLAZING

A. Glazing:
   1. Nonrated doors shall be glazed with 1/4 inch thick clear tempered safety glass, unless otherwise noted.
   2. Door supplier shall provide wood stops for nonrated and 20-minute doors. Stop shall be flush with face veneer; recessed stops will not be acceptable.

B. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed, unless otherwise indicated. Performance requirements:
    a. Distortion Tolerance: Roll wave peak-to-valley (PV) not to exceed 0.003 center/0.008 edges.
    b. Millidiopter: 90 percent of surface not to exceed +/- 120 millidiopters.
    c. Monitoring: Every lite measured with an on-line distortion measurement system.
    d. Bow/Warp Tolerance: Maximum tolerance for bow/warp is 1/2 of ASTM C 1048.
    e. All documentation recorded and may be available upon request.

2.5 LIGHT FRAMES

A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads as follows unless otherwise indicated.
    1. Wood Species: Any closed-grain hardwood.
    2. Profile: Manufacturer's standard shape.
    3. At wood-core doors with 20-minute fire-protection ratings, provide wood beads and metal glazing clips approved for such use.

B. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based elastomeric tape with a solids content of 100 percent, non-staining and non-migrating in contact with non-porous surfaces, with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated, packaged on rolls with a release paper backing, and complying with ASTM C 1281 and AAMA 800 for products indicated below:
    1. AAMA 804.3 tape, where indicated.
    2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
    3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

2.6 PREFITTING AND PREPARATION FOR HARDWARE

A. Prefit and pre-machine wood doors at factory, including beveling both edges 1/8 inch in 2 inches. Where pairs of doors are scheduled, prefit and pre-machine as pairs. Where pairs of doors are scheduled with 3 point latching (lockset and flush bolts), the strike edge of the inactive leaf shall be square equal to WDMA meeting edge option E1.

B. Rated and nonrated doors shall comply with tolerance requirements of NFPA 80 for pre-fitting. Machine doors for hardware requiring cutting of doors. Comply with final hardware schedules and door frame shop drawings and with hardware templates and other essential information required to ensure proper fit of doors and hardware.
    1. Top and hinge edges: 1/8 inch maximum.
    2. Single door, lock edge: 1/8 inch maximum.
    3. Pair meeting edge: 1/16 inch per leaf maximum.
    4. Bottom (rated or nonrated):
        a. 1/2 inch from decorative floor covering.
        b. 3/4 inch maximum from top of noncombustible floor.
        c. 3/8 inch maximum from top of noncombustible sill or threshold.
        d. Doors with vertical rod exit devices, manual or automatic flush bolts shall be undercut for latching of bolts to a flush floor strike or threshold.
        e. See Division 09 Section “Room Finish Schedule”, for floor finish materials.

C. Coordinate with the metal frame supplier the locations of hardware mortises in metal frames to verify dimensions and alignment before proceeding with machining in factory.

D. Factory-machine doors for hardware that is not surface-applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame, shop drawings, DHI A115-W series standards, and hardware templates.

2.7 FABRICATION

A. General:
   1. The utility or structural strength of the doors must not be impaired in fitting to the opening in applying hardware, in preparing for lights, louvers, plant-ons or other detailing.
   2. Pilot holes must be drilled for all screws that act as hardware attachments. Threaded-to-the-head screws are preferable for fastening hardware to nonrated doors and are required on fire-rated doors.
   3. In fitting for height, do not trim top or bottom edge by more than 3/4 inch, unless accommodated by additional blocking. Do not trim top edge of fire doors.

B. Factory-machine doors for hardware that is not surface-applied.
   1. Locate hardware to comply with DHI-WDHS-3.
   2. Comply with final hardware schedules, door frame Shop Drawings, ANSI/BHMA-156.115-W and hardware template standards, and hardware templates.
   3. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory-machining.
   4. For doors scheduled to receive electrified locksets, provide factory-installed raceway and wiring to accommodate specified hardware.
   5. Metal Astragals: Factory-machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

C. Openings: Cut and trim openings through doors in factory.
   1. Light Openings: Trim openings with moldings of material and profile indicated.

2.8 FACTORY FINISHING

A. General: Comply with referenced quality standard for factory-finishing.
   1. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface-applied, before finishing.
   2. Finish faces, all four edges, edges of cutouts, and mortises.
   3. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.

B. Finish doors at factory, unless specifically noted otherwise.

C. Transparent Finish:
   1. Grade: Custom.
   2. Finish: WDMA TR-6 catalyzed polyurethaneor TR-8 UV cured acrylated.
   3. Staining: Match existing adjacent doors.
   4. Sheen: Semigloss.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Hardware: For installation, see Division 08 Section “Door Hardware”.

B. Manufacturer’s Written Instructions: Install doors to comply with manufacturer’s written instructions, referenced quality standard, and as indicated.
   1. Position tapes on fixed stops so that, when compressed by glass, the exposed edges are flush with or protrude slightly above sightline of stops.

C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal cut surfaces after fitting and machining.
   1. Clearances: Provide 1/8 inch at heads, jambs, and between pairs of doors. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide 3/8 inch from bottom of door to top of threshold.
   2. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.

D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.2 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 08 14 16

DIVISION 09

FINISHES

SECTION 09 05 16 – EXISTING SUBSTRATE PREPARATION FOR FLOOR FINISHES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes substrate preparation requirements for existing areas to receive installation of new flooring materials. This Section includes:
   1. Removal of existing floor coverings, where indicated.
   2. Testing concrete floor slabs for moisture and pH.
   3. Floor leveling and repair.
      a. Trowel Leveling Components (Skim Coats/Patches for concrete not within flatness requirements).
   4. Moisture Vapor Emission Control (for concrete with relative humidity and/or pH levels too high prior to installation of flooring).

1.2 PRICE AND PAYMENT PROVISIONS

A. Allowances for substrate preparation are specified in Division 01 Section “Allowances”.
   1. Perform work only as authorized by Change Orders in accordance with unit price if determined necessary.
   2. Concrete MVE – control systems are part of Moisture Vapor Emission Control Allowance.

B. Unit Prices: Work of this Section is affected by unit prices specified in Division 01 Section “Unit Prices”.
   1. Unit prices for each type and units of work.
   2. Work of this Section is affected by Moisture Vapor Emission Control Unit Price.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct meeting at Project site, after shop drawing review. Comply with requirements in Division 01 Section “Project Management and Coordination”. A/E will schedule and conduct meeting. Review methods and procedures related to flooring system installation including, but not limited to, following:
   1. Meet with Owner, CM, A/E, testing and inspecting agency representative, floor system installers, including installed of moisture mitigation and cementitious underlayment, floor system manufacturers representatives, including those of moisture mitigation, cementitious underlayment, and adhesive and installers work interfaces or affects flooring.
   2. Review methods and procedures related to flooring installation, including manufacturer’s written instructions.
   3. Review and finalize construction schedule and verify availability of materials, Installer’s personnel, equipment, and facilities needed to make progress and avoid delays.
   4. Example substrate conditions, including flatness and any testing results pertaining to substrate i.e., core samples, moisture readings.
   5. Review warranty obligations.
   6. Review temporary protection requirement for each sequence of work.

B. Sequence
   1. Perform substrate preparation in following sequences:
      a. Selectivity remove existing floor covering to be replaced, where indicated.
      b. Test concrete for moisture and core drill for composition, including vapor retarder.
      c. Evaluate need for moisture mitigation and install if needed.
      d. Examine floor for flatness and levelness.
      e. Install floor leveling or patching compounds as required to create flat and level substrate to meet flooring manufacturers requirement.
      f. Install moisture vapor emission control for concrete with relative humidity and/or pH levels too high prior to installation of flooring.

1.4 ACTION SUBMITTALS

A. Product Data: Provide data on proposed products, describing physical and performance characteristics; including installation instructions.
   1. Moisture remediation system.
   2. Underlayment primer.
   3. Cementitious trowel-applied underlayment (patching).

1.5 INFORMATIONAL/QUALITY ASSURANCE/CONTROL SUBMITTALS:

A. Certificate: Written approval confirming product compatibility with subfloor material manufacturer and flooring manufacturer.

B. Test Data: Moisture test and pH results performed by a qualified independent testing agency or warranty holding manufacturers technical representative. Include the following:
   1. Description of areas tested; include floor plans and photographs, if helpful.
   2. Summary of conditions encountered.
   3. Moisture and alkalinity (pH) test reports.
   4. Copies of specified test methods.
   5. Recommendations of remediation of unsatisfactory surfaces.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Provide substrate surfaces that are smooth, porous (to ASTM F3191), flat (to minimum industry standards.), level, thoroughly dry, and free from alkali, dust, dirt, adhesives, paint, varnish, solvents, oils and grease, waxes, release agents, sealers and curing and hardening compounds that are incompatible with adhesives and other flooring materials to be used or that are unacceptable or detrimental to the application requirements of select flooring materials.

B. Provide substrate surface level and flatness conditions acceptable for floor covering materials. Testing for moisture and alkalinity shall be done. Test results must show acceptable conditions within manufacturer's moisture and alkalinity limits before commencement of any flooring work.

C. Provide substrate surface level and flatness conditions acceptable for floor covering materials. This shall include grinding or sanding of ridges, undulations, projections, and areas of carbonation and scaling and filling and leveling of expansion joints, cracks, grooves and irregularities. The surface of the floor shall be vacuumed clean.

2.2 MOISTURE REMEDIATION COATING

A. Moisture Vapor Emission Control System: Refer to Division 09 Section "Moisture Vapor Emission Control".

B. Maximum RH requirement: 100 percent testing in accordance with ASTM F 2170.

C. Moisture Vapor Emission Rate (MVER) Reduction: From $\leq$25 to below 3 lbs./1000-ft^2/24hr. per ASTM F1869.

2.3 CEMENTITIOUS TROWEL-APPLIED UNDERLAYMENT

A. Cement-based trowelable compound that is designed to skim coat, smooth, and level irregularities from feather edge up to 1/2 inches. Gypsum-based products are unacceptable.
   1. Feather Edge; TEC.
   2. Feather Finish XF; Ardex.
   3. LevelLite Self-Leveling Underlayment; Custom Building Products.
   4. Skimcrete XL; Dependable.

5. NXT Skim Lite; LATICRETE International.
6. MasterTop 115FC; Master Builders.

B. Compressive Strength: Minimum 4000 psi in 28 days.

C. Trowel-applied underlayment shall not contain silica quartz (sand).

D. Dry Time: Underlayment shall receive application of floor covering in 15 to 20 minutes.

PART 3 - EXECUTION

3.1 EXAMINATION AND TESTING

A. Moisture Testing: Before applying concrete moisture vapor barrier coating, conduct independent testing according to ASTM F2170 must be obtained to determine the relative humidity of the concrete.
1. Testing with electrical impedance or resistance apparatus may not be substituted for the specified ASTM test method, as the values determined are not comparable to the ASTM test values and do not quantify the moisture content sufficiently.
2. If test values exceed floor covering manufacturer's limits, perform moisture remediation as indicated. In the absence of manufacturer limits, perform remediation if any test value exceeds 75 percent relative humidity.
3. Report: Report the information required by the test method.
4. Notify the Architect in writing of any unsatisfactory conditions.

B. Alkalinity Testing: Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
1. The following procedure is the equivalent of that described in ASTM F710, repeated here for the Contractor's convenience.

C. Use wide range alkalinity (pH) test paper, its associated chart, and distilled or deionized water.

D. Place several drops of water on a clean surface of concrete, forming a puddle approximately 1 inch in diameter. Allow the puddle to set for approximately 60 seconds, then dip the alkalinity (pH) test paper into the water, remove it, and compare immediately to chart to determine alkalinity (pH) reading.

E. Use of a digital pH meter with probe is acceptable; follow meter manufacturer's instructions.
1. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if alkalinity (pH) test value is over 12.

F. Floor Flatness: Verify that concrete substrates are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through the flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with the bonding of flooring to the substrate.

3.2 SURFACE PREPARATION

A. Existing concrete slabs with existing floor coverings.
1. Conduct visual observation of existing floor coverage for adhesion, water damage, alkaline deposits, and other defects.
2. Remove existing floor covering and adhesives. Comply with local, state, and federal regulations and RFCI Recommended Work Practices for Removal of Resilient Floor Coverings, as applicable to floor covering being removed.

B. Concrete shall meet requirements of ASTM F 710 and be sound, solid, clean, and free of all oil, grease, dirt, curing compounds, and any substance that might act as a bond-breaker before application. As required prepare slab by mechanical methods. No chemicals or solvents shall be used.

C. General: Prepare and clean substrates according to flooring manufacturer's written instructions for substrate indicated. To provide a successful application to concrete evaluate and address all conditions that would prevent a good bond. The following guidelines are provided to assist in this process. Provide any additional evaluation, testing and/or preparation as required to ensure surface preparation are meet to require a good flooring product installation. It is necessary to evaluate several conditions. Check for Condition 1 on the entire concrete surface. Conditions 2-4 should be checked for at least once per every 50 ft^2 on small applications (1000 ft^2 or less) and once every 100 ft^2 on large applications (greater than 1000 ft^2. Once you have completed the preparation method, always re-check to confirm the method worked.

1. Condition 1: Surface coatings and/or contamination such as gypsum plasters, joint compound, paint and adhesive. Evaluation: Look at the surface and note the type and location of the surface contamination. Preparation: First scrape off any lumps and loose material. Then use an appropriate cleaning method for the type of coating or contamination.
    a. For gypsum plaster and joint compound – scrub with warm water and detergent to remove any remaining material. Thoroughly rinse off any residue and allow concrete to dry.
    b. For paint, chemical strippers should not be used. They may leave a residue or be absorbed into concrete and later migrate into the surface and cause a bond failure. Paint not easily scraped off should be mechanically removed.
    c. For adhesive, scrap off all the adhesive from the surface first, then remove the layer of adhesive-contaminated concrete by mechanical means.
2. Condition 2: Weak top layer (called laitance) or damaged concrete such as spalling, scaling, delaminating or crumbling. Evaluation: First scrape the surface with a knife blade. If this produces a fine powder, then laitance is present. Then use a hammer or other heavy object to sound out weak or hollow areas. Note the areas that are weak or damaged. Preparation: Weak or damaged concrete must be mechanically removed. Do NOT acid wash or etch concrete because it is difficult to remove contaminates and properly neutralize. The acid can penetrate into the porous concrete and chemically undermine it, weakening the concrete. Acid washing will not remove grease or oil.
3. Condition 3: Curing Compounds and Sealers
    a. Broom finish or steel troweled (non-glossy) evaluation: Apply water droplets onto the surface. If the droplets are not absorbed within 60 seconds the surface was treated with curing compound/sealer or is contaminated. Preparation: The sealed or contaminated layer of concrete must be removed by mechanical means.
    b. Burnished finish (glossy surface) evaluation: Frequently the moisture vapor emission control system can be installed over burnished concrete without mechanical preparation. For glossy burnished concrete surfaces, apply test areas to confirm bond strength of at least 150 psi when tested per ASTM D7234 (tensile bond test). Preparation: Glossy burnished concrete surfaces that do not provide bond strength of at least 150 psi must be removed by mechanical means.
4. Condition 4: Final Surface Preparation, removal of dirt and dust. Evaluation: Wipe the surface with a clean dark cloth. If powder is visible on the cloth the surface is not clean enough. Preparation: Always use a two-step method to remove surface dirt and dust. First use a dry clean broom and sweep the entire surface. Do not use oil or wax based sweeping compounds. They can leave a film on the concrete surface that will prevent a proper bond. The second step should consist of one of the following:
    a. Vacuuming: Use a heavy-duty industrial type vacuum to provide a dust-free surface. It may also be necessary to follow vacuuming with a damp sponge wipe to remove residual surface dust.
    b. Water Cleaning: Use a stream of potable water with sufficient pressure to remove dust and dirt. When necessary, also scrub with a stiff bristled brush. Remove all wash water and allow concrete to thoroughly dry.

c. Detergent Water Cleaning: Use a stiff bristled brush or broom, scrub the entire concrete surface with a cleaning product intended for concrete or a solution of at least 4 ounces of trisodium phosphate per gallon of warm water. Before the surface dries, thoroughly flush the concrete with clean potable water to remove all wash water and residue. Allow concrete to thoroughly dry prior to application of additional products.

D. Prepare concrete substrates per ASTM D4249 to an ICRI concrete surface profile between 1 and 3 CSP as follows: Do not use water blast method.
1. Dry abrasive blasting.
2. Vacuum-assisted abrasive blasting.
3. Centrifugal-shot abrasive blasting.

E. Verify that concrete substrates are dry.
1. Perform in situ probe test, ASTM F 2170. Proceed with application only after substrates do not exceed a maximum potential equilibrium relative humidity per floor manufacturer's written recommendations.
2. Provide a written report showing test placement and results.

F. Prepare joints and cracks in accordance with material manufacturer's instructions.
1. For static cracks, cuts or joints less than 3/64 inch (1 mm), wide: Remove dirt, debris or existing sealant from all cracks and joints, then treat static (non-moving) joints, cuts, and cracks with moisture vapor emission control system (MVEC) by direct applying MVEC into the cracks or joints with a paint brush, to completely coat the walls of each cavity.
2. For static cracks/control joints 3/64 inch to 1/8 inch wide: Remove dirt, debris, or existing sealant from cracks and joints, then use a concrete filler, such as feather or patching cementitious underlayment as recommended by underlayment manufacturer.
3. For static cracks/control joints more than 1/8 inch: Remove dirt, debris or existing sealant from cracks and joints, then use a concrete crack filler.
4. For Expansion Joints/Dynamic (Moving) Cracks: Remove any dirt, debris or existing sealant from cracks and joints. Treat all dynamic (movement) joints with MVEC by applying a layer into the joint edges with a paint brush to completely coat the walls of cavity. Once dried, fill the dynamic joint with backer rod, leaving a minimum of 1/2 inch open at top of proper treatments with a sealant.

G. Alkalinity: Measure surface pH in accordance with procedures provided in ASTM F 710 or flooring manufacturer's technical representative.

H. Tolerances: Subsurface shall meet flatness and levelness tolerance as recommended by floor finish manufacturer. Install underlayment to achieve required tolerance.

3.3 CEMENTITIOUS UNDERLAYMENT

A. General: Most impervious floor coverings require the application of a cementitious underlayment over MVEC for adhesives to bond properly to the floor coverings. MVEC can dry in as little as 3 to 4 hours, depending on surface porosity and ambient humidity. Apply appropriate cementitious underlayment directly to dried MVEC at a minimum thickness of 1/8 inch.

B. Install cementitious self-leveling underlayment as required to correct surface defects, floor flatness or levelness corrections to meet floor manufacturer's tolerance requirements.
1. Address non-moving cracks or joints.
2. Provide a smooth surface for installation of flooring covering.
3. All surfaces shall be structurally sound and free from oil, grease, dust, lose or peeling paint, sealers, floor finishes, curing compounds or any contaminant that would prevent a good bond.
4. For installation over cutback adhesive, remove adhesive by scraping until all that remains in a thin transparent layer of adhesive residue (minimum tensile bond strength of 72 psi is required).

5. Create a minimum of 1/8 inch to ¼ wide gap where cast underlayment abuts walls, columns, and fixtures by installing self-sticking foam weather stripping tape or damp sand (vacuum up sand after self-leveling underlayment has cured).
6. Existing building expansion and control joints shall be honored through the patching material.

C. Mix and apply in accordance with manufacturer's instructions.

END OF SECTION 09 05 16

SECTION 09 05 61.13 - MOISTURE VAPOR EMISSION CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes fluid-applied, resin-based, membrane-forming systems that control moisture-vapor-emission rate of high-moisture, interior concrete to prepare it for floor covering installation.
   1. Work Includes:
      a. Testing of concrete floor slabs for moisture and alkalinity (pH).
      b. Moisture Vapor Emission Control (for concrete with relative humidity and/or pH levels too high prior to installation of flooring.

1.2 UNIT PRICES

A. Work of this Section is affected by Moisture Vapor Emission Control Unit Price.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Pre-installation Meeting: Conduct a pre-installation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions, and manufacturer's warranty requirements for flooring. Discuss contract document requirements, moisture tests, manufacturer recommendations, installer's recommendations, scheduling, and protection of work from damage by other trades. A/E will schedule meeting.
   1. Flooring subcontractor and manufacturer representative should attend along with concrete subcontractor.
   2. Objective of meeting is:
      a. Review methods and procedures.
      b. Tour job site representative areas to inspect and discuss condition of substrate.
      c. Review concrete finishing requirements.
      d. Review and finalize construction schedule.
      e. Review required inspections, testing, certifications, material usage procedures.
      f. Review environmental restrictions and forecasts.
      g. Record content of meeting including attendance and topics.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of project. Submit product data on products meeting requirements determined by preinstallation testing and manufacturer's installation requirements.
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

1.5 CLOSEOUT SUBMITTALS

A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
   1. Warranty: Warranty documents specified herein.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Employs factory-trained personnel who are available for consultation and Project-site inspection and approving application method.

B. Contractor Qualifications: An authorized representative who is trained and approved by manufacturer.

C. Contractor's Responsibility Relating to Independent Agency Testing of Concrete:
   1. Provide access for a cooperate with testing agency.
   2. Confirm date of start of testing at least 10 days before actual start.
   3. Allow at least 4 business days on-site for testing agency activities.
   4. Achieve and maintain specified ambient conditions.
   5. Notify A/E when specified ambient conditions have been achieved and when testing will start.

1.7 WARRANTY

A. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to and not a limitation of, other rights Owner may have under Contract Documents.

B. Manufacturer's Product/System Warranty: Provide products warranted to be free of defects in manufacturing and workmanship for a period specified. Manufacturer warrants against failure of – or damage to –installed flooring system due to concrete water-vapor emission and pH during specified warranty period. Manufacturer's warranty shall include replacement of finish flooring material, adhesive, concrete water-vapor emission and alkalinity control system and labor costs for removal and replacement of those products, providing failure is due to water-vapor emissions and pH within limits of installed system.
   1. Warranty Period: Ten years commencing on Date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of following:
   1. MES 100; Floor Seal Technologies
   2. VAPORSEAL HM PLUS; Dependable LLC
   3. VAP I 2000; Koester American Corporation
   4. Tech MVC; Custom Building Products
   5. Plamiseal VS/Plainseal MSP; Mapei Americas U.S.A.
   6. MC RAPID; ARDEX
   7. MasterTop VB 240FS; MBCC Group.
   8. LiquiDam; H.B. Fuller Construction Products Inc./TEC
   9. Moisture Vapor Control; Laticrete Supercap, LLC
   10. Schonox EPA; Schonox HPS North America, Inc.
   11. MVP; Maxxon Corporation

B. Products of other manufacturers will be considered for acceptance provided they equal or exceed material requirements and functional qualities of specified product. "Substitution Request Form" and complete technical data for evaluation must accompany requests for A/E's approval. All materials for evaluation must be received by Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

C. Components of MVE Control System shall be from a single source manufacturer or approved by MVE manufacturer in writing.

2.2 PERFORMANCE REQUIREMENTS

A. General: Provide substrates with moisture and alkalinity levels acceptable for floor covering materials. Final test results must show acceptable conditions within manufacturer's moisture and alkalinity limits before commencement of any flooring work.

B. MVE-Control System Capabilities: Capable of suppressing MVE without failure where installed on concrete that exhibits following conditions:
   1. MVER: Maximum 25 lb of water/1000 sq. ft. when tested according to ASTM F 1869.

2. Relative Humidity: 95 percent or above when tested according to ASTM F 2170 using in situ probes.

C. Water-Vapor Transmission: Through MVE-control system, maximum 0.1 perm when tested according to ASTM E 96.

D. Tensile Bond Strength: For MVE-control system, greater than 200 psi without failure in concrete according to ASTM D 7234.

2.3 MVE-CONTROL SYSTEM

A. MVE-Control System: ASTM F 3010-qualified, fluid-applied, one or two-component, epoxy-resin, membrane-forming system; formulated for application on concrete substrates to reduce MVER to level required for installation of floor coverings indicated and acceptable to manufacturers of floor covering products indicated, including adhesives.
1. Substrate Primer: Provide MVE-control system manufacturer's concrete-substrate primer if required for system indicated by substrate conditions.
2. Cementitious Underlayment Primer: If required for subsequent installation of cementitious underlayment products, provide MVE-control system manufacturer's primer to ensure adhesion of products to MVE-control system.

2.4 ACCESSORIES

A. Bond Promoting Primer: Provide as recommended by MVE manufacturer over MVE coating to receive underlayment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for maximum moisture content, installation tolerances, and other conditions affecting performance of Work.
1. Verify slab has not been contaminated.
2. Perform water bead test and photographically record contact angle of water bead meniscus to floor to ensure concrete is hydrophilic.
3. Record ambient air RH, dew point and temperature.
4. Record slab temperature.
5. Concrete substrates must be structurally sound, solid, and meet industry standards as defined in ACI Committee 201 Report “Guide to Durable Concrete”.
6. Verify that no hydrostatic pressure exist.

B. Proceed with installation only after unsatisfactory conditions have been corrected.
1. Installation of system indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Preinstallation Testing:
1. Testing Agency: Engage a qualified Third Party (Independent) testing agency to perform tests. Testing shall be performed by an ICRI Concrete Moisture Testing Technician – Grade 1 or manufacturer approved technician.
2. Alkalinity Testing: Perform pH testing according to ASTM F 710. Install MVE-control system in areas where pH readings are less than 7.0 and in areas where pH readings are greater than 8.5.
3. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

a. Internal Relative Humidity Test: Using in situ probes, ASTM F 2170. Install MVE-control system in locations where concrete substrates exhibit relative humidity level greater than 95 percent.

4. Tensile-Bond-Strength Testing: For typical locations indicated to receive installation of MVE-control system, install minimum 100-sq. ft. area of MVE-control system to prepared concrete substrate and test according to ASTM D 7234.
   a. Proceed with installation only where tensile bond strength is greater than 200 psi with failure in concrete.

B. Concrete Substrates: Prepare and clean substrates according to MVE-control system manufacturer's written instructions to ensure adhesion of system to concrete.
1. Remove coatings and other substances that are incompatible with MVE-control system and that contain soap, wax, oil, or silicone, using mechanical methods recommended in writing by MVE-control system manufacturer. Do not use solvents or acids.
   a. Do not use sweeping compounds.
2. If required by manufacturer, provide concrete surface profile complying with ICRI 310.2R CSP 3 by shot blasting using apparatus that abrades concrete surface with shot, contains dispensed shot within apparatus, and recirculates shot by vacuum pickup.
   a. Option, in lieu of shot blast contractor may achieve ICRI 310.2R Minimum CSP 2 by diamond grinding that abrades concrete surface. Remove all dust by vacuuming with high-efficiency particulate arrestance (HEPA) filter.
3. After shot blasting, repair damaged and deteriorated concrete according to MVE-control system manufacturer's written instructions.
   a. Reinforcing fibers that become visible after shot blasting must be removed and vacuumed leaving no fibers exposed above concrete surfaces.
   b. Allow concrete to off-gas after bead blasting or grinding prior to application for a minimum of 24 hours but no more than 48 hours to avoid contamination by other trades. Failure to wait may result in epoxy coatings ability to perform as a MVE control due to pin-holing, blisters and fish-eyes.
4. Asbestos abated slabs may have hydrophobic organic compounds in capillaries of concrete which will be a bond break for coatings. Microscopic petrographic examination according to ASTM C856 to evaluate concrete condition, potential deleterious substrates and suitability for shot-blasting and coating adhesion.
5. Protect substrate voids and joints to prevent resins from flowing into or leaking through them.
6. Fill surface depressions and irregularities with patching and leveling material.
7. Fill surface cracks, grooves, control joints, and other nonmoving joints with crack-filling material.
   a. Consult with Project or manufacturers engineer for determine appropriate substrate repair procedures and joint treatment methods. Engineer should address contraction as well as potential expansion, movement and isolation joints.
   b. Mechanically prepare non-moving control and construction joints with a diamond crack-chasing/concrete-cutting blade. Overcut joint width to obtain a sound, clean edge. Clean cracks or joints with oil-free compressed air and dustless high-efficiency particulate arrestance (HEPA) filter vacuum to completely remove contaminants (follow ACI RAP Bulletin 2, “Crack Repair by Gravity Feed with Resin”).
   c. Pre-filling static thin random drying shrinkage cracks (less than 0.01 inch width and not vertically displaced is not required).
8. Allow concrete to dry, undisturbed, for period recommended in writing by MVE-control system manufacturer after surface preparation, but not less than 24 hours.
9. Before installing MVE-control systems, broom sweep and vacuum prepared concrete.

C. Protect walls, floor openings, electrical openings, door frames, and other obstructions during installation.

3.3 INSTALLATION

A. General: Install MVE-control system according to ASTM F 3010 and manufacturer's written instructions to produce a uniform, monolithic surface free of surface deficiencies such as pin holes, fish eyes, and voids.
   1. Install primers as required to comply with manufacturer's written instructions.

B. Do not apply MVE-control system across substrate expansion, isolation, and other moving joints.

C. Apply system, including component coats if any, in thickness recommended in writing by MVE-control system manufacturer for MVER indicated by preinstallation testing.

D. Cure MVE-control system components according to manufacturer's written instructions. Prevent contamination or other damage during installation and curing processes.

E. After curing, examine MVE-control system for surface deficiencies. Repair surface deficiencies according to manufacturer's written instructions.

F. Install cementitious underlayment over cured membrane if required to maintain manufacturers' warranty and in thickness required to maintain warranty.

3.4 CLEANING

A. Immediately clean MVE-control system from glass and metal with soap and water, and dry.

3.5 PROTECTION

A. Protect MVE-control system from damage, wear, dirt, dust, and other contaminants before floor covering installation. Use protective methods and materials, including temporary coverings, recommended in writing by MVE-control system manufacturer.

B. Do not allow subsequent preinstallation examination and testing for floor covering installation to damage, puncture, or otherwise compromise MVE-control system membrane.

END OF SECTION 09 05 61.13

SECTION 09 51 13 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes acoustical panels and exposed suspension systems for ceilings.

1.2 ADMINISTRATIVE REQUIREMENTS

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.

B. Sequencing
   1. Install acoustic units after interior wet work is dry.
   2. Ensure that products of this Section are supplied to affected trades in time to prevent interruption of construction progress.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: Do not submit.

1.4 INFORMATIONAL/QUALITY ASSURANCE/CONTROL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
   1. Ceiling suspension system components, including method of suspension where interference exists.
   2. Structural members to which suspension systems will be attached.
   3. Method of attaching hangers to building structure, including structural members to which suspension system will be attached.
   4. Carrying channels or other supplemental support for hanger-wire attachment where conditions do not permit installation of hanger wires at required spacing.
   5. Items penetrating finish ceiling and ceiling-mounted items including the following:
      a. Lighting fixtures
      b. Diffusers
      c. Grilles
      d. Speakers
      e. Sprinklers
      f. Perimeter moldings
   6. Minimum Drawing Scale: 1/8 inch = 1 foot.

1.5 CLOSEOUT SUBMITTALS

A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
   1. Maintenance Data: For finishes to include in maintenance manuals.
   2. Receipt of extra materials.

1.6 EXTRA (MAINTENANCE) 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 equal to 2.0 percent of quantity installed.
   2. Hold-Down Clips: Equal to 2 percent of quantity installed.

B. Replacement Stock: In addition to the maintenance stock specified above, provide extra replacement stock of acoustical materials, consisting of a minimum of one percent of area of each size, type, and thickness installed on the job. This extra stock is for replacement of damaged materials during the 60-day period following Substantial Completion, when the Owner's agent cannot ascertain the party responsible for the damage. Replacement stock that is not used shall be furnished to the Owner as extra materials.
   1. Replacement Stock may include broken-box quantities.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Products: Refer to information on drawings.

2.2 PERFORMANCE REQUIREMENTS

A. Performance Requirements: Panels shall meet the following minimum performance criteria:
   1. ASTM E1264, Class A materials.
   2. Moisture Resistant: No visible sag at of 90-percent relative humidity and 104 degrees F.

B. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:
   1. 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:
      a. Smoke-Developed Index: 50 or less.

2.3 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’s, unless otherwise indicated.
   1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface per ASTM E 795.

B. Panel Characteristics: Comply with requirements indicated on “List of Finishes” on Drawings.

2.4 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.

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.
   1. Power-Actuated Fasteners in Concrete: Not allowed.

D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
   1. Stainless-Steel Wire: ASTM A 580, Type 304, nonmagnetic.
   2. Nickel-Copper-Alloy Wire: ASTM B 164, nickel-copper-alloy UNS No. N04400.
   3. Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.135-inch diameter wire (fka 9 gauge).

E. Hanger Rods or Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.

F. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed with 0.04-inch thick, galvanized steel sheet complying with ASTM A 653, G90 coating designation; with bolted connections and 5/16-inch diameter bolts.

2.5 METAL SUSPENSION SYSTEM FOR ACOUSTICAL PANEL CEILING

A. Wide-Face, Capped, Double-Web, Hot-Dip Galvanized, G60, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, hot-dip galvanized according to ASTM A 653, G60 coating designation, with prefinished, cold-rolled, 15/16-inch wide, aluminum caps on flanges.
1. Structural Classification: Intermediate duty system.
2. Face Design: Flat, flush.
3. Cap Material: Aluminum.
4. Face Finish: Painted white, unless otherwise noted.
5. Provide this suspension system, unless otherwise noted.

2.6 METAL EDGE MOLDINGS AND TRIM

A. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

B. Layout openings for penetrations centered on the penetrating items.

3.3 INSTALLATION

A. General: Install acoustical panel ceilings to comply with ASTM C 636 and design 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 suspension wires 4 foot on center, maximum in both directions.
2. 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.
3. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

4. Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
5. 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.
6. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structures.
    a. In installations where hanger wire are wrapped through or around main runners, the wire loops shall be tightly wrapped and sharp bent to prevent any vertical movement or rotation of the member within the loops. The wire must be wraped around itself a minimum of three full turns (360 degree each) within a 3-inch length. For safety purposes, the bottom of the hanger wires shall either be cut close to the vertical portion of the wire or shall be bent upward parallel to the vertical portion of the hanger wire.
7. 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, that extend through forms into concrete.
    a. Powder-actuated fasteners are not allowed.
8. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
9. Do not attach hangers to steel deck tabs.
10. Do not attach hangers to steel roof deck. Attach hangers to structural members.
11. Space hangers not more than 48 inches o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
12. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications and so deflection does not exceed 1/360 of the span.

C. Secure bracing wires, if required by authorities, with jurisdiction, to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or post installed anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
    1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
    2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.

END OF SECTION 09 51 13

SECTION 09 65 13 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Resilient base.
   2. Resilient molding accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.
   1. Include fire-resistance testing.

1.3 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
   1. Include at least one inside and one outside corner.
   2. Coordinate mockups in this Section with markups specified in adjacent flooring in other Sections.
   3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups, unless A/E specifically approves such deviations in writing.
   4. Subject to compliance with requirements, approved mockups may become part of the completed work if undisturbed at time of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: As determined by a qualified testing agency by testing identical products.
   1. Critical Radiant Flux Classification (ASTM E 648 or NFPA 253): Class I (not less than 0.45 watts per cm^2.
   2. Smoke Generation (ASTM E 662 or NFPA 258): Maximum specific optical density of 450 or less.

B. Accessibility: Transitions and adaptors shall comply with accessibility requirements of the U.S. Architectural and Transportation Barriers Compliance Board’s ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1 as required by local authorities with jurisdiction.

2.2 RESILIENT BASE (RB)

A. Resilient Base:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the as indicated on the “List of Finishes.

B. Resilient Base Standard: ASTM F 1861.
   1. Material Requirement: Type TS (rubber, vulcanized thermoset) or Type TP (rubber, thermoplastic).
   2. Manufacturing Method: Group I (solid, homogeneous) or Group II (layered).
   3. Style and Location: Style B, Cove: Provide unless otherwise noted or required by governing authority.

C. Minimum Thickness: 0.125 inch.

D. Height: 4 inches, unless otherwise noted.

E. Lengths: Cut lengths, 48 inches long.

F. Outside Corners: Factory preformed or factory precut[or job formed]. Corners must be a minimum of 4 inches in length each way.

G. Inside Corners: Factory preformed or job formed.

H. Finish: Satin.

I. Colors and Patterns: Refer to “List of Finishes”.

2.3 RESILIENT MOLDING ACCESSORY (RMA)

A. Material: Vinyl or rubber, unless otherwise noted.
1. Where indicated, provide extruded aluminum with mill finish of width shown, of height required to protect exposed edges of floor coverings, and in maximum available lengths to minimize running joints.

B. Profile and Dimensions: As indicated.
1. General, provide where meeting unfinished floor or flooring of different material transitions.
a. Comply with accessibility requirements for change in level and slope requirement for ramps.

C. Colors and Patterns: Refer to “List of Finishes”.

2.4 INSTALLATION MATERIALS

A. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.
1. Adhesives shall be approved by manufacturer for use over concrete substrates with RH of less than 95 percent and maximum pH of 10.

B. Metal Edge Strips, where indicated: Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of tiles, and in maximum available lengths to minimize running joints.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates Accessories: Prepare according to ASTM F 710.
1. An adhesive bond test must be performed per manufacturer’s instructions using actual flooring material and proposed adhesive. The test areas must be a minimum of 36 inches and remain in place for at least 72 hours and then evaluated by manufacturers representative for bond strength to the substrate.
2. Proceed with installation only after unsatisfactory conditions have been corrected.
a. Installation of flooring products indicates acceptance of surfaces and conditions.

3.2 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
   1. Exception: Resilient base shall not wrap 1 inch thick worksurface supports between workstations.

C. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Preformed Corners: Install preformed corners before installing straight pieces.

H. Job-Formed Corners:
   1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
      a. Form without producing discoloration (whitening) at bends.
   2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 4 inches in length.
      a. Butt one piece to corner then cope/scribe next piece to fit.

3.3 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor coverings that would otherwise be exposed.

END OF SECTION 09 65 13

SECTION 09 65 19 - RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Solid vinyl floor tile (SVT)

B. Related Sections:
   1. Division 03 Section “Concrete Moisture Vapor Reduction Admixture (MVRA).
   2. Division 09 Section "Resilient Base and Accessories" for resilient base, reducer strips, and other accessories installed with resilient floor coverings.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Preliminary Meeting: Conduct meeting at Project site a minimum of 60 days before scheduled date of “Resilient Tile Flooring” installation.
   1. Review Article “FIELD CONDITIONS”.
   2. Review Article “EXAMINIATION”.

B. Pre-installation Meeting: Before resilient tile installation, conduct a meeting at Project site to review mock-ups, joint locations, transitions, installation methods, and pattern layouts. A/E will schedule and conduct meeting.
   1. Flooring manufacturer shall have a representative at the Pre-installation meeting.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated, including fire-test-response.

B. Samples for Verification: Full-size units of each color and pattern of floor tile required.

1.4 INFORMATIONAL/QUALITY ASSURANCE/CONTROL SUBMITTALS:

A. Manufactures Certification: Manufacturer shall provide a letter on company letterhead stating substrate, material, and installation are in compliance with manufacturer’s guidelines and accepted industry standards and practice. Certification letter shall include a summary written as to observations, conversations, instructions, condition concerns, corrections and other pertinent information.

1.5 MAINTENANCE MATERIALS

A. Leave where directed at Project site, any remaining full size pieces of each type, color, pattern, and size for Owner’s maintenance.

1.6 QUALITY ASSURANCE

A. Manufacturers Qualifications: Flooring product manufacturer will have a technical installation representative available at the job site at the inception of the installation to insure there are no conditions which will compromise the installation of the material and that the material is being installed according to industry standards, practices and manufacturers guidelines. The manufacturer’s technical representative will document and confirm that the substrate, material, and installation are in compliance with manufacturer’s guidelines and accepted industry standards and practices.
   1. Any noticed defect with the product or installation system will require the response of the manufacturer’s technical field service personnel on site to determine cause, correction or replacement.

B. Installer's Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for floor tile installation method.

C. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Build mockups for floor tile including accessories.
      a. Size: First-in-place 100 sq. ft. for each type, color, and pattern shall serve as mockup.
         1) Perform bond testing on mockup.
   2. Approval of mockup does not constitute approval of deviations from the Contract Documents contained in mockups, unless A/E specifically approves such deviations in writing.
   3. Subject to compliance with requirements, approved mockups may become part of the completed Work, if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store floor tiles on flat surfaces.

1.8 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive floor tile during the following time periods:
   1. 48 hours (minimum) before installation.
   2. During installation.
   3. 48 hours after installation.

B. Maintain the ambient relative humidity between 40 and 60 percent during installation.

C. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

D. Close spaces to traffic during floor tile installation.

E. Close spaces to traffic for 48 hours after floor tile installation.

F. Install floor tile after other finishing operations, including painting, have been completed.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
   1. Manufacturers: Subject to compliance with requirements, provide product by the manufacturers specified.
   2. Products: Subject to compliance with requirements, provide one of the products specified.

B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The "Substitution Request Form" and complete technical data for evaluation must accompany requests for A/E's approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.
   1. Where products are indicated on List of Finishes with colors selected, provide sample to verify color match with substitution request.

C. Source Limitations: Obtain resilient tile flooring of same standard, class and type from one manufacturing plant to minimize size variations. Flooring from one manufacturer but separate plants is not acceptable.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: As determined by a qualified testing agency by testing identical products.
1. Critical Radiant Flux Classification (ASTM E 648 or NFPA 253): Class I (not less than 0.45 watts per cm^2).
2. Smoke Generation (ASTM E 662 or NFPA 258): Maximum specific optical density of 450 or less.

B. Accessibility: Flooring shall comply with accessibility requirements of the U.S. Architectural and Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1 as required by local authorities with jurisdiction.
1. Comply with ASTM D 2047, Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring: Exceeds Federal Standards and ADA requirements for slip-resistance.

2.3 SOLID VINYL FLOOR TILE (SVT)

A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified in "List of Finishes".

B. Tile Standard: ASTM F 1700.
1. Class: III.
2. Type: Type B.

C. Overall Thickness: 0.120 inch.

D. Size: As indicated by product designations in "List of Finishes".

E. Colors and Patterns: Refer to "List of Finishes."

2.4 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated and coordinate with substrate. Note: A primer may be required.

B. Adhesives: Water-resistant type recommended by manufacturer to suit floor tile and substrate conditions indicated.
1. Adhesives shall be approved by manufacturer for use over concrete substrates with RH of less than 95 percent (ASTM F2170) and maximum pH of 10.
a. Where results of relative moisture testing of concrete per ASTM F 2170 exceed the 95 percent relative humidity moisture level work to remedy will be by change order. Contractor shall propose a solution as recommended by the flooring manufacture.

2.5 SOURCE QUALITY CONTROL

A. Manufacturer Services: Manufacturer assures the product submitted is appropriate for the application and environment in which it is to be installed and that the product is merchantable for service, free of visible and latent defects and will perform for the purpose for which it is intended without compromise.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
   1. Verify substrate mix design for additives, i.e. hardeners, moisture vapor reduction admixture and other ingredients that might affect performance of installed flooring.
      a. Vinyl is particularly sensitive to the influence of abatement chemicals. Verify substrate is free of all chemical, residue, if abatement of previous flooring with hazardous materials has occurred.
   2. 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, curing compounds, and foreign deposits that might interfere with adhesion of floor tile.

B. Proceed with installation only after unsatisfactory conditions have been corrected and manufacturer has approved substrate for material to be installed without compromise.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
   1. Bond Test: An adhesive bond test must be performed using the actual flooring materials and adhesive to be installed. The tests area must be a minimum of 36 by 36 inches and remain in place for at least 72 hours and then evaluated for bond strength to the substrate.

B. Concrete Substrates: Prepare according to ASTM F 710.
   1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
   2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
      a. Mechanically remove contamination of the substrate that may cause damage to the resilient flooring material. Permanent and non-permanent markers, pens, crayons, paint, etc., must not be used to write on the back of the flooring material or used to mark the substrate as they could bleed through and stain the flooring material.
   3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
      a. A pH test for alkalinity must be conducted. Results should range between 7 and 10. If the test results are not within the acceptable range of 7 to 10, the installation must not proceed until the problem has been corrected.
      b. If concrete additives, i.e., hardeners, moisture vapor reduction admixtures or other ingredients have been included in the mix or suspected to be in the mix that might affect the performance of the flooring installation, test the bond.
         1) Perform bond and any additional tests as recommended by the flooring manufacturer. If tests do not produce satisfactory results, coordinate with both concrete additive manufacturer and flooring manufacturer for potential solutions. Retest until a satisfactory result can be obtained.
   4. Moisture Testing: Perform tests recommended by manufacturer where MVRA has not been used as follows. Proceed with installation only after substrates pass testing.

a. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 95 percent relative humidity level measurement.
b. Moisture testing shall be performed at least 60 days in advance of flooring installation to allow sufficient drying time for levels acceptable to floor manufacturer. Refer to Division 01 Section “Temporary Facilities and Controls.”

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
1. Underlayment shall be steel troweled smooth and trowel marks showing through installed tile shall be reason to remove the tile and sand out trowel marks.

D. Floor covering shall not be installed over expansion joints.

E. Do not install floor tiles until they are same temperature as space where they are to be installed.
1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

F. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.3 FLOOR TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing floor tile.

B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
1. Lay tiles in pattern indicated.

C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
1. Lay tiles in pattern of colors and sizes indicated.

D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.

G. Adhere floor tiles to flooring substrates using manufacturer recommended method for materials and substrate indicated. Produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.
1. Tiles should be lightly butted together when placing the flooring into adhesive.
2. Do not force tiles together creating a ledge condition at the seams and corners. Sliding tiles will result in forcing the adhesive out between the seams.
3. Periodically, lift the corner of an installed tile to ensure proper transfer of adhesive.
4. Roll floor in both directions with a 100 pound three-section roller. Use a small hand roller in areas that cannot be reached with a large roller.
5. Roll the flooring in both directions using a 100 pound three-section roller.

6. Inspect the floor surface, especially seams, and remove any adhesive on the surface.
7. Install adhesive as recommended for the site conditions and follow adhesive label for proper use.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of floor tile.

B. Perform the following operations immediately after completing floor tile installation:
1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect floor tile products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
1. No traffic for 24 hours after installation.
2. No heavy traffic, rolling loads, or furniture placement for 72 hours after installation.

D. Cover floor tile until Substantial Completion.

END OF SECTION 09 65 19

SECTION 09 65 66 - RESILIENT ATHLETIC FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Rubber roll athletic flooring (weight room). (RAF-x)

1.2 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Meeting: Before resilient athletic flooring installation, conduct a meeting at Project site to review mockups, joint locations, transitions, installation methods, and pattern layouts. A/E will schedule and conduct meeting.
   1. Flooring product manufacturer will have a technical installation representative available at the jobsite at the inception of the installation to insure there are no conditions which will compromise the installation of the material and that the material is being installed according to industry standards, practices and manufacturers guidelines. The manufacturer's technical representative will document and confirm that the substrate, material and installation are in compliance with manufacturer's guidelines and accepted industry standards and practices.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated, including printed installation instructions.

1.4 INFORMATIONAL/QUALITY ASSURANCE/CONTROL SUBMITTALS:

A. Closeout Submittals:
   1. Maintenance Data: For floor coverings to include in maintenance manuals.

1.5 EXTRA MATERIALS

A. Leave where directed at Project site, any remaining full size pieces of each type, color, pattern, and size for Owner's maintenance.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Flooring contractor shall be experienced in the flooring field and approved by manufacturer.

B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Build mockups for resilient sheet flooring including accessories.
      a. Size: First-in-place 100 sq.ft. for each type, color and pattern shall serve as mockup.
         1) Perform bond tests on mockups, if product is adhered.
   2. Approval of mockup does not constitute approval of deviations from the Contract Documents contained in mockups unless A/E specifically approves such deviations in writing.
   3. Subject to compliance with requirements, approved mockups may become part of the completed work if undisturbed at time of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: As determined by a qualified testing agency by testing identical products.

1. Critical Radiant Flux Classification (ASTM E 648 or NFPA 253): Class [I][or][II](not less than 0.45 watts per cm^2.
2. Smoke Generation (ASTM E 662 or NFPA 258): Maximum specific optical density of 450 or less.

2.2 RUBBER ROLL ATHLETIC FLOORING (WEIGHT ROOM) (RAF-x)

A. Basis-of-Design Product: Subject to compliance with requirements provide Galaxy XTreme by Robbins Sport Surfaces or a comparable product from one of the following:
1. Tuflex Rubber Products, Inc.
2. Performance Modzilla – 1 inch System; Stray Dog Strength
3. AktivPro Tiles; Regupol America

B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The "Substitution Request Form" and complete technical data for evaluation must accompany requests for A/E's approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.
1. Where products are indicated on List of Finishes with color selected, provide sample to verify color match with substitution request.

C. Surface shall be rubber rolls 18mm thick. Material shall be a field-laminated rolls consisting of 100 percent recycled SBR rubber backing and either recycled SBR or EPDM wear layer.

D. Typical physical properties of Galaxy XTreme (R)

1.	Density ASTM D3676 (top layer)	65pcf-80pcf (depends on surface color)
2.	Shore A Hardness ASTM D2240	65 +/-5
3.	Co-efficient of Friction ASTM D2047	>.95
4.	Tear Strength ASTM D624	70 PLI (min)
5.	Elongation ASTM D412	>150 percent
6.	Tensile Strength AST D412	>200 PSI
7.	Resistance to Chemicals ASTM F925	No change
8.	Impact Insulation Class (IIC) E492	>50
9.	Critical Radiant Flux ASTM E648	Class II

2.3 INSTALLATION ACCESSORIES

A. Adhesives: Water-resistant type recommended in writing by manufacturer to suit resilient athletic flooring for high-moisture substrate conditions indicated.
1. Adhesives shall be approved by manufacturer for use over concrete substrates with maximum RH of less than 95 percent (ASTM F 2170) and maximum pH of 10.
2. Where results of relative moisture testing of concrete per ASTM F 2170 exceed the 95 percent relative humidity moisture level work to remedy will be by Change Order. Contractor shall propose a solution as recommended by flooring manufacturer or provide one of the following systems:
   a. Division 09 Section "Moisture Vapor Emission Control".

2.4 SOURCE QUALITY CONTROL

A. Manufacturer Services: Manufacturer assures the product submitted is appropriate for the application and environment in which it is to be installed and that the product is merchantable for service, free of visible and latent defects and will perform for the purpose for which it is intended without compromise.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance.
   1. Verify substrate mix design for additives, i.e. hardeners, moisture vapor reduction admixture and other ingredients that might affect performance of installed flooring.
   2. 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, curing compound, and foreign deposits that might interfere with adhesion of resilient products.

B. Proceed with installation only after unsatisfactory conditions have been corrected and manufacturer has approved substrate for material to be installed without compromise.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of floor coverings.
   1. Bond Test: An adhesive bond test must be performed using the actual flooring materials and adhesive to be installed. The tests area must be a minimum of 36 by 36 inches and remain in place for at least 72 hours and then evaluated for bond strength to the substrate.

B. Concrete Substrates: Prepare according to ASTM F 710.

C. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended in writing by manufacturer. Do not use solvents.
   1. Mechanically remove contamination of the substrate that may cause damage to the resilient floor material. Permanent and nonpermanent markers, pens, crayons, paint, etc., must not be used to write on the back of the flooring material or used to mark the substrate as they could bleed through and stain the flooring material.

D. Move floor coverings and installation materials into spaces where they will be installed at least 48 hours in advance of installation, unless manufacturer recommends a longer period in writing.
   1. Do not install floor coverings until they are same temperature as space where they are to be installed.

E. Sweep and vacuum clean substrates to be covered by floor coverings immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 FLOOR COVERING INSTALLATION, GENERAL

A. Comply with manufacturer's written installation instructions.

B. Scribe, cut, and fit floor coverings to butt neatly and tightly to vertical surfaces, equipment anchors, floor outlets, and other interruptions of floor surface.

C. Extend floor coverings into toe spaces, door reveals, closets, and similar openings, unless otherwise indicated.

D. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating subfloor markings on floor coverings. Use nonpermanent, nonstaining marking device.

E. Adhere products to substrates using a full spread of adhesive applied to substrate to comply with adhesive and floor covering manufacturers' written instructions, including those for trowel notching, adhesive mixing, and adhesive open and working times.
   1. Provide completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 FLOOR 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 that equal less than one-half tile at perimeter.
   1. Lay tiles in pattern indicated.

B. Discard broken, cracked, chipped, or deformed tiles.

C. Match tiles for color and pattern by selecting tiles from cartons in same sequence as manufactured and packaged, if so numbered.
   1. Lay tiles in pattern of colors and sizes indicated.

D. Adhered Flooring: Adhere products to substrates using a full spread of adhesive applied to substrate to comply with adhesive and flooring manufacturers' written instructions, including those for trowel notching, adhesive mixing, and adhesive open and working times.
   1. Provide completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.
   2. Tiles should be lightly butted together when placing the flooring into adhesive.
   3. Do not force tiles together creating a ledge condition at the seams and corners. Sliding tiles will result in forcing the adhesive out between the seams.
   4. Periodically, lift the corner of an installed tile to ensure proper transfer of adhesive.
   5. Roll floor in both directions with a 100 pound three-section roller. Use a small hand roller in areas that cannot be reached with a large roller.
   6. Inspect the floor surface, especially seams, and remove any adhesive on the surface.

END OF SECTION 09 65 66

SECTION 09 91 23.00 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes surface preparation and application of paint systems on the following interior substrates:
   1. Concrete masonry units (CMU).
   2. Steel and iron.
   3. Galvanized metal.
   4. Gypsum board.
   5. Plaster.
   6. Cotton or canvas insulation covering.
   7. ASJ insulation covering.

B. Work under this contract shall also include, but not necessarily be limited to following:
   1. Surface preparation of substrates as required for acceptance of painting, including cleaning, small crack repair, patching, and caulking.
      a. Preparation and testing of existing painted surfaces, indicated to be repainted to accommodate new work, shall be performed as work of this Section.
         1) When re-painting existing surfaces, “making good surfaces” includes removal of adhesive tape, hanging devices, nails, screws, and similar items, and repair of associated surface defects to match adjoining surface.
      b. Provide for safe and adequate ventilation as required over and above temporary ventilation supplied by others, where toxic and/or volatile/flammable materials are being used.
   2. Priming (except where pre-primed with an approved primer under other sections of work) and painting of structural steel, miscellaneous metal, and primed steel equipment.
   3. Painting of all semi-concealed areas (e.g. inside of light troughs and valances, behind grilles, and projecting edges above and below sight lines).
   4. Painting of exposed-to-view fire suppression, plumbing, HVAC, electrical, communication, and electronic safety and security.

C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

D. Remodeling Work: Where it is necessary to patch and match existing surfaces, prepare surfaces as specified under "Surface Preparation" of this Specification Section. Apply finish paint coats to entire surface adjacent to patched work, terminating paint application at nearest change in surface plane or as directed by A/E.
   1. Prepare existing substrate as necessary (sand, prime, and clean) to receive new finish material. Prepare existing painted surfaces to receive painted finish; new paint finish to be applied over properly prepared existing paint finish may be a 2-coat system, eliminating initial prime coat.
   2. When repainting occupied areas, submit work schedule for various stages of work for A/E’s and Owner’s review.

1.2 DEFINITIONS

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 glass 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.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include recommendations for application and use.

B. Samples for Verification: For each type of paint system and in each color and gloss of topcoat indicated.
   1. Submit Samples on rigid backing, 8 inches square.
   2. Step coats on Samples to show each coat required for system.
   3. Label each coat of each Sample.
   4. Label each Sample for location and application area.

1.4 INFORMATIONAL/QUALITY ASSURANCE/CONTROL SUBMITTALS

A. Product List: For each product indicated, include following:
   1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.

B. Test Reports: Site testing utilized to confirm satisfactory adhesion of intended coating or coating system prior to final coating application.

C. Submit invoice list of all paint materials ordered for Project work indicating manufacturer, types and qualities for verification and compliance with specification.

1.5 CLOSEOUT SUBMITTALS

A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
   1. At Project completion provide an itemized list complete with manufacturer, paint type and color coding of all paints used for Owner's later use in maintenance.

1.6 QUALITY ASSURANCE

A. Mockups: Apply benchmark samples of each paint system indicated and each color and finish selected to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Surface-Preparation Mockups: On existing surfaces using applicable methods recommended by paint manufacturer demonstrate methods of cleaning and other surface preparation, where indicated by A/E. Provide mockup sample of at least 100 sq.ft. for each type of wall substrate.
   2. A/E will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
      a. Wall and ceiling surfaces, unless otherwise noted, first-in-place 100 sq.ft. of each product and surface may serve as mockup.
         1) Provide a test patch where deep colors are indicated.
      b. Other Items: A/E will designate items or areas required.
   3. Apply benchmark samples after permanent lighting and other environmental services have been activated.
   4. Final approval of color selections will be based on benchmark samples.
      a. If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by A/E at no added cost to Owner.
   5. Approval of mockups does not constitute approval of deviations from Contract Documents contained in mockups unless A/E specifically approves such deviations in writing.
   6. Subject to compliance with requirements, approved mockups may become part of completed work if undisturbed at time of Substantial Completion.

B. Preinstallation Meeting: Conduct meeting at Project site.
   1. Review methods and procedures related to painting, including recoating of existing surfaces, but not limited to, following:

a. Construction Schedule. Verify availability of materials, personnel, equipment, and facilities needed to make progress and avoid delays.
b. Materials, material application, colors, patterns, and sequencing.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to job site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label.

B. Store Materials
1. Store only approved materials at jobsite and store only in a suitable and designated area restricted to storage of paint materials and related equipment.
a. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 degrees F. Maintain containers used in storage in a clean condition, free of foreign materials and residue.
b. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily.
c. Remove rags and waste from storage areas daily.
2. Use means necessary to ensure safe storage and use of paint materials and prompt and safe disposal of waste.
3. Use means necessary to protect paint materials before, during, and after application and to protect installed work and materials of other trades.
4. Where toxic and/or volatile/explosive/flammable materials are being used, provide adequate fireproof storage lockers and take all necessary precautions and post adequate warnings as required.
5. Take all necessary precautionary and safety measures to prevent fire hazards and spontaneous combustion and to protect environment from hazard spills. Materials that constitute a fire hazard (paints, solvents, drop clothes, etc.) shall be stored in suitable closed and rated containers and removed from site on a daily basis.

1.8 SCHEDULING

A. Schedule painting operations in occupied facilities to prevent disruption of occupants in and about building. Paint shall be carried out after facility working hours or on weekends in accordance with Owner’s operating requirements. Schedule work such that painted surfaces will have dried before occupants are affected. Obtain written authorization from Owner for changes in work schedule.

PART 2 - PRODUCTS

2.1 PAINT, GENERAL

A. Material Compatibility: Paint materials selected for coating systems for each type of surface shall be product of a single manufacturer.
1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

B. Paint materials and equipment shall be compatible in use; finish coats shall be compatible with prime coats; prime coats shall be compatible with surface to be coated; tools and equipment shall be compatible with coating to be applied.
1. Review other Sections in which primers are provided to ensure compatibility of total system for various substrates. On request, furnish information on characteristic of finish materials to ensure use of compatible primers.

C. Thinners, when used, shall be only those thinners recommended for that purpose by manufacturer of material to be thinned.

D. All materials used shall be lead-, mercury-, and cadmium free and VOC-compliant with local authorities with jurisdiction.

E. Colors: As indicated in “List of Finishes.”

F. By submitting a proposal, Contractor has reviewed bidding documents with painting subcontractor and accepts Specifications as sufficient to produce approved painting results. If painting subcontractor contends that materials or number of coats specified will not produce satisfactory results, he shall so notify A/E directly or indirectly through a Bidding Contractor 10 days prior to receipt of bids for proper action.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.

B. Test suspect surfaces (masonry surfaces) for moisture and alkalinity as required by paint manufacturer. Conduct all moisture tests using a properly calibrated electronic moisture meter, except test concrete floors for moisture using a “cover patch test, unless otherwise required by paint manufacturer. Maximum moisture shall not exceed:
1. Masonry (CMU): 12 percent
2. Gypsum Board: 12 percent

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
1. Test galvanized surfaces for chromates or other passivating treatments.

E. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations applicable to substrates indicated.
1. Proper product selection, surface preparation and application affect coating performance. Coating integrity and service life will be reduced because of improperly prepared surfaces. Selection and implementation of proper surface preparation ensures coating adhesion to substrate and prolongs service life of coating system.

B. Protect all adjacent interior surfaces and areas, including rating and instruction labels on doors, frames, equipment, piping, etc., from painting operations and damage by drop cloths, shields, masking, templates, or other suitable protective means and make good any damage caused by failure to provide such protection.
1. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, nomenclature plates, or communicating cabling.

C. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.
1. Schedule cleaning and painting application so dust and other contaminates from cleaning process will not fall on wet, newly coated surfaces.

D. Concrete Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

E. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer, but not less than following:
   1. SSPC-SP 2, "Hand Tool Cleaning," unless otherwise noted or recommended by paint manufacturer for application indicated.

F. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

G. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
   1. Surface preparation should start with SSPC SP-1 Solvent Cleaning to remove oil/grease contamination. If galvanized surface is shinney, surface must be de-glossed and roughened in one of two ways:
      a. In mild building environments, wash with a chemical etching solution.
   2. Galvanized metals are very smooth and have virtually no profile for coating to adhere to. It is important to abrade surface of galvanized metal through Brush of Blast (SSPC SP7), or an etching primer before coatings application, as recommended by paint manufacturer.
   3. Galvanized surfaces must use a primer before applying a topcoat. Topcoats will not adhere to zinc layer of galvanized surface and requires a primer to form a bond between two. Manufacturer's water-based bonding primers as an alternative to previously used cementitious primers. An epoxy primer may also be used, however, it should be noted that epoxy primers typically require an abrasive blast-cleaned surface.

H. Gypsum Wallboard: Must be clean and dry. Fill nail heads must be set and spackled. Joints must be taped and covered with joint compound. Spackled nail heads and taped joints must be sanded smooth and all dust removed prior to painting.
   1. Vacuum wall with brush attachment.
      a. As wall is vacuumed, wipe if down with microfiber cloth. Piles of dust may accumulate near base. Be sure to vacuum this dust before you begin to paint; otherwise, it could become airborne and ruin your smoothly painted wall.
   2. Wipe down wall with microfiber cloth.
   3. Gently wash walls.
      a. Apply water sparingly. Let wall dry thoroughly before painting.
   4. Repeat steps until all traces of dust are removed.

I. Cotton or Canvas Insulation Covering Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

J. Existing Painted Surfaces: Prepare all interior surfaces for repainting in accordance with paint manufacturers requirements.
   1. In accordance with good painting practice, all surface and absorbed contaminants (i.e., dirt, dust, grease, oil, mildew, moisture, chemical fall-out, etc.) shall be removed prior to applying any new coat of paint, since performance and adhesion of new coat is directly proportional to cleanliness of substrate.
   2. Removal of old painting system prior to application of a new coat of paint shall not be required unless adhesion problems between existing coating and new proposed coating cannot be eliminated.
      a. New coating shall be compatible with existing coating based on previous testing of coating products for adhesion by manufacturer and on installer's field experience.
      b. A test patch shall be used when previous testing does not exist or is unacceptable to A/E.
      c. Preparation of substrates does not apply to previously coated surfaces that contain lead. These surfaces require special preparation. Contractor shall refer to recommendations of paint manufacturer for preparation requirements.

3.3 APPLICATION

A. General: Do not commence painting unless substrates are acceptable and until all environmental conditions (heating, ventilation, lighting and completion of other substrate work, if applicable) are acceptable for applications of products.

B. Apply paints according to manufacturer's written instructions.
   1. Where a level 5 drywall finish is specified or required in critical lighting conditions or when using non-flat finish, comply with following to optimize results:
      a. Even if initial finish was sprayed, back roll surface: Stipple pattern of roller can help hide underlying texture variations. A 1/2 inch/15 mm nap roller may offer best and most efficient results.
      b. When finish occurs in phases (stops one batch and finishes with another) painter shall “blend back” finish of each new section by shading new topcoat back over previous section with a spray gun; with a flat finish, this can effectively prevent a noticeable difference between sections finished at different dates with material from different batches.

C. Scheduling Painting: Apply first coat material to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
   1. Allow sufficient time between successive coatings to permit proper drying. Do not recoat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and application of another coat of paint does not cause lifting or loss of adhesion of undercoat, unless manufacturer’s directions state otherwise, each coat shall be sufficiently dry and hard before a following coat is applied.
   2. Slightly vary color of succeeding coats.

D. Minimum Coating Thickness: Apply materials at not less than manufacturer's recommended spreading rate.
   1. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
   2. Sand and dust between each coat to provide an anchor for next coat and to remove defects in preview coat (runs, sags, etc.) visible from a distance up to 39 inches.
   3. Deep and accent clear base colors may require 1 or 2 more coats to achieve proper hide.

E. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

F. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
   1. To avoid air entrapment in applied coats, apply material in strict accordance with manufacturer’s spread rates and application requirements.

G. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication and Electronic Safety and Security Work:
   1. Paint following work where exposed in occupied spaces:
      a. Mechanical, electrical, and other equipment:
         1) Exceptions:
            a) Do not paint electrical switchgear, transformers or substation equipment.
            b) Do not paint new electrical panelboards.
            c) Do not paint communication cabling.
            d) Do not paint sprinkler heads.
      b. Uninsulated metal piping.
      c. Pipe hangers and supports.
      d. Metal conduit.
      e. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.

2. Paint portions of internal surfaces of metal ducts, without liner behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves right to invoke following procedure at any time and as often as Owner deems necessary during period when paints are being applied:
   1. Owner will engage services of a qualified testing agency to sample paint materials being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
   2. Testing agency will perform tests for compliance with product requirements, including dry film thicknesses.
      a. Contractor shall touch up and restore painted surfaces damaged by testing.
      b. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.
   3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying-paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, two paints are incompatible.

B. Standard of Acceptance
   1. All surfaces, preparation and paint applications shall be inspected by A/E.
   2. Painted interior surfaces shall be considered to lack uniformity and soundness if any of following defects are apparent to A/E:
      a. Brush/roller marks, streaks, laps, runs, sags, drips, heavy stippling, hiding or shadowing by inefficient application methods, skipped or missed areas, and foreign materials in paint coatings.
      b. Evidence of poor coverage at rivet heads, plate edges, lap joints, crevices, pockets, corners and re-entrant angles.
      c. Damage due to touching before paint is sufficiently dry or any other contributory cause.
      d. Damage due to application on moist surfaces or caused by inadequate protection from weather.
      e. Damage and/or contamination of paint due to blown contaminants (dust, spray paint, etc.).
   3. Painted surfaces shall be considered unacceptable if any of following are evident under natural lighting source for exterior surfaces and final lighting source (including daylight) for interior surfaces:
      a. Visible defects are evident on vertical surfaces when viewed at normal viewing angles from a distance of not less than 39 inches.
      b. Visible defects are evident on horizontal surfaces when viewed at normal viewing angles from a distance of not less than 39 inches.
      c. Visible defects are evident on ceiling, soffit and other overhead surfaces when viewed at normal viewing angles.
      d. When final coat on any surface exhibits a lack of uniformity of color, sheen, texture, and hiding across full surface area.
   4. Painted surfaces rejected by A/E shall be made good at expense of Contractor. Small affected areas may be touched up; large affected areas or areas without sufficient dry film thickness of paint shall be repainted. Runs, sags of damaged paint shall be removed by scraper or by sanding prior to application of paint.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
   1. Remove combustible rubbish materials and empty paint cans each day and safely dispose of same in accordance with requirements of authorities having jurisdiction.

2. Clean equipment and dispose of wash water/solvents as well as all other cleaning and protective materials (e.g. rags, drop cloths, masking papers, etc.), paints, thinners, paint removers/strippers in accordance with safety requirements of authorities having jurisdiction.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by A/E, and leave in an undamaged condition.
1. Erect barriers or screens and post signs to warn, limit or direct traffic away or around work area as required.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE (P-CODE)

A. CMU Substrates:
1. Institutional Low-Odor/VOC Latex System: (Code #4.14)
a. Prime Coat: Interior/exterior latex block filler.
1) Sherwin Williams; PreRite Block Filler.
2) Pittsburgh Paints Company; 6-15XI Speedhide Hi-Fill Latex Block Filler
3) Benjamin Moore: Ultra Spec HP Masonry Int/Ext High Build Block Filler 571
4) Behr Pro Block Filler Primer No. PR50
b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.
c. Topcoat: Institutional low-odor/VOC interior latex (semigloss).
1) Sherwin Williams; Pro Mar 200 Zero VOC
2) Pittsburgh Paints Company; Speedhide Zero, 0 VOC
3) Benjamin Moore: Ultra Spec 500 Zero VOC – T537 (Low Sheen Eggshell) T546 (Semi-Gloss)
4) Behr I300 IPRO Eggshell/Semi-Gloss
5) Application includes, but is not limited to:
a) Typical concrete block walls not subject to high-humidity or abuse.

B. Steel (Ferrous) Substrates:
1. Water-Based Dry-Fall System (over shop-applied primer): (Code #5.11).
a. Prime Coat: Not applicable.
b. Topcoat: Waterborne dry fall, flat or eggshell.
1) Sherwin Williams; Pro Industrial Waterborne Acrylic DryFall
2) Pittsburgh Paints Company; 6-725XI Speedhide Super Tech Interior Dry Fog.
3) Benjamin Moore: Latex Dry Fall Flat 395
4) Behr Pro Waterborne Acrylic Dryfall
5) Application includes, but is not limited to:
a) Beams and joists.
2. Institutional Low-Odor/VOC Latex System: (Code #5.12)
a. Prime Coat: Rust-inhibitive primer (water based).
1) Sherwin Williams; Pro Industrial Pro-Cryl Universal Primer
2) Pittsburgh Paints Company; Pitt-Tech Plus EP Acrylic Primer, 90-1912
3) Benjamin Moore: Ultra Spec HP Acrylic Metal Primer HP04
4) Behr Metal Primer No. 435
5) Verify compatibility with primer, if shop-applied primer is used.
b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.
c. Topcoat: Institutional low-odor/VOC interior latex (eggshell).
1) Sherwin Williams; B66-600 Pro Industrial High Performance Acrylic or Pro Industrial Waterbased Alykd Urethane, B53-2150 Series.
2) Pittsburgh Paints Company; Pitt-Tech Plus EP DTM Acrylic, 90-1610 Series.
3) Benjamin Moore: Ultra Spec HP DTM Acrylic Enamel – HP25 (Low Luster) HP29 (Semi-Gloss)

4) Application includes, but is not limited to:
a) Beams and joists.
b) Hollow metal doors, including vision lite kits, frames, door mullions and astragals.
c) Miscellaneous ferrous metal surfaces.
d) Exposed to view, in public areas, fire suppression, plumbing, HVAC, electrical communication, and electronic safety and security unfinished items.

3. Institutional Low-Odor/VOC Latex System: (Code #5.14)
a. Prime Coat: Bonding primer (water based).
1) Sherwin Williams; Extreme Bond Interior/Exterior Bonding Primer
2) Pittsburgh Paints Company; Rust-Oleum X-I-M UMA Advanced Technology Primer Sealer Bonder.
3) Behr Bonding Primer No. 432
b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.
c. Topcoat: Institutional low-odor/VOC interior latex (semigloss).
1) Sherwin Williams; B66-600 Pro Industrial Acrylic
2) Pittsburgh Paints Company; Pitt-Tech Plus EP DTM Acrylic 90-15_.
3) Behr Premium Direct-to-Metal Semi-Gloss Gloss Paint No. 3200
4) Application includes, but is not limited to:
a) Existing metal surfaces with alkyd paint.

C. Galvanized-Metal Substrates:
1. Water-Based Dry-Fall System: (Code #5.31)
a. Prime Coat: Waterborne dry fall.
b. Topcoat: Waterborne dry fall, flat or eggshell.
1) Sherwin Williams; Pro Industrial Waterborne Acrylic DryFall
2) Pittsburgh Paints Company; 6-725XI Speedhide Super Tech Interior Dry Fog.
3) Benjamin Moore: Latex Dry Fall Flat 395
4) Behr Pro Waterborne Acrylic Dryfall Flat No. HP210
5) Application includes, but is not limited to:
a) Overhead decking, pipes, ducts, etc.
b) Exposed metal deck.
2. Institutional Low-Odor/VOC Latex System: (Code #5.32).
a. Prime Coat: Waterborne galvanized-metal bonding primer. MPI #134.
1) Sherwin Williams: Pro Industrial Pro-Cryl Universal Primer
2) Pittsburgh Paints Company; Pitt-Tech Plus EP Acrylic Primer, 90-1912.
3) Benjamin Moore: Ultra Spec HP Acrylic Metal Primer HP04
4) Behr Metal Primer No. 435
5) Note: Primer may be omitted, if not required by paint manufacturer.
b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.
c. Topcoat: Institutional low-odor/VOC interior latex (semigloss).
1) Sherwin Williams: B66-600 Pro Industrial High Performance Acrylic or Pro Industrial Waterbased Alkyd Urethane B53-2150 Series.
2) Pittsburgh Paints Company; Pitt-Tech Plus EP DTM Acrylic, 90-1610 Series.
3) Benjamin Moore: Ultra Spec HP DTM Acrylic Enamel – HP29 (Semi-Gloss) HP-28 (Gloss)
4) Application includes, but is not limited to:
a) Hollow metal doors, including vision lite kits, frames, door mullions, and astragals.
b) Other non-ferrous surfaces.
c) Exterior lintels and exposed structural steel.

D. Gypsum Board Substrates:
1. Institutional Low-Odor/VOC Latex System: (Code #9.21)
a. Prime Coat: Interior latex primer/sealer. .
1) Sherwin Williams; Pro Mar 200 Zero VOC Latex Primer
2) Pittsburgh Paints Company; 6-2 Speedhide Quick Drying Latex Sealer
3) Benjamin Moore: Ultra Spec 500 Zero VOC Interior Latex Primer N534
4) Behr Premium Urethane Alkyd Semi-Gloss Enamel No. 3900

b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.
c. Topcoat: Institutional low-odor/VOC interior latex flat.
1) Sherwin Williams; Pro Mar 200 Zero VOC
2) Pittsburgh Paints Company; Speedhide Zero, 0 VOC
3) Benjamin Moore: Ultra Spec 500 Interior Zero VOC - Flat T535
4) Behr IPRO 300 Interior Flat
5) Application includes, but is not limited to:
a) Horizontal gypsum surfaces.

2. Institutional Low-Odor/VOC Latex System: (Code #9.22)
a. Prime Coat: Interior latex primer/sealer.
1) Sherwin Williams; Pro Mar 200 Zero VOC Latex Primer
2) Pittsburgh Paints Company; 6-2 Speedhide Quick Drying Latex Sealer
3) Benjamin Moore: Ultra Spec 500 Interior Zero VOC Latex Primer N534
4) Behr Premium Urethane Alkyd Semi-Gloss Enamel No. 3900
b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.
c. Topcoat: Institutional low-odor/VOC interior latex eggshell.
1) Sherwin Williams; Pro Mar 200 Zero VOC
2) Pittsburgh Paints Company; Speedhide Zero, 0 VOC
3) Benjamin Moore: Ultra Spec 500 Interior Low Sheen Eggshell T537
4) Behr IPRO Interior Eggshell
5) Application includes, but is not limited to:
a) Vertical gypsum surfaces where cleaning is not frequently to occur.

3. Institutional Low-Odor/VOC Latex System: (Code #9.23)
a. Prime Coat: Interior latex primer/sealer.
1) Sherwin Williams; Pro Mar 200 Zero VOC Latex Primer
2) Pittsburgh Paints Company; 6-2 Speedhide Quick Drying Latex Sealer
3) Benjamin Moore: Ultra Spec 500 Interior Zero VOC Latex Primer N534
4) Behr Premium Urethane Alkyd Semi-Gloss Enamel No. 3900
b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.
c. Topcoat: Institutional low-odor/VOC interior latex semigloss.
1) Sherwin Williams; Pro Mar 200 Zero VOC
2) Pittsburgh Paints Company; Speedhide Zero, 0 VOC
3) Benjamin Moore: Ultra Spec 500 Interior Zero VOC Semi-Gloss T546
4) Behr IPRO Interior Semi-Gloss
5) Application includes, but is not limited to:
a) Vertical gypsum surfaces where cleaning is likely to occur.

E. Cotton or Canvas and ASJ Insulation-Covering Substrates:
1. Institutional Low-Odor/VOC Latex System: (Code #10.11)
a. Prime Coat: Interior latex primer/sealer.
1) Sherwin Williams; Pro Mar 200 Zero VOC Latex Primer
2) Pittsburgh Paints Company; 6-2 Speedhide Quick Drying Latex Sealer
3) Benjamin Moore: Ultra Spec 500 Interior Zero VOC Latex Primer N534
b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.
c. Topcoat: Institutional low-odor/VOC interior latex (flat), unless otherwise noted.
1) Sherwin Williams; Pro Mar 200 Zero VOC
2) Pittsburgh Paints Company; Speedhide Zero, 0 VOC
3) Benjamin Moore: Ultra Spec 500 Interior Zero VOC – Flat T535 Low Sheen Eggshell T537
4) Behr IPRO Interior Flat and Eggshell
5) Application includes, but is not limited to:
a) Pipe and duct coverings.

END OF SECTION 09 91 23.00

DIVISION 10

SPECIALTIES

SECTION 10 14 23.17 – INTERIOR VINYL GRAPHIC SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Vinyl wall graphics

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 VINYL WALL GRAPHICS

A. Applied Vinyl Wall Graphics: Vinyl film of nominal thickness of between 3 and 3.5 mil, adhesive; aggressive and removable, unprinted outdoor durability; 5 years, indoor durability; 5 years and ASTM E 84, Class A surface burning resistance.
   1. Vendor:
      a. Turechoice Graphics, 4269 Diplomacy Drive, Columbus OH 43228 / 614-969-3060
   2. Size: As indicated on Drawings.
   3. Substrate: As indicated on Drawings.
   4. Graphics: As indicated on Drawings.

2.2 ACCESSORIES

A. Adhesive: As recommended by sign vendor.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install signs and accessories, using mounting methods of types described and complying with manufacturer's written instructions.

B. Field-Applied, Vinyl Signs: Clean and dry substrate. Align sign in final position before removing release liner. Remove release liner in stages, and apply and firmly press characters into final position. Press from the middle outward to obtain good bond without blisters or fish mouths. Remove carrier film without disturbing applied vinyl film.

END OF SECTION 10 14 23.17

23

DIVISION

SECTION 23 05 00 - COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Warranty, closeout procedures, and submitted requirements are specified in Division 01 Sections.

1.2 SUMMARY

A. This Section includes the following:
1. Piping materials and installation instructions common to most piping systems.
2. Escutcheons.
3. Grout.
4. HVAC demolition.
5. Equipment installation requirements common to equipment sections.
6. Painting and finishing.
7. Concrete bases.
8. Supports and anchorages.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:
1. CPVC: Chlorinated polyvinyl chloride plastic.
2. PE: Polyethylene plastic.
3. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:
1. EPDM: Ethylene-propylene-diene monomer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:
1. Transition fittings.

2. Mechanical sleeve seals.
3. Escutcheons.

1.5 INFORMATIONAL/QUALITY ASSURANCE/CONTROL SUBMITTALS

A. Welding certificates.

1.6 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements. Mechanical Contractor is to assume all financial responsibility associated with higher electrical characteristics.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

C. Sheet metal accessories shall include air distribution outlets, air filters, sound attenuators and ductwork accessories.

D. Store all insulation, ductwork, and sheet metal accessories indoors, or in a storage trailer. Do not store outdoors. Any insulation, ductwork, or accessories stored outdoors will be rejected, and shall be removed from the project site by the Contractor.

E. Do not allow insulation, ductwork, or sheet metal accessories to be exposed to moisture, to avoid introduction of mold spores into the building.

F. Do not run air systems prior to ductwork being insulated, to prevent condensation from occurring on the ductwork.

G. Equipment covered under this article include the following:
1. Air handling units
2. Boilers
3. Chillers
4. VAV terminals
5. Coils
6. Unit heaters
7. Cabinet unit heaters
8. Exhaust fans
9. Variable volume refrigerant units

10. Fan Coil Units

H. Air handling units shall be shipped fully crated or shrink-wrapped from the factory for protection of the equipment from the weather.

I. Equipment shall be stored at the site indoors, or outdoors on pallets where approved by A/E and CM. Do not set units directly on grade.

J. Equipment shall be fully protected from moisture while being stored. Use heavy tarps with tie down straps or other means to protect the units from moisture and outdoor weather conditions.

K. All air side devices such as air handling units, VAV terminals, coils, fans, terminal heating devices, ductwork and ductwork accessories shall be shipped, received and stored in such a manner that moisture is not allowed to be exposed to any portion of the equipment. Any equipment that is found to have or have had moisture present shall be removed from the job site and replaced.

1.8 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for HVAC installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors in walls, ceilings, and floors for HVAC items requiring access that are concealed behind finished surfaces. Access panels and doors for building components are specified in Division 08 Section "Access Doors and Frames." Access doors for ductwork are specified in Section 23 33 00 – Air Duct Accessories.

D. Coordination Drawings: Contractors shall produce a coordinated set of installation drawings from Project Drawings to establish the final coordinated installation elevations and routing of building services, such as but not limited to duct, pipe, wiring, conduit, cabling, and etc.
   1. Coordination drawings shall be drawn to 1/4” = 1’0” scale.
   2. All building trades shall participate; Division 23 contractor shall lead coordination, review, and produce the finished document set for review.
   3. Generally, the following installation conditions shall be met to organize the different building materials, and as otherwise noted and identified on the Project Drawings.
      a. Install Divisions 21, 22, 23, 25, 26 and 28 pipe and conduit mains first, at higher elevation(s); above duct mains and sub-mains.
      b. Install Division 23 duct mains and sub-mains, typically higher is better, and not less than 12 inches above finished ceiling elevation.
      c. Install branch duct, pipe and conduit run-outs, typically higher is better, and not less than 8 inches above the finished ceiling elevation.
      d. Equipment is expected to be at an accessible and serviceable location, typically not more than 18 inches above the finished ceiling elevation.
      e. Valves, dampers, and other manual controls shall be visible and accessible.
      f. Access of components is considered from a ladder positioned below the ceiling elevation with the operator standing appropriately atop the ladder.
   4. Generalized routing of building utilities is not expected to vary significantly from Project Drawings, but coordination with the appropriate designer(s) shall be the responsibility of the contractor to facilitate if significant deviations are necessary.
   5. A fully coordinated and detailed set of installation drawings shall be submitted for review prior to commencement of installation; equipment procurement is expected to occur simultaneously with production of the coordinated installation document set.
   6. Coordinated document set shall account for all service and maintenance requirements of the intended/expected equipment selections.
   7. Failure to complete and submit coordination drawing(s) for review prior to installation of work will result in the rejection of the coordination drawing submission(s).

E. Coordinate the use of pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for HVAC installations.

F. Contractor is responsible to coordinate requirements for access panels and doors and assign installation locations at walls, ceilings, and floors for HVAC items requiring access. Access doors for building components are specified in Division 08 Section "Access Doors and Frames." Access doors for ductwork are specified in Section 23 33 00.

G. Coordinate with the Division 26 Contractor regarding the location of all Switchboards and Switchgear. Piping shall not be run over or near any Switchboard or Switchgear. Piping or ductwork foreign to the electrical installation whose malfunction would endanger the operation of the electrical system shall not be routed through the Main Electrical Room, shall not be routed through the Main Emergency Equipment Room, and shall not be routed through the Emergency Generator Room. The exception would be statutorily required fire protection piping.
   1. Piping should be avoided over any wall mounted electrical panel with a voltage of 120 volts or higher. Obtain written approval from Owners Representative before routing piping above an electrical panel.

1.9 PROJECT CONDITIONS

A. Unless otherwise stipulated under a particular heading, the following rules relative to responsibilities of the several Contractors and subcontractors will apply.
   1. Each Contractor shall install roughing-in work pertaining to his trade for connection of Work performed under other Sections of these Specifications.

B. Certain areas will be designated for the storage of materials and equipment and cooperation/coordination with the Owner in minimizing interferences with existing operations will be mandatory.
   1. Where possible, store materials inside and protected from weather. Where necessary to store outside, elevate above grade and enclose the durable, waterproof wrapping.
   2. Follow manufacturer’s instructions for receiving, inspecting, handling, storage, and protection of products prior to final installation.

C. Equipment Clearances and Requirements
   1. Due to the possibility of restrictions imposed by space limitations, the responsibility for resolving conflicts resulting from the use of equipment other than the design basis shall rest with the equipment supplier and the Contractor. Submittals for this equipment will be considered as a statement that clearances for access, service, maintenance, etc., have been checked and found adequate.
   2. Alternate equipment or the equipment of additional manufacturers named in these documents shall meet Base Bid specifications. In the event such equipment or any equipment which the bidder proposes to furnish, deviates from the requirements of equipment first named regarding electric service, power wiring, control wiring, plumbing or piping, sound attenuation, or vibration damping, it shall be the responsibility of the bidder to include in his price a sufficient sum to cover additional costs or charges resulting there from.

D. In general, the piping and ductwork shown on the Drawings shall be considered as diagrammatic for clearness in indicating the general run and connections required, and may not be shown in its true position. The piping and ductwork and equipment may have to be offset, lowered or raised, as required, or as directed at the site in order to accommodate field conditions.

1.10 CLOSEOUT DOCUMENTS

A. After corrections and any job installation changes, the contractor shall be responsible for delivering the following closeout documents to the owner. Each set of documents shall be provided in paper copy and digital format. The digital format shall be coordinated directly with the owner. Contractor responsible for any hard drive and/or storage requirements to deliver documents. Include items specified in Division 01 Section "Operation and Maintenance Data," along with the following:

1. Full size as-built drawings (Quantity: 1)
    a. Including ductwork, piping, temperature control schematics, etc.
2. Complete parts list of HVAC equipment and accessories
3. Specifications sheets
4. Operation and maintenance manuals of all new HVAC equipment
5. Refer to individual Division 23 sections for more specific requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
    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 manufacturers specified.
    2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 23 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Type: With set screw.
    1. Finish: Polished chrome-plated.

D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
    1. Finish: Polished chrome-plated.

E. One-Piece, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.

F. Split-Plate, Stamped-Steel Type: With concealed or exposed-rivet hinge, set screw or spring clips, and chrome-plated finish.

G. One-Piece, Floor-Plate Type: Cast-iron floor plate.

H. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.4 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
    1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
    2. Design Mix: 5000-psi, 28-day compressive strength.
    3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 HVAC DEMOLITION

A. Refer to Division 01 Section "Cutting and Patching" and Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.

B. Disconnect, demolish, and remove HVAC systems, equipment, and components indicated to be removed.
   1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
   2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
   3. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
   4. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
   5. Equipment to Be Removed: Disconnect and cap services and remove equipment.
   6. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
   7. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
   1. New Piping:
      a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
      b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
      c. Insulated Piping: One-piece, stamped-steel type with spring clips.
      d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
      e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
      f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
      g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type and set screw.
      h. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated finish.
      i. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type with hinge and set screw.
      j. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
      k. Bare Piping in Equipment Rooms: One-piece, stamped-steel type with set screw.
      l. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
   2. Existing Piping: Use the following:
      a. Chrome-Plated Piping: Split-casting, cast-brass type with chrome-plated finish.
      b. Insulated Piping: Split-plate, stamped-steel type with concealed or exposed-rivet hinge and spring clips.
      c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
      d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and spring clips.
      e. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.

f. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and set screw.
g. Bare Piping in Unfinished Service Spaces: Split-casting, cast-brass type with polished chrome-plated finish.
h. Bare Piping in Unfinished Service Spaces: Split-plate, stamped-steel type with concealed or exposed-rivet hinge and set screw or spring clips.
i. Bare Piping in Equipment Rooms: Split-casting, cast-brass type.
j. Bare Piping in Equipment Rooms: Split-plate, stamped-steel type with set screw or spring clips.
k. Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting, floor-plate type.

B. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.3 DUCT SYSTEMS – COMMON REQUIREMENTS

A. Install ductwork according to the following requirements and Division 23 Sections specifying ductwork systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of ductwork systems. Indicated locations and arrangements were used to size ductwork and calculate friction loss, expansion, fan sizing, and other design considerations. Install ductwork in general location as indicated in Contract Documents unless deviations to layout are approved on Coordination Drawings. Minor offsets, lowering or raising the ductwork shall be routed to accommodate field conditions at no expense to the project.

3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are indicated.

B. Install equipment level and plumb, parallel, and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

E. Coordinate ceiling mounted equipment locations to provide proper maintenance access and where possible, maintain a 24 by 24 inch clear path from the floor level to the equipment. All equipment above the ceiling shall be accessible via 10 foot (or shorter) ladder and shall be no more than 24 inches above the ceiling grid. Equipment mounted above ceilings that are greater than 10 feet high, shall have access via other means approved by the Owner, and as a minimum shall not require special lifts to access. The contractor shall coordinate with other trades to ensure that systems below the equipment (piping, cable trays, ductwork, etc.) shall not impede the service area or path to that service area. The contractor shall note service access areas on all shop drawings for ceiling mounted systems for all trades to ensure proper clearance.

3.5 PAINTING

A. Painting of HVAC systems, equipment, and components is specified in Division 09 Sections "Interior Painting" and "Exterior Painting."

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.6 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions.
   1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
   2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
   3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
   4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   5. Install anchor bolts to elevations required for proper attachment to supported equipment.
   6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
   7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete."

3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.8 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor HVAC materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.9 GROUTING

A. Mix and install grout for HVAC equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

END OF SECTION 23 05 00

SECTION 23 05 13 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
   1. Motor controllers.
   2. Torque, speed, and horsepower requirements of the load.
   3. Ratings and characteristics of supply circuit and required control sequence.
   4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with requirements in this Section except when stricter requirements are specified in HVAC equipment schedules or Sections.

B. Motor shall be Premium Efficient as described in NEMA Standards Publication MG 1-2006.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Service Factor: 1.15.

C. Rotor: Random-wound, squirrel cage.

D. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

E. Temperature Rise: Match insulation rating.

F. Insulation: Class F.

G. Code Letter Designation:
   1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
   2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

H. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
   1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
   2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
   3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
   4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
   5. All motors driven by a variable frequency controller shall include a maintenance free, circumferential, conductive microfiber shaft grounding ring to discharge shaft currents to ground.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
   1. Permanent-split capacitor.
   2. Split phase.
   3. Capacitor start, inductor run.
   4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 23 05 13

SECTION 23 05 23 - GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Ball valves.
2. Iron, single-flange butterfly valves.
3. Iron, grooved-end butterfly valves.
4. Bronze, grooved-end butterfly valves.
5. Bronze swing check valves.
6. Iron swing check valves.
7. Iron, grooved-end swing-check valves.
8. Iron, grooved-end spring-actuated check valves.
9. Bronze globe valves.
10. Iron globe valves.
11. Lubricated plug valves.
12. Drain valves.
13. Chainwheels.

B. Related Sections:
1. Division 23 HVAC piping Sections for specialty valves applicable to those Sections only.
2. Division 23 Section "Identification for HVAC Piping and Equipment" for valve tags and schedules.

1.2 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene-propylene-diene monomer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

D. NRS: Nonrising stem.

E. OS&Y: Outside screw and yoke.

F. RS: Rising stem.

G. SWP: Steam working pressure.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of valve indicated.

1.4 QUALITY ASSURANCE

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
1. Grooved-end valves shall be of the same manufacturer as the grooved components.
2. No yellow brass containing more than 15 percent zinc.

B. ASME Compliance:
1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
2. ASME B31.1 for power piping valves.
3. ASME B31.9 for building services piping valves.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:
   1. Protect internal parts against rust and corrosion.
   2. Protect threads, flange faces, grooves, and weld ends.
   3. Set globe valves closed to prevent rattling.
   4. Set ball and plug valves open to minimize exposure of functional surfaces.
   5. Set butterfly valves closed or slightly open.
   6. Block check valves in either closed or open position.

B. Use the following precautions during storage:
   1. Maintain valve end protection.
   2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

B. Valve Sizes: Same as upstream piping unless otherwise indicated.

C. Valve Actuator Types:
   1. Gear Actuator: For quarter-turn valves NPS 8 and larger.
   2. Handwheel: For valves other than quarter-turn types.
   3. Hand lever: For quarter-turn valves NPS 6 and smaller.
   4. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 10 plug valves, for each size square plug-valve head.
   5. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator; of size and with chain for mounting height, as indicated in the "Valve Installation" Article.

D. Valves in Insulated Piping: With 2-inch stem extensions and the following features:
   1. Ball Valves: With extended operating handle that allows operation of valve without disturbing insulation.
   2. Butterfly Valves: With extended neck.

E. Valve-End Connections:
   1. Flanged: With flanges according to ASME B16.1 for iron valves.
   2. Grooved: With grooves according to AWWA C606 or copper tube dimensions.
   3. Solder Joint: With sockets according to ASME B16.18.
   4. Threaded: With threads according to ASME B1.20.1.

F. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BALL VALVES

A. Two-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Apollo.

b. NIBCO INC.
c. Hammond Valve.
d. Milwaukee Valve Company.
e. Watts.
f. Victaulic Company.
g. Anvil Gruvlok.
h. Tyco-Grinnell.

2. Description:
a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: ASTM B584 C8440.
f. Ends: Threaded or press fit.
g. Seats: PTFE or TFE.
h. Stem: Stainless steel.
i. Ball: Stainless steel.
j. Port: Full.

2.3 IRON, SINGLE-FLANGE BUTTERFLY VALVES

A. 150 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Aluminum-Bronze Disc:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Hammond Valve.
b. Milwaukee Valve Company.
c. NIBCO Inc.
d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
a. Standard: MSS SP-67, Type I.
b. CWP Rating: 150 psig.
c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
e. Seat: EPDM.
f. Stem: One- or two-piece stainless steel.
g. Disc: Aluminum bronze.

2.4 IRON, GROOVED-END BUTTERFLY VALVES

A. 300 CWP, Iron, Grooved-End Butterfly Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Anvil Gruvlok.
b. Tyco-Grinnell.
c. Mueller Steam Specialty; a division of SPX Corporation.
d. NIBCO INC.
e. Victaulic Company.
2. Description:
a. Standard: MSS SP-67, Type I.
b. NPS 8 and Smaller CWP Rating: 300 psig.
c. NPS 10 and Larger CWP Rating: 200 psig.
d. Body Material: Coated, ductile iron.
e. Stem: Two-piece stainless steel.
1) Stem shall be offset from the disc centerline to provide full 360 degree circumferential seating.
f. Disc: Coated, ductile iron, aluminum-bronze, or stainless steel.
g. Seal: EPDM.

2.5 BRONZE, GROOVED-END BUTTERFLY VALVES

A. 300 CWP, Iron, Bronze Body Grooved-End Butterfly Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Victaulic Company
b. Tyco-Grinnell
c. Mueller Steam Specialty; a division of SPX Corporation.
d. NIBCO Inc.
e. Anvil Gruvlok
2. Description
a. CWP Rating: 300 psig.
b. Body Material: Cast bronze.
c. Stem: Integrally cast with disc.
d. Disc: EPDM coated, ductile iron.

2.6 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Hammond Valve.
b. Milwaukee Valve Company.
c. NIBCO INC.
d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
a. Standard: MSS SP-80, Type 3.
b. CWP Rating: 200 psig.
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: Bronze.

B. Class 150, Bronze Swing Check Valves with Bronze Disc:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Hammond Valve.
b. Milwaukee Valve Company.
c. NIBCO INC.
d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
a. Standard: MSS SP-80, Type 3.
b. CWP Rating: 300 psig.
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: Bronze.

2.7 IRON SWING CHECK VALVES

A. Class 125, Iron Swing Check Valves with Metal Seats:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Hammond Valve.
b. Milwaukee Valve Company.
c. NIBCO INC.
d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
a. Standard: MSS SP-71, Type I.
b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.

c. NPS 14 to NPS 24, CWP Rating: 150 psig.
d. Body Design: Clear or full waterway.
e. Body Material: ASTM A 126, gray iron with bolted bonnet.
f. Ends: Flanged.
g. Trim: Bronze.
h. Gasket: Asbestos free.

B. Class 250, Iron Swing Check Valves with Metal Seats:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Hammond Valve.
b. Milwaukee Valve Company.
c. NIBCO INC.
d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
a. Standard: MSS SP-71, Type I.
b. NPS 2-1/2 to NPS 12, CWP Rating: 500 psig.
c. NPS 14 to NPS 24, CWP Rating: 300 psig.
d. Body Design: Clear or full waterway.
e. Body Material: ASTM A 126, gray iron with bolted bonnet.
f. Ends: Flanged.
g. Trim: Bronze.
h. Gasket: Asbestos free.

2.8 IRON, GROOVED-END SWING CHECK VALVES

A. 300 CWP, Iron, Grooved-End Swing Check Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Anvil Gruvlok.
b. Tyco-Grinnell.
c. Victaulic Company.
2. Description:
a. CWP Rating: 300 psig.
b. Body Material: ASTM A 536, ductile iron.
c. Seal: EPDM.
d. Disc: Spring operated, ductile iron or stainless steel.

2.9 IRON, GROOVED-END SPRING-ACTUATED CHECK VALVES

A. 300 CWP, Iron, Grooved-End Spring-Actuated Check Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Victaulic Company
b. Tyco-Grinnell.
c. Anvil Gruvlok
2. Description
a. CWP Rating: 300 psig.
b. Body Material: ASTM A536, ductile iron.
c. Seal: EPDM.
d. Disc:
1) NPS 2-1/2 and NPS 3: Aluminum-bronze.
2) NPS 4 through NPS 12: Elastomer coated ductile iron.
3) NPS 14 through NPS 24: Dual stainless steel disc.
e. Spring and Shaft: Stainless steel.

2.10 BRONZE GLOBE VALVES

A. Class 125, Bronze Globe Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Hammond Valve.
    b. Milwaukee Valve Company.
    c. NIBCO INC.
    d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
    a. Standard: MSS SP-80, Type 1.
    b. CWP Rating: 200 psig.
    c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
    d. Ends: Threaded or solder joint.
    e. Stem and Disc: Bronze.
    f. Packing: Asbestos free.
    g. Handwheel: Malleable iron, bronze, or aluminum.

2.11 IRON GLOBE VALVES

A. Class 125, Iron Globe Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Hammond Valve.
    b. Milwaukee Valve Company.
    c. NIBCO INC.
    d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
    a. Standard: MSS SP-85, Type I.
    b. CWP Rating: 200 psig.
    c. Body Material: ASTM A 126, gray iron with bolted bonnet.
    d. Ends: Flanged.
    e. Trim: Bronze.
    f. Packing and Gasket: Asbestos free.

B. Class 250, Iron Globe Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Hammond Valve.
    b. Milwaukee Valve Company.
    c. NIBCO INC.
    d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
    a. Standard: MSS SP-85, Type I.
    b. CWP Rating: 500 psig.
    c. Body Material: ASTM A 126, gray iron with bolted bonnet.
    d. Ends: Flanged.
    e. Trim: Bronze.
    f. Packing and Gasket: Asbestos free.

2.12 DRAIN VALVE (HOSE END)

A. For Low Pressure Drainage Service
1. Threaded ends 2 inches and smaller: Class 125, bronze body, screwed bonnet, rising stem, composition disc, 3/4 inch hose outlet connection with cap and chain.
2. Soldered ends 2 inches and smaller: Class 125 bronze body, screwed bonnet, rising stem, composition disc, 3/4 inch hose outlet connection with cap and chain.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Examine grooved-ends for form and cleanliness. Grooved-ends shall be clean and free from indentations and projections in the area from valve end to groove.

F. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions, grooved joint couplings or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install check valves for proper direction of flow and as follows:
   1. Swing Check Valves: In horizontal position with hinge pin level.

F. Insulation: Where insulation is indicated, install extended-stem valves, arranged in proper manner to receive insulation.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:
   1. Shutoff Service: Ball or butterfly.
   2. Butterfly Valve Dead-End Service: Grooved-end or single-flange (lug) type.
   3. Throttling Service: Globe, ball, or butterfly valves.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.

C. Select valves, except wafer types, with the following end connections:
   1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.

2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
3. For Copper Tubing, NPS 5 and Larger: Flanged ends.
4. For Steel Piping, NPS 2 and Smaller: Threaded ends.
5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
6. For Steel Piping, NPS 5 and Larger: Flanged ends.
7. For Grooved-End Copper Tubing and Steel Piping except Steam and Steam Condensate Piping: Valve ends may be grooved.
8. For NPS 2 and Smaller: Valve ends may be press fit in lieu of soldered copper or threaded steel.

3.5 CHILLED-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:
1. Ball Valves: May be provided with solder-joint ends instead of threaded ends.
2. Ball Valves:
   a. Two-piece, full port.
3. Bronze Swing Check Valves: Class 125, bronze disc.
4. Bronze Globe Valves: Class 125, bronze disc.

B. Pipe NPS 2-1/2 and Larger:
1. Iron, Single-Flange Butterfly Valves, NPS 2-1/2 to NPS 12: 200 CWP, EPDM seat, aluminum-bronze disc.
2. Iron, Grooved-End Butterfly Valves, NPS 2-1/2 to NPS 24: 300 CWP.
3. Iron Swing Check Valves: Class 125 or Class 250, metal seats.
4. Iron, Grooved-End Check Valves
   a. NPS 3 to NPS 12: 300 CWP.
   b. NPS 14 to NPS 24: 230 CWP.
5. Iron Globe Valves: Class 250.

3.6 HEATING-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:
1. Ball Valves: May be provided with solder-joint ends instead of threaded ends.
2. Ball Valves:
   a. Two-piece, full port.
3. Bronze Swing Check Valves: Class 125, bronze disc.
4. Bronze Globe Valves: Class 125, bronze disc.

B. Pipe NPS 2-1/2 and Larger:
1. Iron, Single-Flange Butterfly Valves, NPS 2-1/2 to NPS 12: 200 CWP, EPDM seat, aluminum-bronze disc.
2. Iron, Grooved-End Butterfly Valves, NPS 2-1/2 to NPS 24: 300 CWP.
3. Iron Swing Check Valves: Class 250, metal seats.
4. Iron, Grooved-End Check Valves, NPS 3 to NPS 12: 300 CWP.
   a. NPS 3 to NPS 12: 300 CWP.
   b. NPS 14 to NPS 24: 230 CWP.
5. Iron Globe Valves, NPS 2-1/2 to NPS 12: Class 250.

3.7 DRAIN VALVE SCHEDULE

A. At all low points in the piping system.

B. Where indicated on the drawings and details.

END OF SECTION 23 05 23

SECTION 23 05 29 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following hangers and supports for HVAC system piping and equipment:
   1. Steel pipe hangers and supports.
   2. Trapeze pipe hangers.
   3. Metal framing systems.
   4. Thermal-hanger shield inserts.
   5. Pipe insulation supports.
   6. Fastener systems.
   7. Pipe stands.
   8. Equipment supports.
   9. Duct hangers and supports.
   10. Structural roof curbs.
   11. Pipe curbs.

B. Related Sections include the following:
   1. Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
   2. Division 07 Section “Roof Accessories” for general information concerning roof accessories.

1.2 DEFINITIONS

A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.

B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.3 PERFORMANCE REQUIREMENTS

A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

C. Provide additional supplemental steel as required to support equipment, ductwork, piping, etc. from structure above.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:
   1. Steel pipe hangers and supports.
   2. Duct hangers and supports.
      a. Include safety factor and sizing guidelines, methodology by duct type, and SMACNA-approved duct hanger/support products as listed in the specification.
   3. Suspended Equipment Support (For equipment indicated)
      a. Submit building attachment product data, cable/rod product data.
      b. Submit a summation of all loads being suspended.

c. Submit proposed structural coordination drawings with approved mechanical equipment including summation of all loads, safety factors, and maximum allowable load data for review and approval prior to installation.
d. Submit partial IOM of approved equipment for installation attachment and procedures.
e. Indicated equipment: Fan Coil Units

1.5 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to the following:
1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.2, "Structural Welding Code--Aluminum."
3. AWS D1.3, "Structural Welding Code--Sheet Steel."
4. AWS D1.4, "Structural Welding Code--Reinforcing Steel."
5. ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. 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, but are not limited to, manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 STEEL PIPE HANGERS AND SUPPORTS

A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.

B. Manufacturers:
1. AAA Technology & Specialties Co., Inc.
2. Bergen-Power Pipe Supports.
3. B-Line Systems, Inc.; a division of Cooper Industries.
4. Carpenter & Paterson, Inc.
5. Empire Industries, Inc.
6. ERICO/Michigan Hanger Co.
7. Globe Pipe Hanger Products, Inc.
8. Grinnell Corp.
9. GS Metals Corp.
10. National Pipe Hanger Corporation.
11. PHD Manufacturing, Inc.
12. PHS Industries, Inc.
13. Piping Technology & Products, Inc.
14. Tolco Inc.
15. Anvil International

C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.4 METAL FRAMING SYSTEMS

A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.

B. Manufacturers:
1. B-Line Systems, Inc.; a division of Cooper Industries.
2. ERICO/Michigan Hanger Co.; ERISTRUT Div.
3. GS Metals Corp.
4. Power-Strut Div.; Tyco International, Ltd.
5. Thomas & Betts Corporation.
6. Tolco Inc.
7. Unistrut Corp.; Tyco International, Ltd.

C. Coatings: Manufacturer's standard finish unless bare metal surfaces are indicated.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.5 PIPE INSULATION SUPPORTS

A. Insulation Shields: Hangers for insulated pipe shall be provided with ribbed insulation shields; Anvil Fig. 167, MSS SP-69, Type 40.

B. Pipe and Duct Mineral-Fiber Insulation Supports for fibrous-type insulation materials.
1. Manufacturers: Subject to compliance; comparable by:
a. ICA Insulation; H-Block.
b. Johns Manville; Thermo-12 Gold.
c. Industrial Insulation Group; Thermo-12 Gold.
d. Industrial Insulation Group; Super Caltemp Gold 1700.
2. Description:
a. Description: Manufactured unit shall be a molded block style support composed of compressed fiberglass or calcium silicate block.
b. Thermal Conductivity: 0.30 BTU-Inch/(hr-ft^2-^{o}F); ASTM C177.
c. Moisture Absorption: <0.2% by volume.
d. Compressive Strength: 80-PSI, Minimum; ASTM D1621.
e. Compression: 10%at 80-PSI, or less.
f. Service Temperature: -40°F to 1000°F.
g. Flame Spread< 25, Smoke Developed<50.
h. Support thickness shall be sized to the insulation thickness, with expected compression included; block shall be installed within field-cut pipe insulation.

C. Pipe Mounted Elastomeric Insulation Support Collar.
1. Manufacturers: Subject to compliance; comparable by:
a. Aeroflex USA Inc.; Aerofix-U.
b. Armacell LLC; AP Armafix.
c. K-Flex USA; 360 Insulated Pipe Support.
2. Description:
a. Manufactured unit shall be a collar style, 360-degree support composed of a rigid closed-cell polyurethane core with an outer overlapping PVC jacket material. Size support to match adjacent insulation thickness.
b. Thermal Conductivity: 0.32 BTU-Inch/(hr-ft^2-^{o}F); ASTM C177.
c. Water Permeability: <0.01 perm-inch; ASTM E96.
d. Compressive Strength: 80-PSI, Minimum; ASTM D1621.
e. Service Temperature: -40°F to 220°F.

f. Vapor Barrier Jacket: All service jacket meeting ASTM D-774, D-828 and E-84, Flame Spread< 25, Smoke Developed<50.
g. Support inside diameter shall be sized to the outside diameter of the supported pipe, and the support outside diameter sized to the outside diameter of the adjacent pipe insulation.

2.6 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
1. Manufacturers:
a. Hilti, Inc.
b. ITW Ramset/Red Head.
c. Masterset Fastening Systems, Inc.
d. MKT Fastening, LLC.
e. Powers Fasteners.

B. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
1. Manufacturers:
a. B-Line Systems, Inc.; a division of Cooper Industries.
b. Empire Industries, Inc.
c. Hilti, Inc.
d. ITW Ramset/Red Head.
e. MKT Fastening, LLC.
f. Powers Fasteners.

2.7 PIPE STAND FABRICATION

A. Pipe Stands, General: Shop or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Compact Pipe Stand: One-piece plastic unit with integral-rod-roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
1. Manufacturers:
a. ERICO/Michigan Hanger Co.
b. MIRO Industries.

C. Low-Type, Single-Pipe Stand: One-piece plastic base unit with plastic roller, for roof installation without membrane penetration.
1. Manufacturers:
a. MIRO Industries.

D. High-Type, Single-Pipe Stand: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
1. Manufacturers:
a. ERICO/Michigan Hanger Co.

b. MIRO Industries.
c. Portable Pipe Hangers.
2. Base: Plastic.
3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

E. High-Type, Multiple-Pipe Stand: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
1. Manufacturers:
a. Portable Pipe Hangers.
2. Bases: One or more plastic.
3. Vertical Members: Two or more protective-coated-steel channels.
4. Horizontal Member: Protective-coated-steel channel.
5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

F. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe support made from structural-steel shape, continuous-thread rods, and rollers for mounting on permanent stationary roof curb.

2.8 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.9 PRE-FABRICATED ROOF EQUIPMENT SUPPORT

A. Manufacturers:
1. Rooftop Support Systems
2. Miro Industries, Inc.
3. Big Foot Systems

B. Modular support designed to support condensing units while protecting roof membrane.
1. Condensing units equivalent to Rooftop Support Systems RTSEQ series.

C. Framing: Welded 1-5/8 in x 3-1/4 in solid, and 1-5/8 in x 1-5/8 in perforated, 12 gauge strut channel

D. Framing Finish: Hot Dip Galvanized (ASTM 123) or 304 Stainless Steel

E. Hardware Finish: 304 Stainless Steel.

F. Supports to be hot-dipped galvanized steel.

G. Supports designed for gravity loading and minimum load of 300 lbs.

H. Support shall not penetrate the roof membrane. Coordinate support base with existing roof material and condition.

2.10 DUCT HANGERS AND SUPPORTS

A. Support horizontal ductwork runs with suitable strap or trapeze hangers. When weight of duct between hangers does not exceed 60 pounds, hangers shall be 1 inch wide by 18 gauge. For greater weights, use trapeze hangers, as approved by A/E.

B. Contractor may use load rated cable suspension system. Suspension system shall have a specified manufacturers safe working load and supplemental safety factor of at least five times the safe working load.

1. Suspension system shall be verified by SMACNA Testing and Research Institute to comply with SMACNA Duct Construction Standards Guidelines (1995 CH.4).

2.11 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36, steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, non-shrink and nonmetallic grout; suitable for interior and exterior applications.
1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

2.12 PIPE CURBS

A. Pipe curb shall consist of a heavy gauge galvanized steel roof curb, unitized construction, with integral base plate, 3 pound density insulation, and 2 by 2 nailer. Curb shall be covered with a thermoplastic cover, fastening screws, graduated step boots with stainless steel adjustable clamps.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use padded hangers for piping that is subject to scratching.

F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F pipes, NPS 4 to NPS 16, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4 inches of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24, if no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2.
10. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8.

11. Extension Hinged or 2-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
16. Adjustable, Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36, if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.
17. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30, from 2 rods if longitudinal movement caused by expansion and contraction might occur.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20, from single rod if horizontal movement caused by expansion and contraction might occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42, if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 24, if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30, if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.

H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
6. Swivel connections shall be utilized for attachment to sloping structure. Threaded rod shall not be bent.

I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.

9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.
13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

K. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
    a. Horizontal (MSS Type 54): Mounted horizontally.
    b. Vertical (MSS Type 55): Mounted vertically.
    c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

L. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

M. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

N. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction. The use of powder-actuated fasteners or mechanical-expansion anchors may only be used after approval from the structural engineer.

3.2 HANGER AND SUPPORT INSTALLATION

A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.
   1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
   2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:
   1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
   2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Pipe Stand Installation:
   1. Pipe Stand Types except Curb-Mounting Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
   2. Curb-Mounting-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. Refer to Division 07 Section "Roof Accessories" for curbs.

G. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

I. Install hangers and supports to allow controlled thermal **[and seismic]**movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

J. Install lateral bracing with pipe hangers and supports to prevent swaying.

K. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

L. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

M. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.

N. Insulated Piping: Comply with the following:
   1. Attach clamps and spacers to piping.
      a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
      b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
      c. Do not exceed pipe stress limits according to ASME B31.1 for power piping and ASME B31.9 for building services piping.
   2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
      a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
   3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
      a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
   4. Shield Dimensions for Pipe: Not less than the following:
      a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
      b. NPS 4: 12 inches long and 0.06 inch thick.
      c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
      d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
      e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
   5. Pipes NPS 8 and Larger: Include wood inserts.
   6. Insert Material: Length at least as long as protective shield.
   7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.
   8. Insulated Support Collar: Install insulated support collars for all insulated pipes requiring the use of pipe clamp supports.
   9. The hydronic piping shall have continuous insulation through all supports.

O. Hangers and supports shall not be attached to the roof deck without prior written authorization from the Architect/Engineer.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.6 PAINTING

A. Touch Up: 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.

B. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 23 05 29

SECTION 23 05 53 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Duct labels.
5. Valve tags.
6. Warning tags.
7. Ceiling tags.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.3 INFORMATIONAL/QUALITY ASSURANCE/CONTROL SUBMITTALS

A. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:
1. Material and Thickness:
a. Brass, 0.032-inch
b. Stainless steel, 0.025-inch
c. Aluminum, 0.032-inch or
d. Anodized aluminum, 0.032-inch minimum thickness
2. Provided with predrilled or stamped holes for attachment hardware.
3. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
4. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
5. Fasteners: Stainless-steel self-tapping screws.
6. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:
1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: White.
3. Background Color: Black.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: Black.

C. Background Color: Yellow.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches high.

2.4 DUCT LABELS

A. Material: Printed plastic with contact-type, permanent-adhesive backing.

B. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

C. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

D. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

E. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

F. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, duct size, and an arrow indicating flow direction.
   1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions, or as separate unit on each duct label to indicate flow direction.
   2. Lettering Size: At least 1-1/2 inches high.

2.5 STENCILS

A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 1-1/4 inches for ducts; and minimum letter height of 3/4 inch for access panel and door labels, equipment labels, and similar operational instructions.
   1. Stencil Paint: Exterior, gloss, black unless otherwise indicated. Paint may be in pressurized spray-can form.
   2. Identification Paint: Exterior, in colors according to ASME A13.1 unless otherwise indicated.

2.6 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
   1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
   2. Fasteners: Brass wire-link or beaded chain; or S-hook.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
   1. Valve-tag schedule shall be included in operation and maintenance data.

2.7 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.
   1. Size: 3 by 5-1/4 inches minimum.
   2. Fasteners: Brass grommet and wire.
   3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
   4. Color: Yellow background with black lettering.

2.8 CEILING TAGS

A. Ceiling Tags
   1. Additional location and identification of plumbing and HVAC system valves shall be accomplished using 1/2 inch diameter colored, pressure-sensitive adhesive paper circles. Apply circles to ceiling grid below location of system valves per following color code:

a. Unit labels shall be applied using plastic ½" text label with pressure-sensitive backing applied to ceiling grid at location of access or service point.

Heating Hot Water	=	Orange
Chilled Water – Chiller Loop	=	Green
VVR/FCU Units	=	Unit Label
In-Line Exhaust Fan	=	Unit Label
Duct Static Pressure Sensor	=	Brown
Hydronic Differential Pressure Transmitter	=	Purple
Smoke Damper	=	SD
Fire Damper	=	FD
Fire/Smoke Damper	=	FD/SD

2. Circles which have been applied to ceiling pads are not acceptable.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment, along with all associated devices such as starters, disconnect switches, etc.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Piping Color-Coding: Painting of piping is specified in Division 09 Section "Interior Painting."

B. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels with painted, color-coded bands or rectangles, complying with ASME A13.1, on each piping system.
1. Identification Paint: Use for contrasting background.
2. Stencil Paint: Use for pipe marking.

C. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 25 feet along each run. Reduce intervals to 10 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

3.4 DUCT LABEL INSTALLATION

A. Install self-adhesive duct labels with permanent adhesive on air ducts.

B. Stenciled Duct Label Option: Stenciled labels, showing service and flow direction, may be provided instead of plastic-laminated duct labels, at Installer's option, if lettering larger than 1 inch high is needed for proper identification because of distance from normal location of required identification.

C. Locate labels near points where ducts enter concealed spaces and at maximum intervals of 25 feet in each space where ducts are exposed or concealed by removable ceiling system.
   1. In mechanical rooms, located duct labels at reduced intervals of 15 feet in areas of congested ductwork, piping, and/or equipment.

3.5 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

3.6 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

3.7 CEILING TAG INSTALLATION

A. Install tags below HVAC systems, equipment, valves, and accessories for ease of location.

END OF SECTION 23 05 53

SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes TAB to produce design objectives for the following:
   1. Air Systems:
      a. Constant-volume air systems.
      b. Variable-air-volume systems.
      c. Exhaust systems.
   2. Hydronic Piping Systems:
      a. Constant-flow systems.
      b. Variable-flow systems.
      c. Primary-secondary systems.
   3. HVAC equipment quantitative-performance settings.
   4. Existing systems TAB.
   5. Verifying that automatic control devices are functioning properly.
   6. Reporting results of activities and procedures specified in this Section.

1.2 DEFINITIONS

A. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.

B. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to indicated quantities.

C. Barrier or Boundary: Construction, either vertical or horizontal, such as walls, floors, and ceilings that are designed and constructed to restrict the movement of airflow, smoke, odors, and other pollutants.

D. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.

E. NC: Noise criteria.

F. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.

G. RC: Room criteria.

H. Report Forms: Test data sheets for recording test data in logical order.

I. Smoke-Control System: An engineered system that uses fans to produce airflow and pressure differences across barriers to limit smoke movement.

J. Smoke-Control Zone: A space within a building that is enclosed by smoke barriers and is a part of a zoned smoke-control system.

K. Static Head: The pressure due to the weight of the fluid above the point of measurement. In a closed system, static head is equal on both sides of the pump.

L. Suction Head: The height of fluid surface above the centerline of the pump on the suction side.

M. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

N. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.

O. TAB: Testing, adjusting, and balancing.

P. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.

Q. Test: A procedure to determine quantitative performance of systems or equipment.

R. Testing, Adjusting, and Balancing (TAB) Firm: The entity responsible for performing and reporting TAB procedures.

1.3 INFORMATIONAL/QUALITY ASSURANCE/CONTROL SUBMITTALS

A. Certified TAB Reports: Submit two copies of reports prepared, as specified in this Section, on approved forms certified by TAB firm.

B. Warranties specified in this Section.

1.4 QUALITY ASSURANCE

A. TAB Firm Qualifications: Engage a TAB firm certified by either AABC or NEBB.

B. Certification of TAB Reports: Certify TAB field data reports. This certification includes the following:
1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
2. Certify that TAB team complied with approved TAB plan and the procedures specified and referenced in this Specification.

C. TAB Report Forms: Use standard forms from AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems," NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems," or SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing."

D. Instrumentation Type, Quantity, and Accuracy: As described in AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems or NEBB's " Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems, " Section II, " Required Instrumentation for NEBB Certification."

E. Instrumentation Calibration: Calibrate instruments at least every six months or more frequently if required by instrument manufacturer.
1. Keep an updated record of instrument calibration that indicates date of calibration and the name of party performing instrument calibration.

F. Establish setpoints and calibrate controls. Coordinate with the Temperature Control Contractor and HVAC Contractor.

G. Mark final control damper and volume damper positions.

1.5 PROJECT CONDITIONS

A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Coordinate/cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.6 COORDINATION

A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.

B. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.

C. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

D. The Building Automation System shall be fully operational and adjustable before final balancing can be accomplished.

1.7 WARRANTY

A. National Project Performance Guarantee: Provide a guarantee on AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" forms stating that AABC will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents. Guarantee includes the following provisions:
   1. The certified TAB firm has tested and balanced systems according to the Contract Documents.
   2. Systems are balanced to optimum performance capabilities within design and installation limits.

B. Special Guarantee: Provide a guarantee on NEBB forms stating that NEBB will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents. Guarantee shall include the following provisions:
   1. The certified TAB firm has tested and balanced systems according to the Contract Documents.
   2. Systems are balanced to optimum performance capabilities within design and installation limits.

1.8 ACTION SUBMITTALS

A. Product Data: Test and balance report shall be sent to the Engineer for review and approval upon completion of testing and balancing.

1.9 CLOSEOUT SUBMITTALS

A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
   1. Operation and Maintenance Data: Include the Engineer reviewed and approved test and balance report in operation and maintenance manuals. This test and balance report shall bear the Engineers submittal stamp.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
   1. Contract Documents are defined in the General and Supplementary Conditions of Contract.
   2. Verify that balancing devices, such as test ports, gauge cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are installed as required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.

B. Examine approved submittal data of HVAC systems and equipment.

C. Examine Project Record Documents described in Division 01 Section "Project Record Documents."

D. Examine design data, including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine equipment performance data including fan and pump curves.
   1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
   2. Calculate system effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from those presented when the equipment was performance tested at the factory. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," Sections 7 through 10; or in SMACNA's "HVAC Systems--Duct Design," Sections 5 and 6. Compare this data with the design data and installed conditions.

F. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Sections have been performed.

G. Examine system and equipment test reports.

H. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.

I. Examine HVAC equipment to ensure that clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

J. Examine terminal units, such as variable-air-volume boxes, to verify that they are accessible, and their controls are connected and functioning.

K. Examine plenum ceilings used for supply air to verify that they are airtight. Verify that pipe penetrations and other holes are sealed.

L. Examine strainers for clean screens and proper perforations.

M. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.

N. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

O. Examine system pumps to ensure absence of entrained air in the suction piping.

P. Examine equipment for installation and for properly operating safety interlocks and controls.

Q. Examine automatic temperature system components to verify the following:
1. Dampers, valves, and other controlled devices are operated by the intended controller.
2. Dampers and valves are in the position indicated by the controller.
3. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in multizone units, mixing boxes, and variable-air-volume terminals.
4. Automatic modulating and shutoff valves, including two-way valves and three-way mixing and diverting valves, are properly connected.
5. Thermostats and humidistats are located to avoid adverse effects of sunlight, drafts, and cold walls.
6. Sensors are located to sense only the intended conditions.
7. Sequence of operation for control modes is according to the Contract Documents.
8. Controller set points are set at indicated values.
9. Interlocked systems are operating.
10. Changeover from heating to cooling mode occurs according to indicated values.

R. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures.

B. Complete system readiness checks and prepare system readiness reports. Verify the following:
1. Permanent electrical power wiring is complete.
2. Airside:
a. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.
b. Equipment and duct access doors are securely closed.
c. Duct systems are complete with terminals installed.
d. Volume, smoke, and fire dampers are open and functional.
e. Clean filters are installed.
f. Fans are operating, free of vibration, and rotating in correct direction.
g. Variable-frequency controllers' startup is complete, and safeties are verified.
h. Automatic temperature-control systems are operational.
i. Ceilings are installed.
j. Windows and doors are installed.
k. Suitable access to balancing devices and equipment is provided.
l. Relief air system adjustment.
3. Hydronics:
a. Verify leakage and pressure tests on water distribution systems have been satisfactorily completed.
b. Piping is complete with terminals installed.
c. Water treatment is complete.
d. Systems are flushed, filled, and air purged.
e. Strainers are pulled and cleaned.
f. Control valves are functioning in accordance with the sequence of operation.
g. Shutoff and balance valves have been verified to be 100 percent open.
h. Pumps are started and proper rotation is verified.
i. Pump gauge connections are installed directly at pump inlet and outlet flanges or in discharge and suction pipe prior to valves or strainers.
j. Variable-frequency controllers' startup is complete, and safeties are verified.
k. Suitable access to balancing devices and equipment is provided.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems", NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems", or SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to insulation Specifications for this Project.

C. Mark equipment and balancing device settings with paint or other suitable, permanent identification material, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct airflow measurements.

E. Check airflow patterns from the outside-air louvers and dampers and the return- and exhaust-air dampers, through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Identify fan and motor RPM, motor current and voltage, fan coil, and filter status.

I. Check dampers for proper position to achieve desired airflow path.

J. Check for airflow blockages.

K. Check condensate drains for proper connections and functioning.

L. Check for proper sealing of air-handling unit components.

M. Check for proper sealing of air duct system.

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
   1. Measure fan static pressures to determine actual static pressure as follows:
      a. Measure outlet static pressure as far downstream from the fan as practicable and upstream from restrictions in ducts such as elbows and transitions.
      b. Measure static pressure directly at the fan outlet or through the flexible connection.

c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from flexible connection and downstream from duct restrictions.
d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

2. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
   a. Simulate dirty filter operation and record the point at which maintenance personnel must change filters.
3. Measure static pressures entering and leaving other devices such as sound traps, heat recovery equipment, and air washers, under final balanced conditions.
4. Compare design data with installed conditions to determine variations in design static pressures versus actual static pressures. Compare actual system effect factors with calculated system effect factors to identify where variations occur. Recommend corrective action to align design and actual conditions.
5. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Make required adjustments to pulley sizes, motor sizes, and electrical connections to accommodate fan-speed changes.
6. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full cooling, full heating, economizer, and any other operating modes to determine the maximum required brake horsepower.
7. Coordinate with Division 23 Contractor to provide correct sheave size to allow fan motor to produce full rated horsepower with the (VFC) variable frequency controller at 100 percent speed. The maximum design airflow shall be accommodated by reducing the fan speed through the VFC. Make required adjustments to pulley sizes, motor sizes, and electrical connections as required.
8. Record air handling unit airflow during normal unit occupied and unoccupied operation and during economizer operation.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
   1. Measure static pressure at a point downstream from the balancing damper and adjust volume dampers until the proper static pressure is achieved.
      a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
   2. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

C. Measure terminal outlets and inlets without making adjustments.
   1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

D. Adjust terminal outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using volume dampers rather than extractors and the dampers at air terminals.
   1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
   2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

A. Adjust air handling unit fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
   1. Measure fan static pressures to determine actual static pressure as follows:
      a. Measure outlet static pressure as far downstream from the fan as practicable and upstream from restrictions in ducts such as elbows and transitions.
      b. Measure static pressure directly at the fan outlet or through the flexible connection.

c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from flexible connection and downstream from duct restrictions.
d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

2. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and treating equipment.
   a. Simulate dirty filter operation and record the point at which maintenance personnel must change filters.
3. Measure static pressures entering and leaving other devices such as sound traps, heat recovery equipment, and air washers, under final balanced conditions.
4. Compare design data with installed conditions to determine variations in design static pressures versus actual static pressures. Compare actual system effect factors with calculated system effect factors to identify where variations occur. Recommend corrective action to align design and actual conditions.
5. Provide correct sheave size to allow fan motor to produce full rated horsepower with the (VFC) variable frequency controller at 100 percent speed. The maximum design airflow shall be accommodated by reducing the fan speed through the VFC. Make required adjustments to pulley sizes, motor sizes, and electrical connections as required.
6. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers above fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full cooling, full heating, economizer, and any other operating modes to determine the maximum required brake horsepower.
7. Record air handling unit airflow during normal unit occupied and unoccupied operation and during economizer operation.

B. Compensating for Diversity: When the total airflow of all terminal units is more than the indicated airflow of the fan, place a selected number of terminal units at a maximum set-point airflow condition until the total airflow of the terminal units equals the indicated airflow of the fan. Select the reduced airflow terminal units so they are distributed evenly among the branch ducts.

C. Pressure-Independent, Variable-Air-Volume Systems: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:
1. Set outside-air dampers at minimum, and return- and exhaust-air dampers at a position that simulates full-cooling load.
2. Select the terminal unit that is most critical to the supply-fan airflow and static pressure. Measure static pressure. Adjust system static pressure so the entering static pressure for the critical terminal unit is not less than the sum of terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
3. Measure total system airflow. Adjust to within indicated airflow.
4. Set terminal units at maximum airflow and adjust controller or regulator to deliver the designed maximum airflow. Use terminal-unit manufacturer's written instructions to make this adjustment. When total airflow is correct, balance the air outlets downstream from terminal units as described for constant-volume air systems.
5. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow as described for constant-volume air systems.
   a. If air outlets are out of balance at minimum airflow, report the condition but leave outlets balanced for maximum airflow.
6. Remeasure the return airflow to the fan while operating at maximum return airflow and minimum outside airflow. Adjust the fan and balance the return-air ducts and inlets as described for constant-volume air systems.
7. Measure static pressure at the most critical terminal unit and adjust the static-pressure controller at the main supply-air sensing station to ensure that adequate static pressure is maintained at the most critical unit.
8. Record the final fan performance data.

D. Pressure-Dependent, Variable-Air-Volume Systems without Diversity: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:
   1. Balance systems similar to constant-volume air systems.
   2. Set terminal units and supply fan at full-airflow condition.
   3. Adjust inlet dampers of each terminal unit to indicated airflow and verify operation of the static-pressure controller. When total airflow is correct, balance the air outlets downstream from terminal units as described for constant-volume air systems.
   4. Readjust fan airflow for final maximum readings.
   5. Measure operating static pressure at the sensor that controls the supply fan, if one is installed, and verify operation of the static-pressure controller.
   6. Set supply fan at minimum airflow if minimum airflow is indicated. Measure static pressure to verify that it is being maintained by the controller.
   7. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow as described for constant-volume air systems.
      a. If air outlets are out of balance at minimum airflow, report the condition but leave the outlets balanced for maximum airflow.
   8. Measure the return airflow to the fan while operating at maximum return airflow and minimum outside airflow. Adjust the fan and balance the return-air ducts and inlets as described for constant-volume air systems.

E. Pressure-Dependent, Variable-Air-Volume Systems with Diversity: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:
   1. Set system at maximum indicated airflow by setting the required number of terminal units at minimum airflow. Select the reduced airflow terminal units so they are distributed evenly among the branch ducts.
   2. Adjust supply fan to maximum indicated airflow with the variable-airflow controller set at maximum airflow.
   3. Set terminal units at full-airflow condition.
   4. Adjust terminal units starting at the supply-fan end of the system and continuing progressively to the end of the system. Adjust inlet dampers of each terminal unit to indicated airflow. When total airflow is correct, balance the air outlets downstream from terminal units as described for constant-volume air systems.
   5. Adjust terminal units for minimum airflow.
   6. Measure static pressure at the sensor.
   7. Measure the return airflow to the fan while operating at maximum return airflow and minimum outside airflow. Adjust the fan and balance the return-air ducts and inlets as described for constant-volume air systems.

3.7 PROCEDURES FOR EXHAUST AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
   1. Measure fan static pressures to determine actual static pressure.
   2. Compare design data with installed conditions to determine variations in design static pressure versus actual static pressures. Compare actual system effect factors with calculated system effect factors to identify where variations occur. Recommend corrective action to align design and actual conditions.
   3. Obtain approval from A/E for adjustment of fan speed higher or lower than indicated speed. Make required adjustments to pulley sizes, motor sizes, and electrical connections to accommodate fan-speed changes.
   4. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full cooling, full heating, economizer, and any other operating modes to determine the maximum required brake horsepower.

5. Coordinate with Division 23 Contractor to provide correct sheave size to allow fan motor to produce full rated horsepower with the (VFC) variable frequency controller at 100 percent speed. The maximum design airflow shall be accommodated by reducing the fan speed through the VFC. Make required adjustments to pulley sizes, motor sizes, and electrical connections as required.
6. Record air handling unit airflow during normal unit occupied and unoccupied operation and during economizer operation.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
1. Measure static pressure at a point downstream from the balancing damper and adjust volume dampers until the proper static pressure is achieved.
a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
2. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

C. Measure air devices without making adjustments.
1. Measure air devices using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

D. Adjust air devices for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using volume dampers.
1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.

3.8 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

A. Prepare test reports with pertinent design data and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against approved pump flow rate. Correct variations that exceed plus or minus 5 percent.

B. Prepare schematic diagrams of systems' "as-built" piping layouts.

C. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:
1. Open all manual valves for maximum flow.
2. Check expansion tank liquid level.
3. Check makeup-water-station pressure gauge for adequate pressure for highest vent.
4. Check flow-control valves for specified sequence of operation and set at indicated flow.
5. Set differential-pressure control valves at the specified differential pressure. Do not set at fully closed position when pump is positive-displacement type unless several terminal valves are kept open.
6. Set system controls so automatic valves are wide open to heat exchangers.
7. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.
8. Check air vents for a forceful liquid flow exiting from vents when manually operated.
9. Determine optimum pressure setting of differential pressure transmitter. Coordinate with the Temperature Control Contractor.
10. All coils with 3-way temperature control valves have manual balance valves on the bypass leg. Adjust the pressure drop through the bypass leg to match the pressure drop through the coil at full flow.

3.9 PROCEDURES FOR HYDRONIC SYSTEMS

A. Measure water flow at pumps. Use the following procedures, except for positive-displacement pumps:

1. Verify impeller size by operating the pump with the discharge valve closed. Read pressure differential across the pump. Convert pressure to head and correct for differences in gauge heights. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
2. Check system resistance. With all valves open, read pressure differential across the pump and mark pump manufacturer's head-capacity curve. Adjust pump discharge valve until indicated water flow is achieved.
3. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.
4. Report flow rates that are not within plus or minus 5 percent of design.

B. Set calibrated balancing valves, if installed, at calculated presettings.

C. Measure flow at all stations and adjust, where necessary, to obtain first balance.
1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.

D. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than indicated flow.

E. Adjust balancing stations to within specified tolerances of indicated flow rate as follows:
1. Determine the balancing station with the highest percentage over indicated flow.
2. Adjust each station in turn, beginning with the station with the highest percentage over indicated flow and proceeding to the station with the lowest percentage over indicated flow.
3. Record settings and mark balancing devices.
4. When automatic flow control valves are used, measure pressure drop across valve. Verify pressure drop is within valve operating range. Submit pressure and waterflow results in final report schedule.

F. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures including outdoor-air temperature.

G. Measure the differential-pressure control valve settings existing at the conclusions of balancing.

3.10 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

A. Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals and proceed as specified above for hydronic systems.

B. Balance pump flow with all valves to the 100 percent open location.

C. Triple-duty valve shall be fully open.

D. Adjust pump flow by reducing (VFC) variable frequency-controller speed to attain scheduled flow rate.

3.11 PROCEDURES FOR PRIMARY-SECONDARY-FLOW HYDRONIC SYSTEMS

A. Balance the primary system crossover flow first, then balance the secondary system.

B. Refer to procedures for variable flow hydronic systems.

3.12 PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer, model, and serial numbers.
2. Motor horsepower rating.
3. Motor rpm.
4. Efficiency rating.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass for the controller to prove proper operation. Record observations, including controller manufacturer, model and serial numbers, and nameplate data.

3.13 PROCEDURES FOR CONDENSING UNITS

A. Verify proper rotation of fans.

B. Measure entering- and leaving-air temperatures.

C. Measure and record entering and leaving refrigerant pressures.

D. Record compressor data.

3.14 PROCEDURES FOR TEMPERATURE MEASUREMENTS

A. During TAB, report the need for adjustment in temperature regulation within the automatic temperature-control system.

B. Measure indoor wet- and dry-bulb temperatures every other hour for a period of two successive eight-hour days, in each separately controlled zone, to prove correctness of final temperature settings. Measure when the building or zone is occupied.

C. Measure outside-air, wet- and dry-bulb temperatures.

3.15 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS

A. Perform a preconstruction inspection of existing equipment that is to remain and be reused.
1. Measure and record the operating speed, airflow, and static pressure of each fan.
2. Measure motor voltage and amperage. Compare the values to motor nameplate information.
3. Check the refrigerant charge.
4. Check the condition of filters.
5. Check the condition of coils.
6. Check the operation of the drain pan and condensate drain trap.
7. Check bearings and other lubricated parts for proper lubrication.
8. Report on the operating condition of the equipment and the results of the measurements taken. Report deficiencies.

B. Before performing testing and balancing of existing systems, inspect existing equipment that is to remain and be reused to verify that existing equipment has been cleaned and refurbished.
1. New filters are installed.
2. Coils are clean and fins combed.
3. Drain pans are clean.
4. Fans are clean.
5. Bearings and other parts are properly lubricated.
6. Deficiencies noted in the preconstruction report are corrected.

C. Perform testing and balancing of existing systems to the extent that existing systems are affected by the renovation work.
   1. Compare the indicated airflow of the renovated work to the measured fan airflows and determine the new fan, speed, filter, and coil face velocity.
   2. Verify that the indicated airflows of the renovated work result in filter and coil face velocities and fan speeds that are within the acceptable limits defined by equipment manufacturer.
   3. If calculations increase or decrease the airflow and water flow rates by more than 5 percent, make equipment adjustments to achieve the calculated airflow and water flow rates. If 5 percent or less, equipment adjustments are not required.
   4. Air balance each air outlet and inlet.

3.16 TEMPERATURE-CONTROL VERIFICATION

A. Verify that controllers are calibrated and commissioned.

B. Check transmitter and controller locations and note conditions that would adversely affect control functions.

C. Record controller settings and note variances between set points and actual measurements.

D. Check the operation of limiting controllers (i.e., high- and low-temperature controllers).

E. Check free travel and proper operation of control devices such as damper and valve operators.

F. Check the sequence of operation of control devices. Note air pressures and device positions and correlate with airflow and water flow measurements. Note the speed of response to input changes.

G. Check the interaction of electrically operated switch transducers.

H. Check the interaction of interlock and lockout systems.

I. Record voltages of power supply and controller output. Determine whether the system operates on a grounded or nongrounded power supply.

J. Note operation of electric actuators using spring return for proper fail-safe operations.

3.17 TOLERANCES

A. Set HVAC system airflow and water flow rates within the following tolerances:
   1. Supply, Return, and Exhaust Fans and Equipment with Fans: 0 to plus 10 percent.
   2. Air Outlets and Inlets: 0 plus 10 percent.
   3. Heating-Water Flow Rate: 0 to plus 10 percent.
   4. Cooling-Water Flow Rate: 0 to plus 10 percent.

3.18 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: As Work progresses, prepare reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.19 FINAL REPORT

A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in three-ring binder, tabulated and divided into sections by tested and balanced systems.

B. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.
   1. Include a list of instruments used for procedures, along with proof of calibration.

C. Final Report Contents: In addition to certified field report data, include the following:
   1. Pump curves.
   2. Fan curves.
   3. Manufacturers' test data.
   4. Field test reports prepared by system and equipment installers.
   5. Other information relative to equipment performance, but do not include Shop Drawings and Product Data.

D. General Report Data: In addition to form titles and entries, include the following data in the final report, as applicable:
   1. Title page.
   2. Name and address of TAB firm.
   3. Project name.
   4. Project location.
   5. Architect's name and address.
   6. Engineer's name and address.
   7. Contractor's name and address.
   8. Report date.
   9. Signature of TAB firm who certifies the report.
   10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
   11. Summary of contents including the following:
      a. Indicated versus final performance.
      b. Notable characteristics of systems.
      c. Description of system operation sequence if it varies from the Contract Documents.
   12. Nomenclature sheets for each item of equipment.
   13. Data for terminal units, including manufacturer, type size, and fittings.
   14. Notes to explain why certain final data in the body of reports varies from indicated values.
   15. Test conditions for fans and pump performance forms including the following:
      a. Settings for outside-, return-, and exhaust-air dampers.
      b. Conditions of filters.
      c. Cooling coil, wet- and dry-bulb conditions.
      d. Face and bypass damper settings at coils.
      e. Fan drive settings including settings and percentage of maximum pitch diameter.
      f. Inlet vane settings for variable-air-volume systems.
      g. Settings for supply-air, static-pressure controller.
      h. Other system operating conditions that affect performance.

E. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
   1. Quantities of outside, supply, return, and exhaust airflows.
   2. Water and steam flow rates.
   3. Duct, outlet, and inlet sizes.
   4. Pipe and valve sizes and locations.
   5. Terminal units.
   6. Balancing stations.
   7. Position of balancing devices.

F. Air-Handling Unit Test Reports: For air-handling units with coils, include the following:
   1. Unit Data: Include the following:

a. Unit identification.
b. Location.
c. Make and type.
d. Model number and unit size.
e. Manufacturer's serial number.
f. Unit arrangement and class.
g. Discharge arrangement.
h. Sheave make, size in inches, and bore.
i. Sheave dimensions, center-to-center, and amount of adjustments in inches.
j. Number of belts, make, and size.
k. Number of filters, type, and size.

2. Motor Data:
   a. Make and frame type and size.
   b. Horsepower and rpm.
   c. Volts, phase, and hertz.
   d. Full-load amperage and service factor.
   e. Sheave make, size in inches, and bore.
   f. Sheave dimensions, center-to-center, and amount of adjustments in inches.
3. Test Data (Indicated and Actual Values):
   a. Total airflow rate in cfm.
   b. Total system static pressure in inches wg.
   c. Fan rpm.
   d. Discharge static pressure in inches wg.
   e. Filter static-pressure differential in inches wg.
   f. Preheat coil static-pressure differential in inches wg.
   g. Cooling coil static-pressure differential in inches wg.
   h. Heating coil static-pressure differential in inches wg.
   i. Outside airflow in cfm.
   j. Return airflow in cfm.
   k. Outside-air damper position.
   l. Return-air damper position.
   m. Vortex damper position.

G. Apparatus-Coil Test Reports:
1. Coil Data:
   a. System identification.
   b. Location.
   c. Coil type.
   d. Number of rows.
   e. Fin spacing in fins per inch o.c.
   f. Make and model number.
   g. Face area in sq. ft.
   h. Tube size in NPS.
   i. Tube and fin materials.
   j. Circuiting arrangement.
2. Test Data (Indicated and Actual Values):
   a. Airflow rate in cfm.
   b. Average face velocity in fpm.
   c. Air pressure drop in inches wg.
   d. Outside-air, wet- and dry-bulb temperatures in deg F.
   e. Return-air, wet- and dry-bulb temperatures in deg F.
   f. Entering-air, wet- and dry-bulb temperatures in deg F.
   g. Leaving-air, wet- and dry-bulb temperatures in deg F.
   h. Water flow rate in gpm.
   i. Water pressure differential in feet of head or psig.
   j. Entering-water temperature in deg F.
   k. Leaving-water temperature in deg F.
   l. Refrigerant expansion valve and refrigerant types.
   m. Refrigerant suction pressure in psig.
   n. Refrigerant suction temperature in deg F.

o. Inlet steam pressure in psig.

H. Fan Test Reports: For supply, return, and exhaust fans, include the following:
1. Fan Data:
a. System identification.
b. Location.
c. Make and type.
d. Model number and size.
e. Manufacturer's serial number.
f. Arrangement and class.
g. Sheave make, size in inches, and bore.
h. Sheave dimensions, center-to-center, and amount of adjustments in inches.
2. Motor Data:
a. Make and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Sheave dimensions, center-to-center, and amount of adjustments in inches.
g. Number of belts, make, and size.
3. Test Data (Indicated and Actual Values):
a. Total airflow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Suction static pressure in inches wg.

I. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
1. Report Data:
a. System and air-handling unit number.
b. Location and zone.
c. Traverse air temperature in deg F.
d. Duct static pressure in inches wg.
e. Duct size in inches.
f. Duct area in sq. ft.
g. Indicated airflow rate in cfm.
h. Indicated velocity in fpm.
i. Actual airflow rate in cfm.
j. Actual average velocity in fpm.
k. Barometric pressure in psig.

J. Air-Terminal-Device Reports:
1. Unit Data:
a. System and air-handling unit identification.
b. Location and zone.
c. Test apparatus used.
d. Area served.
e. Air-terminal-device make.
f. Air-terminal-device number from system diagram.
g. Air-terminal-device type and model number.
h. Air-terminal-device size.
i. Air-terminal-device effective area in sq. ft.
2. Test Data (Indicated and Actual Values):
a. Airflow rate in cfm.
b. Air velocity in fpm.
c. Preliminary airflow rate as needed in cfm.
d. Preliminary velocity as needed in fpm.
e. Final airflow rate in cfm.
f. Final velocity in fpm.

g. Space temperature in deg F.

K. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:
1. Unit Data:
a. System and air-handling unit identification.
b. Location and zone.
c. Room or riser served.
d. Coil make and size.
e. Flowmeter type.
2. Test Data (Indicated and Actual Values):
a. Airflow rate in cfm.
b. Entering-water temperature in deg F.
c. Leaving-water temperature in deg F.
d. Water pressure drop in feet of head or psig.
e. Entering-air temperature in deg F.
f. Leaving-air temperature in deg F.

L. Compressor and Condenser Reports: For refrigerant side of unitary systems, stand-alone refrigerant compressors, air-cooled condensing units, or water-cooled condensing units, include the following:
1. Unit Data:
a. Unit identification.
b. Location.
c. Unit make and model number.
d. Compressor make.
e. Compressor model and serial numbers.
f. Refrigerant weight in lb.
g. Low ambient temperature cutoff in deg F.
2. Test Data (Indicated and Actual Values):
a. Inlet-duct static pressure in inches wg.
b. Outlet-duct static pressure in inches wg.
c. Entering-air, dry-bulb temperature in deg F.
d. Leaving-air, dry-bulb temperature in deg F.
e. Condenser entering-water temperature in deg F.
f. Condenser leaving-water temperature in deg F.
g. Condenser-water temperature differential in deg F.
h. Condenser entering-water pressure in feet of head or psig.
i. Condenser leaving-water pressure in feet of head or psig.
j. Condenser-water pressure differential in feet of head or psig.
k. Control settings.
l. Unloader set points.
m. Low-pressure-cutout set point in psig.
n. High-pressure-cutout set point in psig.
o. Suction pressure in psig.
p. Suction temperature in deg F.
q. Condenser refrigerant pressure in psig.
r. Condenser refrigerant temperature in deg F.
s. Oil pressure in psig.
t. Oil temperature in deg F.
u. Voltage at each connection.
v. Amperage for each phase.
w. Kilowatt input.
x. Crankcase heater kilowatt.
y. Number of fans.
z. Condenser fan rpm.
aa. Condenser fan airflow rate in cfm.
bb. Condenser fan motor make, frame size, rpm, and horsepower.
cc. Condenser fan motor voltage at each connection.
dd. Condenser fan motor amperage for each phase.

M. Air-to-Air Heat-Recovery Unit Reports:
1. Unit Data:
a. Unit identification.
b. Location.
c. Service.
d. Make and type.
e. Model and serial numbers.
2. Motor Data:
a. Make and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Sheave dimensions, center-to-center, and amount of adjustments in inches.
3. If fans are an integral part of the unit, include the following for each fan:
a. Make and type.
b. Arrangement and size.
c. Sheave make, size in inches, and bore.
d. Sheave dimensions, center-to-center, and amount of adjustments in inches.
4. Test Data (Indicated and Actual Values):
a. Total exhaust airflow rate in cfm.
b. Purge exhaust airflow rate in cfm.
c. Outside airflow rate in cfm.
d. Total exhaust fan static pressure in inches wg.
e. Total outside-air fan static pressure in inches wg.
f. Pressure drop on each side of recovery wheel in inches wg.
g. Exhaust air temperature entering in deg F.
h. Exhaust air temperature leaving in deg F.
i. Outside-air temperature entering in deg F.
j. Outside-air temperature leaving in deg F.
k. Calculate sensible and total heat capacity of each airstream in MBh.

N. Instrument Calibration Reports:
1. Report Data:
a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

3.20 INSPECTIONS

A. Initial Inspection:
1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the Final Report.
2. Randomly check the following for each system:
a. Measure airflow of at least 10 percent of air outlets.
b. Measure water flow of at least 5 percent of terminals.
c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
d. Measure sound levels at two locations.
e. Measure space pressure of at least 10 percent of locations.
f. Verify that balancing devices are marked with final balance position.
g. Note deviations to the Contract Documents in the Final Report.

B. Final Inspection:
1. After initial inspection is complete and evidence by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Engineer.

2. TAB firm test and balance engineer shall conduct the inspection in the presence of Owner, Architect and Construction Manager.
3. Engineer shall select measurements documented in the final report to be rechecked. The rechecking shall be limited to either 10 percent of the total measurements recorded, or the extent of measurements that can be accomplished in a normal 8-hour business day.
4. If the rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.
6. TAB firm shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes and resubmit the final report.
7. Request a second final inspection. If the second final inspection also fails, Owner shall contract the services of another TAB firm to complete the testing and balancing in accordance with the Contract Documents and deduct the cost of the services from the final payment.

3.21 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional testing, inspecting, and adjusting during near-peak summer and winter conditions.

C. 11 Month Warranty Walk: TAB to perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to report unusual conditions with recommendations of adjustments. TAB Contractor shall allow two days for this work.

END OF SECTION 23 05 93

SECTION 23 07 00 - HVAC INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Insulation Materials:
      a. Cellular glass.
      b. Flexible elastomeric.
      c. Mineral fiber.
   2. Duct liner.
   3. Fire-rated insulation systems.
   4. Insulating cements.
   5. Adhesives.
   6. Mastics.
   7. Sealants.
   8. Factory-applied jackets.
   9. Field-applied fabric-reinforcing mesh.
   10. Field-applied cloths.
   11. Field-applied jackets.
   12. Tapes.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include schedule summary indicating thermal conductivity, thickness, jacket (if applicable), and performance data for each type of insulation application. Summary shall include type of piping/ductwork system, size parameters, location, and other relevant information corresponding to the insulation schedules listed in this specification.

1.3 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
   1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
   2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.5 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing. Refer to “23 05 33 Heat Tracing for HVAC Piping” for more information.

1.6 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. “K” Value: 0.23 at 75 degrees F (0.033 at 24 degrees C.), factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Cell-U-Foam Corporation; Ultra-CUF.
      b. Pittsburgh Corning Corporation; Foamglas Super K.
      c. Superior Plus Construction Products Corporation.
   2. Block Insulation: ASTM C 552, Type I.
   3. Special-Shaped Insulation: ASTM C 552, Type III.
   4. Board Insulation: ASTM C 552, Type IV.
   5. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
   6. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

G. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials. “K” Value: 0.28 at 75 degrees F (0.04 at 24 degrees C.).
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Aeroflex USA Inc.; Aerocel.
      b. Armacell LLC; AP Armaflex.
      c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.
      d. Armstrong
      e. Certainteed
      f. Johns Manville
      g. Knauf Insulation
      h. Owens Corning
      i. Rubatex Corp.

H. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket.

“K” Value: 0.24 at 75 degrees F (0.035 at 24 degrees C.), factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following:
    a. CertainTeed Corp.; Duct Wrap.
    b. Johns Manville; Microlite.
    c. Knauf Insulation; Duct Wrap.
    d. Manson Insulation Inc.; Alley Wrap.
    e. Owens Corning; All-Service Duct Wrap.

I. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. “K” Value: 0.23 at 75 degrees F (0.033 at 24 degrees C.). For duct and plenum applications, provide insulation with factory-applied FSK jacket. For equipment applications, provide insulation with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following:
    a. CertainTeed Corp.; Commercial Board.
    b. Fibrex Insulations Inc.; FBX.
    c. Johns Manville; 800 Series Spin-Glas.
    d. Knauf Insulation; Insulation Board.
    e. Manson Insulation Inc.; AK Board.
    f. Owens Corning; Fiberglas 700 Series.

J. Mineral-Fiber, Preformed Pipe Insulation:

1. Products: Subject to compliance with requirements, provide one of the following:
    a. Fibrex Insulations Inc.; Coreplus 1200.
    b. Johns Manville; Micro-Lok.
    c. Knauf Insulation; 1000 Pipe Insulation.
    d. Manson Insulation Inc.; Alley-K.
    e. Owens Corning; Fiberglas Pipe Insulation.
2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. “K” Value: 0.23 at 75 degrees F (0.033 at 24 degrees C.).Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
3. Type II, 1200 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type II, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

K. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied ASJ complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following:
    a. CertainTeed Corp.; CrimpWrap.
    b. Johns Manville; MicroFlex.
    c. Knauf Insulation; Pipe and Tank Insulation.
    d. Manson Insulation Inc.; AK Flex.
    e. Owens Corning; Fiberglas Pipe and Tank Insulation.

2.2 DUCT LINER

A. Fibrous-Glass Liner: Comply with NFPA 90A or NFPA 90B and with NAIMA AH124.

1. Manufacturers:
    a. CertainTeed Corp.; Insulation Group.
    b. Johns Manville International, Inc.
    c. Knauf Fiber Glass GmbH.
    d. Owens Corning.
2. Materials: ASTM C 1071; surfaces exposed to airstream shall be coated to prevent erosion of glass fibers.

a. Thickness: 1 inch.
b. Thermal Conductivity (k-Value): 0.26 at 75 deg F mean temperature.
c. Fire-Hazard Classification: Maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E 84.
d. Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.
e. Mechanical Fasteners: Galvanized steel suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in duct.
1) Tensile Strength: Indefinitely sustain a 50-lb tensile, dead-load test perpendicular to duct wall.
2) Fastener Pin Length: As required for thickness of insulation and without projecting more than 1/8 inch into airstream.
3) Adhesive for Attaching Mechanical Fasteners: Comply with fire-hazard classification of duct liner system.

B. Round Duct Liner: Johns-Manville Spiracoustic Plus; CertainTeed ToughGard; Owens Corning Quiet Zone.
1. "K" ("ksi") Value: ASTM C C518, 0.23 at 75 degrees F.
2. Noise Reduction Coefficient: .70 per ASTM C 427 (Type A mounting).
3. Maximum Velocity: 6000 fpm (30.5 m/sec.).

2.3 FIRE-RATED INSULATION SYSTEMS

A. Fire-Rated Board: Structural-grade, press-molded, xonolite calcium silicate, fireproofing board suitable for operating temperatures up to 1700 deg F. Comply with ASTM C 656, Type II, Grade 6. tested and certified to provide a 2-hour fire rating by a NRTL acceptable to authority having jurisdiction.

B. Fire-Rated Blanket: High-temperature, flexible, blanket insulation with FSK jacket that is tested and certified to provide a 2-hour fire rating by a NRTL acceptable to authority having jurisdiction.
1. Products: Subject to compliance with requirements, provide one of the following:
a. CertainTeed Corp.; FlameChek.
b. Johns Manville; Firetemp Wrap.
c. Nelson Firestop Products; Nelson FSB Flameshield Blanket.
d. Thermal Ceramics; FireMaster Duct Wrap.
e. 3M; Fire Barrier Wrap Products.
f. Unifrax Corporation; FyreWrap.
g. Vesuvius; PYROSCAT FP FASTR Duct Wrap.

2.4 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Insulco, Division of MFS, Inc.; Triple I.
b. P. K. Insulation Mfg. Co., Inc.; Super-Stik.
c. Rock Wool Manufacturing Company; Delta One Shot.

B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.
1. Products: Subject to compliance with requirements, provide one of the following:
a. P. K. Insulation Mfg. Co., Inc.; Thermal-V-Kote.

C. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Insulco, Division of MFS, Inc.; SmoothKote.
b. P. K. Insulation Mfg. Co., Inc.; PK No. 127, and Quik-Cote.
c. Rock Wool Manufacturing Company; Delta One Shot.

2.5 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Cellular-GlassAdhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Childers Products, Division of ITW; CP-96.
      b. Foster Products Corporation, H. B. Fuller Company; 81-33.
      c. Bakor; 830-05.

C. Flexible Elastomeric: Comply with MIL-A-24179A, Type II, Class I.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Aeroflex USA Inc.; Aeroseal.
      b. Armacell LCC; 520 Adhesive.
      c. Foster Products Corporation, H. B. Fuller Company; 85-75.
      d. RBX Corporation; Rubatex Contact Adhesive.

D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Childers Products, Division of ITW; CP-82.
      b. Foster Products Corporation, H. B. Fuller Company; 85-20.
      c. ITW TACC, Division of Illinois Tool Works; S-90/80.
      d. Marathon Industries, Inc.; 225.
      e. Mon-Eco Industries, Inc.; 22-25.

E. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Childers Products, Division of ITW; CP-82.
      b. Foster Products Corporation, H. B. Fuller Company; 85-20.
      c. ITW TACC, Division of Illinois Tool Works; S-90/80.
      d. Marathon Industries, Inc.; 225.
      e. Mon-Eco Industries, Inc.; 22-25.

F. PVC Jacket Adhesive: Compatible with PVC jacket.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Dow Chemical Company (The); 739, Dow Silicone.
      b. Johns-Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
      c. P.I.C. Plastics, Inc.; Welding Adhesive.
      d. Red Devil, Inc.; Celulon Ultra Clear.
      e. Speedline Corporation; Speedline Vinyl Adhesive.

2.6 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Childers Products, Division of ITW; CP-35.
      b. Foster Products Corporation, H. B. Fuller Company; 30-90.
      c. ITW TACC, Division of Illinois Tool Works; CB-50.
      d. Marathon Industries, Inc.; 590.
      e. Mon-Eco Industries, Inc.; 55-40.
      f. Vimasco Corporation; 749.
   2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.

3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
5. Color: White.

C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below ambient services.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Childers Products, Division of ITW; CP-30.
b. Foster Products Corporation, H. B. Fuller Company; 30-35.
c. ITW TACC, Division of Illinois Tool Works; CB-25.
d. Marathon Industries, Inc.; 501.
e. Mon-Eco Industries, Inc.; 55-10.
2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.
3. Service Temperature Range: 0 to 180 deg F.
4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
5. Color: White.

D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Childers Products, Division of ITW; Encacel.
b. Foster Products Corporation, H. B. Fuller Company; 60-95/60-96.
c. Marathon Industries, Inc.; 570.
d. Mon-Eco Industries, Inc.; 55-70.
2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
3. Service Temperature Range: Minus 50 to plus 220 deg F.
4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
5. Color: White.

E. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Childers Products, Division of ITW; CP-10.
b. Foster Products Corporation, H. B. Fuller Company; 35-00.
c. ITW TACC, Division of Illinois Tool Works; CB-05/15.
d. Marathon Industries, Inc.; 550.
e. Mon-Eco Industries, Inc.; 55-50.
f. Vimasco Corporation; WC-1/WC-5.
2. Water-Vapor Permeance: ASTM F 1249, 3 perms at 0.0625-inch dry film thickness.
3. Service Temperature Range: Minus 20 to plus 200 deg F.
4. Solids Content: 63 percent by volume and 73 percent by weight.
5. Color: White.

2.7 SEALANTS

A. Joint Sealants:
1. Joint Sealants for Cellular-Glass: Subject to compliance with requirements, provide one of the following:
a. Childers Products, Division of ITW; CP-76.
b. Foster Products Corporation, H. B. Fuller Company; 30-45.
c. Marathon Industries, Inc.; 405.
d. Mon-Eco Industries, Inc.; 44-05.
e. Pittsburgh Corning Corporation; Pittseal 444.
f. Vimasco Corporation; 750.

B. FSK and Metal Jacket Flashing Sealants:
1. Products: Subject to compliance with requirements, provide one of the following:
a. Childers Products, Division of ITW; CP-76-8.
b. Foster Products Corporation, H. B. Fuller Company; 95-44.
c. Marathon Industries, Inc.; 405.
d. Mon-Eco Industries, Inc.; 44-05.
e. Vimasco Corporation; 750.
2. Materials shall be compatible with insulation materials, jackets, and substrates.

3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.

C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:
1. Products: Subject to compliance with requirements, provide one of the following:
a. Childers Products, Division of ITW; CP-76.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.

2.8 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
5. Vinyl Jacket: White vinyl with a permeance of 1.3 perms when tested according to ASTM E 96, Procedure A, and complying with NFPA 90A and NFPA 90B.

2.9 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Johns Manville; Zeston.
b. P.I.C. Plastics, Inc.; FG Series.
c. Proto PVC Corporation; LoSmoke.
d. Speedline Corporation; SmokeSafe.
2. Adhesive: As recommended by jacket material manufacturer.
3. Color: White.
4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
5. Factory-fabricated tank heads and tank side panels.

D. Metal Jacket:
1. Products: Subject to compliance with requirements, provide one of the following:
a. Childers Products, Division of ITW; Metal Jacketing Systems.
b. PABCO Metals Corporation; Surefit.
c. RPR Products, Inc.; Insul-Mate.
2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105 or 5005, Temper H-14.
a. Factory cut and rolled to size.
b. Finish and thickness are indicated in field-applied jacket schedules.
c. Moisture Barrier for Indoor Applications: 3-mil thick, heat-bonded polyethylene and kraft paper.

d. Moisture Barrier for Outdoor Applications: 3-mil thick, heat-bonded polyethylene and kraft paper.
e. Factory-Fabricated Fitting Covers:
1) Same material, finish, and thickness as jacket.
2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
3) Tee covers.
4) Flange and union covers.
5) End caps.
6) Beveled collars.
7) Valve covers.
8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.10 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
b. Compac Corp.; 104 and 105.
c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
2. Width: 3 inches.
3. Thickness: 11.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
b. Compac Corp.; 110 and 111.
c. Ideal Tape Co., Inc., an American Biltrite Company; 491 AWF FSK.
d. Venture Tape; 1525 CW, 1528 CW, and 1528 CW/SQ.
2. Width: 3 inches.
3. Thickness: 6.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0555.
b. Compac Corp.; 130.
c. Ideal Tape Co., Inc., an American Biltrite Company; 370 White PVC tape.
d. Venture Tape; 1506 CW NS.
2. Width: 2 inches.
3. Thickness: 6 mils.
4. Adhesion: 64 ounces force/inch in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.

b. Compac Corp.; 120.
c. Ideal Tape Co., Inc., an American Biltrite Company; 488 AWF.
d. Venture Tape; 3520 CW.

2. Width: 2 inches.
3. Thickness: 3.7 mils.
4. Adhesion: 100 ounces force/inch in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch in width.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
1. Verify that systems and equipment to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
   1. Install insulation continuously through hangers and around anchor attachments.
   2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
   3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
   4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:
   1. Draw jacket tight and smooth.
   2. Cover circumferential joints with 3-inch wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
   3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.
      a. For below ambient services, apply vapor-barrier mastic over staples.
   4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
   5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above ambient services, do not install insulation to the following:
   1. Vibration-control devices.
   2. Testing agency labels and stamps.
   3. Nameplates and data plates.
   4. Manholes.
   5. Handholes.
   6. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
   1. Seal penetrations with flashing sealant.
   2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
   3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
   4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
   1. Seal penetrations with flashing sealant.
   2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
   3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
   4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions. Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.
   1. Comply with requirements in Division 07 Section "Penetration Firestopping" firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:
   1. Duct: Install insulation continuously through floor penetrations that are not fire rated. For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
   2. Pipe: Install insulation continuously through floor penetrations.
   3. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions for Heating Water and Chilled Water.
   1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
   2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
   3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
   4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
   5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe

diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.

6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gauges, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:
1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 MINERAL-FIBER INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:
1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:
1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:
1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

E. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.

2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
    a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    d. Do not overcompress insulation during installation.
    e. Impale insulation over pins and attach speed washers.
    f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
    a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches.
5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

F. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
    a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    d. Do not overcompress insulation during installation.
    e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
    a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches.
5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.8 APPLICATION OF LINER IN RECTANGULAR DUCTS

A. The net free area of the duct dimensions on the Contract Documents shall be maintained. Increase metal duct dimensions as necessary to compensate for addition of the liner.

B. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.

C. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.

D. Butt transverse joints without gaps and coat joint with adhesive.

E. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.

F. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and standard liner product dimensions make longitudinal joints necessary.

G. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm

H. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.

I. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:
    1. Fan discharges.
    2. Intervals of lined duct preceding unlined duct.
    3. Upstream edges of transverse joints in ducts where air velocities are greater than 2500 fpm or where indicated.

3.9 Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

3.10 FIELD-APPLIED JACKET INSTALLATION

A. Where FSK jackets are indicated, install as follows:
   1. Draw jacket material smooth and tight.
   2. Install lap or joint strips with same material as jacket.
   3. Secure jacket to insulation with manufacturer's recommended adhesive.
   4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch wide joint strips at end joints.
   5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

B. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.
   1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

C. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.11 FIRE-RATED INSULATION SYSTEM INSTALLATION

A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.

B. Insulate duct access panels and doors to achieve same fire rating as duct.

C. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Division 07 Section "Penetration Firestopping."

3.12 FINISHES

A. Duct, Equipment, and Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.
   1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
      a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work. Coordinate with interior finish plans.

D. Do not field paint aluminum or stainless-steel jackets.

3.13 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:
   1. Indoor, concealed supply and outdoor air.
   2. Indoor, exposed supply and outdoor air.
   3. Indoor, concealed return located in nonconditioned space.
   4. Indoor, exposed return located in nonconditioned space.

5. Indoor, concealed exhaust or relief between isolation damper and penetration of building exterior.
6. Indoor, exposed exhaust or relief between isolation damper and penetration of building exterior.
7. Outdoor, concealed supply and return.
8. Outdoor, exposed supply and return.
9. Indoor, dryer/kiln vent ductwork.
10. Indoor, round supply duct liner as denoted.

B. Items Not Insulated:
1. Fibrous-glass ducts.
2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
3. Factory-insulated flexible ducts.
4. Factory-insulated plenums and casings.
5. Flexible connectors.
6. Vibration-control devices.
7. Factory-insulated access panels and doors.

3.14 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed, rectangular, round and flat-oval, supply-air duct insulation shall be the following:
1. Mineral-Fiber Blanket: 1-1/2 inches thick.

B. Concealed, rectangular, round and flat-oval, outdoor-air duct insulation shall be the following:
1. Mineral-Fiber Blanket: 1-1/2 inches thick.
2. Mineral-Fiber Board: 1-1/2 inches thick.

C. Concealed, rectangular, round and flat-oval, exhaust-air and relief-air duct insulation shall be the following:
1. Mineral-Fiber Blanket: 1-1/2 inches thick.

D. Concealed, supply-air plenum insulation shall be one of the following:
1. Mineral-Fiber Blanket: 1-1/2 inches thick.
2. Mineral-Fiber Board: 1-1/2 inches thick.

E. Concealed, outdoor-air plenum insulation shall be the following:
1. Mineral-Fiber Blanket: 1-1/2 inches thick.
2. Mineral-Fiber Board: 1-1/2 inches thick.

F. Concealed, exhaust-air plenum insulation shall be one of the following:
1. Mineral-Fiber Blanket: 1-1/2 inches thick.
2. Mineral-Fiber Board: 1-1/2 inches thick.

G. Concealed, Dryer Vent
1. Fire Rated Insulation Blanket: Thickness as required to achieve 2-hour fire rating.

H. Exposed, rectangular, round and flat-oval, supply-air duct insulation in unconditioned spaces shall be the following:
1. Mineral-Fiber Blanket: 1-1/2 inches thick.

I. Exposed, rectangular, round and flat-oval, outdoor-air duct insulation shall be one of the following:
1. Mineral-Fiber Blanket: 1-1/2 inches thick.
2. Mineral-Fiber Board: 1-1/2 inches thick.

J. Exposed, rectangular, round and flat-oval, exhaust-air or relief air duct insulation shall be the following:

1. Mineral-Fiber Blanket: 1-1/2 inches thick.

K. Exposed, supply-air plenum insulation shall be one of the following:
1. Mineral-Fiber Blanket: 1-1/2 inches thick.
2. Mineral-Fiber Board: 1-1/2 inches thick.

L. Exposed, outdoor-air plenum insulation shall be one of the following:
1. Mineral-Fiber Blanket: 1-1/2 inches thick.
2. Mineral-Fiber Board: 1-1/2 inches thick.

M. Exposed, exhaust-air plenum insulation shall be one of the following:
1. Mineral-Fiber Blanket: 1-1/2 inches thick.
2. Mineral-Fiber Board: 1-1/2 inches thick.

3.15 EQUIPMENT INSULATION SCHEDULE

A. Insulation materials and thicknesses are identified below. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option.

B. Insulate indoor and outdoor equipment in paragraphs below that is not factory insulated.

C. VAV terminal unit coil sections shall be the following:
1. Mineral Fiber Blanket: 1-1/2 inches thick and 0.75 lb./cu.ft. nominal density.

3.16 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

3.17 INDOOR PIPING INSULATION SCHEDULE

A. Condensate and Equipment Drain Water below 60 Deg F:
1. All Pipe Sizes: Insulation shall be one of the following:
a. Flexible Elastomeric: 3/4 inch thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

B. Chilled Water and Brine, 40 Deg F and below:
1. NPS 1-1/2 and Smaller: Insulation shall be the following:
a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inch thick.
2. NPS 2 to NPS 12: Insulation shall be the following:
a. Mineral-Fiber, Preformed Pipe, Type I: 1-1/2 inches thick.

C. Chilled Water and Brine, above 40 Deg F:
1. NPS 1-1/2 and Smaller: Insulation shall be the following:
a. Mineral-Fiber, Preformed Pipe, Type I: 1-1/2 inch thick.
2. NPS 2 inch and Larger: Insulation shall be the following:
a. Mineral-Fiber Preformed Pipe, Type I: 1-1/2 inches thick.

D. Heating-Hot-Water Supply and Return, 200 Deg F and below:
1. NPS 1-1/2 and Smaller: Insulation shall be the following:
a. Mineral-Fiber, Preformed Pipe, Type I: 1-1/2 inch thick.
2. NPS 2 inch and Larger: Insulation shall be the following:
a. Mineral-Fiber, Preformed Pipe, Type I: 2 inches thick.

E. Refrigerant Liquid, Suction and Hot-Gas Piping:
1. All Pipe Sizes: Insulation shall be the following:
a. Flexible Elastomeric: 1-1/2 inch thick.

3.18 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Ducts and Plenums, Concealed:
1. None.

D. Ducts and Plenums, Exposed:
1. None.

E. Equipment, Concealed:
1. None.

F. Equipment, Exposed:
1. None.

G. Piping, Concealed:
1. None.

H. Piping, Exposed (in Finished Spaces):
1. PVC: 30 mils thick.
2. Aluminum, Stucco Embossed: 0.020 inch thick.

3.19 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Refrigerant Suction, Liquid and Hot Gas Bypass
1. All Pipe Sizes: Insulation shall be the following:
a. Flexible Elastomeric: 1 inch thick with PVC protective jacketing.

END OF SECTION 23 07 00

SECTION 23 09 00 – HVAC DIRECT DIGITAL CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. The provisions of the General Conditions, Sections included under Division 1, General Requirements, and Section 230500 of this Division are included as a part of this Section as though bound herein.

C. Refer to Construction Documents.

D. Refer to Section 230993 – HVAC Sequence of Operations.

1.2 SUMMARY

A. The contractor shall fully integrate new equipment, sensors, etc. into the districts existing Automated Logic Corporation (ALC) building automation system (BAS), utilizing the districts Ethernet and unitary controller communication networks. Coordinate requirements with existing systems prior to installation.

B. The integration of new equipment, sensors, etc. into the control system shall be performed under the direct supervision of the controls manufacturer with the shop drawings, flow diagrams, bill of materials, component designation or identification number, and sequence of operation all bearing the name of the manufacturer. The installing contractor shall certify, in writing, that the shop drawings have been prepared by the equipment manufacturer and that the equipment manufacturer shall certify, in writing, that the shop drawings were prepared by their company and that all temperature control equipment was installed under their direct supervision.

C. The installed controls system to utilize BACnet protocol only by BACnet Testing Labs (BTL) and BTL Certified. To allow the owner future flexibility in making additions to the system, the system shall utilize an open protocol across the entire system. The protocol selected by this Owner is BACnet as defined by ASHRAE in the latest published revision. Coordinate with existing BAS.

D. All materials and equipment used shall be standard components, regularly manufactured for the specified system. All systems and components shall have been thoroughly tested and proven in actual use of at least 2 years.

E. The contractor shall be responsible for:
   1. Integration of new equipment, sensors, etc. into the existing DDC electronic automatic temperature control system.
   2. Coordinating installation and integration with field conditions and existing BAS.
   3. Control of air handling units, VAV terminals, fan coil units, unit ventilators, and unit heaters, as denoted on drawings, etc. in accordance with requirements herein specified.
   4. Providing of control devices, valves, instruments, and the like, as herein specified and as required to comply with required sequences of automatic control.
   5. Providing of wiring for secondary control devices, relay switches, safety low limit controls, etc., and such interlock wiring required.
   6. Furnishing adequate supervision on Work performed for him by others to insure proper operation and the neatest and best possible arrangement.
   7. Testing, maintenance of system as herein specified.
   8. Providing all necessary transformers for low voltage control wiring requirements.
   9. The Contractor is required to provide all necessary control panels and 120V power to those panels for a complete system. All 120V wiring shall meet the requirements of the electrical specifications.

10. Integration with variable frequency controllers, air handling units, and other equipment and control devices specified in other sections of the specifications.
11. Providing all control wiring, conduit, junction boxes, etc. as required.
12. The drawings show locations where control panels shall be installed, and they show 120 volt power wiring to each control panel. If the temperature control system design prepared by the Contractor requires additional panels, all such additional panels shall be provided at no additional cost to the Owner and shall be installed only in locations approved by the Architect / Engineer.
    a. The Temperature Control Prime shall provide all additional 120 volt power required for operation of the temperature control system at no additional cost to the Owner. Connection locations for sources for any additional power circuits shall be submitted for approval. All additional 120 volt wiring shall meet the requirements of Division 26.
13. This contractor shall provide labeling to all control system sensors, panels, devices and actuators. The label names shall match the point names labeled in the control graphics and as-built drawings.
14. The temperature control contractor is responsible to have all new equipment, sensors, etc. integrated into the temperature control system by the date of Substantial Completion of the project.

F. The contractor shall read all other Drawings and Specifications, become familiar with requirements and scope of the Project, and include such coordination work as may be required.

G. HVAC Control System shall be installed such that individual control equipment can be replaced by similar control equipment from other equipment manufacturers with no loss of system functionality.

H. HVAC Control System shall be installed and configured such that other fully trained and certified contractors are able to perform repair, replace, and upgrade individual hardware without further interaction with the installing contractor.

I. The installing contractor shall provide all necessary documentation, data, configuration information, configuration tools, programs, drivers, and other software such that other fully trained and certified contractors are able to perform repair, replacement, upgrades, and expansions of the system without subsequent or future dependence on the installing contractor.

J. Associated Services: Cooperate with test and balance contractor performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. Access to the work.
2. Incidental labor and facilities necessary to facilitate tests, inspections, and recalibration.
3. Provide access password in controls system.

K. Temperature control contractor shall display all DDC points and set points on graphics and linked text screens and make all these points and set points adjustable with the ability to restrict any point and set point from being adjustable through multiple level/tiered password protection.

L. The equipment provided with factory mounted controllers and programmed by the unit manufacturer. The Temperature Control Contractors shall integrate with these controllers for seamless operation. Coordinate requirements with unit manufacturer.

M. Related Sections include the following:
1. Division 23 Section "Sequence of Operations for HVAC Controls" for requirements that relate to this Section.

1.3 SYSTEM DESCRIPTION

A. The existing system is the ALC WebCTRL system. Provide all hardware and software modifications necessary to integrate all new equipment, sensors, points, etc. into the existing system.
   1. The Temperature Control contractor shall be responsible for all controls including building DDC controls, all connectivity, and all items required for a complete system integration of BACnet DDC system.
   2. Provide all necessary hardware, software, programming and node license to provide a complete operating communication system. All graphics, graphic software and associated licenses shall be owned by Dublin City Schools.

1.4 SUBMITTALS

A. The BAS subcontractor shall submit the following information to the Engineer for review with their bid package;
   1. Enterprise Network Architecture Map, a schematic riser diagram depicting the enterprise level network including the Enterprise Server and each System Controller.
   2. Building Network Architecture Map, a schematic riser diagram showing the network layout in each of the project buildings including all existing network components that the contractor intends to re-use.
   3. Manufacturer’s Product Data Sheets for major system components..
   4. A letter confirming that the contractors proposed solution meets all requirements of this specification in intent and specific requirement. The letter shall indicate by section any deviations from this specification.
   5. A project schedule indicative of the contractor’s plan to complete the project with minimal disruption to the Owner’s educational efforts and in accordance with the Engineer’s overall project schedule.

B. Control Diagrams
   1. Prior to installation and as required, submit to the Architect/Engineer a complete system diagram, showing control connections and devices and their connection to other equipment, together with a clearly written description of the system and an outline of its function under conditions of operation.
   2. Submittals shall be prepared on, or folded to, 8-1/2 inch by 11 inch size and bound in brochure form.
   3. DDC logic and control diagrams shall be included for all equipment and sequences of control.
   4. Upon completion of the Work, provide the complete, accurate, and approved diagrammatic blueprinted layouts on the automatic control system specified herein and as installed. Layouts shall show all control equipment including job installation changes, and the function of each system shall be indicated. Layouts and descriptions shall be included in the project record set and in the operating and maintenance manuals.
   5. Final points list to be provided prior to control programming.
   6. Schedule of dampers including size, leakage, and flow characteristics.
   7. Schedule of valves including close-off and flow characteristics.
   8. Schedule of air flow measuring equipment including size, velocities, and flow at minimum and maximum air flow.

C. Equipment
   1. Submit shop drawings for the Architect/Engineer's approval on all, but not limited to, the following equipment and components indicating arrangements, capacities, range, voltage, horsepower, construction.
      a. Valves
      b. Thermostats
      c. Relays
      d. Panels
      e. Gauges
      f. Sensors
      g. Dampers
      h. Switches

i. Pressure Controllers
j. DDC microprocessor
k. Unitary DDC controllers
l. Actuators
m. Airflow measuring stations

D. Project Record Documents: The Temperature Control Contractor shall provide the Owner with a complete set of all final documentation including final sequence of operations and system diagrams. Refer to Division 01.

E. Controls Graphics
1. Equipment Graphics shall match the existing BAS graphics.

F. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.
1. DDC System Hardware: Bill of materials of equipment indicating quantity, manufacturer, and model number. Include technical data for operator workstation equipment, interface equipment, control units, transducers/transmitters, sensors, actuators, valves, relays/switches, control panels, and operator interface equipment.
2. Control System Software: Include technical data for operating system software, operator interface, color graphics, and other third-party applications.
3. Controlled Systems: Instrumentation list with element name, type of device, manufacturer, model number, and product data. Include written description of sequence of operation including schematic diagram.

G. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
1. Bill of materials of equipment indicating quantity, manufacturer, and model number.
2. Schematic flow diagrams showing fans, pumps, coils, dampers, valves, and control devices.
3. Wiring Diagrams: Power, signal, and control wiring.
4. Details of control panel faces, including controls, instruments, and labeling.
5. Schedule of valves including flow characteristics.
6. DDC System Hardware:
a. Wiring diagrams for control units with termination numbers.
b. Schematic diagrams and floor plans for field sensors and control hardware.
c. Schematic diagrams for control, communication, and power wiring, showing trunk data conductors and wiring between operator workstation and control unit locations.
7. Control System Software: List of color graphics indicating monitored systems, data (connected and calculated) point addresses, output schedule, and operator notations.
8. Controlled Systems:
a. Schematic diagrams of each controlled system with control points labeled and control elements graphically shown, with wiring.
b. Scaled drawings showing mounting, routing, and wiring of elements including bases and special construction.
c. Written description of sequence of operation including schematic diagram.
d. Points list.

H. Provide a BACnet Protocol Implementation Conformance Statement (PICS) for each BACnet system level device (i.e. Building Controller & Operator Workstations) type. This defines the points list for proper coordination of interoperability with other building systems if applicable for this project.

1.5 PROJECT RECORD DOCUMENTS

A. Submit three copies of record (as-built) documents upon completion of installation for approval prior to final completion. Each building shall be submitted independently. Submittal shall consist of:

1. Project Record Drawings. As-built versions of submittal shop drawings provided as AutoCAD 2020 (or newer) compatible files on magnetic or optical disk (file format: .DWG, .DXF, .VSD, or comparable) and 6 prints of each drawing on 11" x 17" paper.
2. Operation and Maintenance (O&M) Manual. Printed, electronic, and online help documentation of the following:
    a. As-built versions of submittal product data.
    b. Names, addresses, and telephone numbers of installing contractors and service representatives for equipment and control systems.
    c. Operator's manual with procedures for operating control systems: logging on and off, handling alarms, producing point reports, trending data, overriding computer control, and changing setpoints and variables.
    d. Programming manual or set of manuals with description of programming language and syntax, of statements for algorithms and calculations used, of point database creation and modification, of program creation and modification, and of editor use.
    e. Engineering, installation, and maintenance manual or set of manuals that explains how to design and install new points, panels, and other hardware; how to perform preventive maintenance and calibration; how to debug hardware problems; and how to repair or replace hardware.
    f. Documentation of programs created using custom programming language including setpoints, tuning parameters, and object database. Electronic copies of programs shall meet this requirement if control logic, setpoints, tuning parameters, and objects can be viewed using furnished programming tools.
    g. Graphic files, programs, and database on magnetic or optical media.
    h. List of recommended spare parts with part numbers and suppliers.
    i. Complete original-issue documentation, installation, and maintenance information for furnished third-party hardware including computer equipment and sensors.
    j. Complete original-issue copies of furnished software, including operating systems, custom programming language, operator workstation or web server software, and graphics software.
    k. Licenses, guarantees, and warranty documents for equipment and systems.
    l. Recommended preventive maintenance procedures for system components, including schedule of tasks such as inspection, cleaning, and calibration; time between tasks; and task descriptions.
    m. All adjustable setpoint ranges shall be included in the as-built sequences. For systems that do not have this feature, all sensor inputs shall be required to be brought into a virtual point so that virtual points can be manipulated for system testing.

1.6 QUALITY ASSURANCE

A. Electrical components shall be UL listed.

B. Damper components shall comply with AMCA 500.

C. Energy management components shall comply with NEMA EMCI.

D. Enclosures shall comply with NEMA 250.

E. Electrical requirements shall meet NFPA 70.

F. Installation as a part of the HVAC system shall comply with NFPA 90A.

G. Central system shall meet the requirements of ASHRAE Standard 90.1.

1.7 CONTRACTOR RESPONSIBILITIES

A. The contractor shall furnish and install a fully integrated building automation system that seamlessly integrates new digital unitary controllers into the districts existing Automated Logic Corporation (ALC) building automation system (BAS), utilizing the districts Ethernet and unitary

controller communication networks. Coordinate requirements with existing systems prior to installation.

B. The contractor shall be responsible for final design drawings, installation of all control wiring and control devices in accordance with National Electric Code. The temperature control contractor shall also be responsible for startup and complete checkout of the systems.

C. This Contractor shall furnish complete drawings, component lists, specification sheets and sequences of operation to the Engineer for approval before start of installation.

D. After corrections and any job installation changes, 6 sets of full drawings, parts lists, specification sheets, and operation and maintenance manuals are to be furnished to the Owner.

E. All DDC logic diagrams shall be updated as built and included in the Operation and Maintenance Manuals for the Owner.

F. The contractor is responsible to use all room numbers developed and approved by the Owner in the development of the temperature control system for this building. Coordinate with existing BAS.

G. This Contractor shall assist the Test and Balance Procedures as required to complete his work.

H. Coordinate specific equipment graphics, control points and alarm reporting with the Owners' representative.

I. The Contractor is responsible to label all temperature control system sensors, control panels, control dampers and operators, and control valves and operators. Label names shall match the point names of the control system and on the as-built drawings.

J. Contractor shall be responsible for the accurate location of their Work and for informing themselves of the nature and arrangement of the materials, equipment, and construction to which their Work attaches or passes through.

K. In general, work shall be concealed in walls in conduit and above ceilings in wire management systems, conduit in chases, and in equipment rooms, insofar as is practical; so that such work will not interfere with the proper coordinated installation work of other trades or Contractors.

L. In general, wiring, and conduit shall be installed parallel (or at right angles) to the building walls, and at such heights as not to obstruct any portion of windows, doorways, stairways, pipe space, tunnels, or passageways, and properly concealed to not interfere with the proper coordinated installation of other trades or Contractors. Where interferences develop in the field, the Work shall be offset or routed as required to clear such interferences. Consult all bid documents and coordinate with other Contractors before installing work.

1.8 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Heating and cooling piping:
   1. Control valves
   2. Coordinate locations with all Contractors
   3. Other items noted on the Drawings

1.9 PRODUCTS NOT FURNISHED OR INSTALLED BUT INTEGRATED WITH THE WORK OF THIS SECTION

A. Communications with Third Party Equipment:
   1. Any additional integral control systems included with the products integrated with the work of this section shall be furnished with a BACnet interlace for integration into the Direct Digital Control System described in this section.

B. Section 23 62 00 – Packaged Condensing Units

C. Section 23 82 19 – Fan Coil Units

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. The temperature control system specification is based on products manufactured by one of the following manufacturers. All approved systems must integrate to an acceptable open protocol, web browser system. The system shall be designed, manufactured, engineered, and demonstrated by employees in the direct employment of the manufacturer. Electrical wiring may be subcontracted to a licensed electrical contractor with low voltage controls experience. Installation of new control valves may be subcontracted to a licensed mechanical contractor with relevant experience. The Controls Contractor shall provide adequate supervision and quality control for each installing subcontractor.
   1. Automated Logic installed by:
      a. Factory Branch
      b. Premier Energy Systems
      c. Emcor Services
      d. Limbach Company

B. The intent of this specification is to provide a peer-to-peer networked, stand-alone, distributed control system with the capability to integrate both the ANSI/ASHRAE Standard 135-1995 BACnet technology communication protocols in one open, interoperable system.
   1. BAS controllers shall be listed by BACnet Testing Laboratories (BTL) with appropriate classification.
      a. Enterprise Server shall be BTL listed BACnet Advanced Operator Workstation (B-AWS). Servers listed only as BACnet Operator Workstation (B-OWS) are not acceptable.
      b. System Controller shall be BTL listed BACnet Building Controller (B-BC).
      c. Equipment Controllers shall be BACnet Advanced Application Controller (B-AAC) for use in higher level applications; Air Handling Units, Central Plants and other locations as appropriate for the purpose of the controller.
   2. Equipment Controllers shall be BTL listed BACnet Application Specific Controller (B-ASC) for use in simple control applications; Unit Heaters, VAV Boxes, Exhaust Fans and other locations as appropriate for the purpose of the controller.

C. The temperature control contractor shall have 10 years' experience and be licensed or certified by the controls manufacturer in the installation of the same size of control system as proposed.

2.2 CONTROL VALVES

A. Control Valves: Factory fabricated, of type, body material, and pressure class based on maximum pressure and temperature rating of piping system, unless otherwise indicated.

B. Ball Valves NPS 2" and smaller: Bronze body, stainless steel ball and stem, two or three port as indicated on drawings, seats PTEF or TFE, 600 WOG/ANSI 250 , 35 degree F. to 250 degree F. temperature rating, equal percentage control characteristic, 90 degree rotation control. Sizing: 5 psig maximum pressure drop at design flow rate and to close against pump shutoff head.

C. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics for globe valves. Two-way and three-way valves shall have equal percentage characteristics for ball valves.

D. Sizing of Valves: Valves shall be furnished to the HVAC Contractor who will mount them as piping is installed. Valve sizes shall be as recommended by the temperature control manufacturer who shall be responsible for their proper sizing, regardless of indicated valve or line size on Drawings. Water valves shall not exceed 5 psi pressure drop, unless otherwise stipulated.

2.3 VALVE AND DAMPER OPERATORS

A. Damper Operators
   1. Damper operators shall be electronic, spring return, low voltage (24VAC), and shall be properly sized so as to stroke the damper smoothly and efficiently throughout its range. Actuator response shall be linear in response to sensed load.
      a. Damper operators on outside air intakes shall be spring return closed.
      b. Damper operators on return dampers shall be spring return open.
      c. Damper operators on pressure dampers shall be spring return closed.
      d. All non-spring return damper must have manual override ability built into the actuator.
   2. Operators shall have ample power to overcome damper linkage friction and 200 percent of the torque required. Provide not less than one damper operator for each 25 square feet of damper area.
   3. All damper operators shall be warranted for 5 years from date of manufacturing.

B. Valve Operators
   1. Valve actuators shall be electronic or floating type, low voltage (24VAC), and properly selected for the valve body, service, and DDC control functions.
   2. Actuators shall be fully proportioning and be spring return for normally open or normally closed operation as called out in the sequence of operations.
      a. Heating valves on units that have outdoor air connections shall be spring return open.
      b. Heating valves on units that do not have outdoor air connections do not require spring return.
      c. All non-spring valves must have manual override ability built into the actuator.
   3. All valve operators shall be warranted for 5 years from date of manufacturing.
   4. All non-spring return valves must have manual override ability built into the actuator.

2.4 RELAYS

A. Electric
   1. Where required, provide relays for energizing or re-energizing the various branch circuits, in response to master control panels. Relays shall be UL labeled and sized for not less than 140 percent of the connected amperage load. Relays shall be rated for the system voltage and have proper throw and poles.

2.5 SENSING DEVICES

A. All field mounted sensors shall be field labeled/tagged with common identification terminology as to their system identification and function.

B. Mount all wall mounted sensors at 44” AFF to the bottom of device.

C. Multifunctional Temperature & Carbon Dioxide Sensors (TYPE M)
   1. Install wall mounted sensors as indicated on the construction documents. Controller shall be low profile, unobtrusive design and shall include a dual analog output (0-10V and 4-20mA).
   2. Slide temperature adjustment potentiometer and mounting/wiring sub-base. Slide potentiometer shall be configured to allow for a 3 degree deadband operating range.
   3. Temperature sensor shall accurate within +/- 1 percent of reading.
   4. Carbon dioxide sensor shall be a non-dispersive infrared (NDIR) absorption sensor calibrated for measurements within 0 to 2000 ppm range, +/- 5% of reading. Controller shall be self calibrating with drift compensation algorithm, such as Automatic Background Calibration (ABC) logic, to eliminate the need for calibration under normal usage and the device shall have a manufacture’s lifetime calibration guarantee.
   5. Install wall mounted sensors where indicated on the Construction Drawings.
   6. Manufacturer/Model: GE Telaire-NSP, BAPI, Honeywell, Johnson Controls, Reliable Controls, Schneider Electric, Siemens and Trane.

D. Wall Mounted Non-Adjustable Temperature Sensors (TYPE S)
   1. Temperature thermostats shall be Precon Type-3 or equal thermistors utilizing a 10K ohm thermistor. Manufactured of a flush mount stainless steel cover plate, indicating its purpose or system manufacturer, for protection from elements when installed in the sensors operating environment. Sensor cover shall be provided with tamperproof screws.
   2. Install wall mounted temperature sensors where indicated on Construction Drawings.
   3. Wall mounted non-adjustable temperature sensors for a single-zone air-handler system shall also be equipped with a simple push-button style occupancy over-ride button in addition to the requirement described above.

E. Wall Mounted Electronic Room Temperature Only Sensors (TYPE T)
   1. Temperature sensors shall be Precon type-3 or equal thermistors utilizing a 10K ohm thermistor. Sensors shall be manufactured in a durable epoxy housing and shall be enclosed for protection from elements when installed in the sensors operating environment. The sensor cover shall be provided with tamperproof screws.
   2. Install wall mounted temperature sensors where indicated on Construction Drawings.
   3. The range of set point adjustment shall be initially programmed for +/- 2 □F.
   4. Provide LCD temperature display
   5. Provide unoccupied override pushbutton on each thermostat.
   6. If Type T sensor is provided in lieu of Type S sensor in a finished, public space (i.e. corridor, restroom, vestibule, etc.), provide sensor guard. Coordinate exact locations with Engineer.

F. Sensor Guards
   1. Provide clear guard, mounted with back frame to wall using screws where denoted on drawings with a sub "G".
   2. Guards shall be made of LEXAN or other durable material to withstand abuse, equal to Uni-Gard, Inc.; Model UG-2C or BAPI-Guard.
   3. Provide the Owner with the tool to remove guards.
   4. Guards are not required when stainless steel cover plate is installed (i.e. TYPE S sensors).

G. Air Temperature Sensors
   1. Provide temperature sensors and other temperature indicating sensors of commercial grade quality located at the point of measurement and installed according to the manufacturer's recommendations.
   2. Thermistor temperature sensors shall be 10,000 ohm at 77 F with Precon type-3 material. Accuracy shall be +/-0.36 F between the range of 32.0 - 158.0 F.
   3. Provide temperature sensors such that the BAS shall be able to convert the resistive input signal available from the element into a digital signal for use by the BAS.
   4. Provide outside air temperature sensors with a watertight fitting and adequate protection from the effects of solar radiation.

H. Liquid Temperature Sensors
   1. Thermistor temperature sensors shall be 10,000 ohm at 77 F with Precon type-3 material. Accuracy shall be +/-0.36 F between the range of 32.0 - 158.0 F.
   2. Temperature sensors shall allow Temperature Control System to convert resistive input signal form element into digital signal for Temperature Control System.
   3. Web-bulb type sensors shall mount within brass or stainless steel wells filled with a heat conductive compound and in direct contact with the water within the pipe.

I. Electronic Duct Temperature Sensors
   1. All duct sensors shall be true averaging type sensors with capillary lengths not less than 20 feet long. The only exceptions will be return air and outdoor air sensors.
   2. All duct sensors shall be installed within enclosures that are suitable for the application.

J. Safety Low Limit Thermostats
   1. Safety low limit thermostats with flexible sensing elements shall serpentine full length of duct or coil. Instrument to be sensitive to lowest temperature at any 12 inch increment on its 20 foot length. Thermostat shall have a range of 34 degrees F. to 60 degrees F. with a fixed 5 degrees F. differential.
      a. Safety low limit thermostats shall be capable of being reset through software at the building energy management computer.

K. Humidity Sensors
1. Shall be a "Current Type" humidity transducer. Sensor shall produce a linear 4-20mA current representing the span of the sensor. This signal shall be produced by the sensor itself through a current convertor supplied with the sensor.
2. Outdoor air humidity sensor shall be enclosed in a weathertight enclosure and shall be located in a place to provide best representation of outdoor air relative humidity. Sensor span shall be 10 to 90 percent relative humidity and shall be accurate within ± 2 percent of span.
3. Space humidity sensor shall be enclosed in a durable enclosure for mounting in interior zones. Sensor shall have a range of 0 to 100 percent relative humidity and shall be accurate with ± 2 percent of span.
4. Duct humidity sensor shall be a probe type with all wiring enclosed in an electrical box. Sensor shall have a range of 0 to 100 percent with an accuracy of ± 3 percent of span.
5. Provide one exterior humidity sensor.

L. Current Sensing Status Switch
1. Shall be capable of detecting changes in flow of current to motors in determining accurate and reliable equipment status.
2. Ampere rating for 0 - 135 amps continuous.
3. Sensor supply voltage shall be included from monitor conductor.
4. Minimum current required is 1 amp.
5. Trip setpoint shall be adjustable to ± 1 percent of range.
6. Shall be equal to Model No. 705 (Hawkeye) by Veris Industries, Inc.

M. Control Transformers
1. Provide and install step down transformers in NEMA 1 enclosures as required for variable air volume terminal units shown and scheduled on Construction Documents.
2. This contractor is to provide wire and route control wiring from step down transformer to each variable air volume terminal unit.
3. Sizes, locations, final quantity required, and any additional electrical requirements is the responsibility of this contractor.
4. Extra Materials: Provide (2) additional control transformers to district. If transformers are size dependent. Provide a minimum of one extra transformer per size installed.

2.6 CONTROL CABINETS/ENCLOSURES

A. Control cabinet/enclosure shall be extruded aluminum, galvanized steel or factory-hardened plastic with key locks and hinged doors. Electric panels shall be of code steel construction with UL label.
1. The control cabinet/enclosure shall be required to house devices not enclosed as a part of the DDC building automation system panels. Prewire with internal wiring terminated at labeled terminal strips. Thermometers and switches shall be mounted on the cover of the panel. Relays, transformers, and components shall be mounted inside the panel. Devices, whether interior or exterior, shall be provided with legend plates of engraved formica or equal. Cabinets shall be located as approved by the Architect/Engineer or as indicated on the Drawings.
2. Where two or more control items or accessories (thermostats, thermometer, relay, etc.) are to be mounted at a single location, such equipment shall be mounted in a suitable cabinet. Cabinets shall be located as approved by the Architect/Engineer or indicated on the Drawings.
3. Local type panels need not contain graphic representations or symbols, unless specified below, but must contain approved nameplates, legends, etc., for each device.
4. Where panels contain any wiring, panels shall be UL approved cubicles.

2.7 TEMPERATURE CONTROL WIRING

A. Cabling in air plenums shall be open wired UL listed plenum cable or shall be installed in conduit.

B. Conduit shall be 1/2-inch minimum size and shall be furnished and installed by the temperature control contractor. Run all control wiring exposed in mechanical rooms and similar spaces in conduit, in a neat, workmanlike manner. Provide bushings on and open end of conduit. Conduit

construction and sizing shall be in accordance with Project Manual Section 26 05 33, Conduit and Boxes for Electrical Systems.

C. Concealed wiring and wiring in non-plenum ceiling cavities, which is operating under 100 volts, may be open wired if in compliance with Article 725, NFPA-70 (NEC). Open wiring shall be supported as denoted below.

D. Terminations shall be performed by the Contractor.

E. Wire and conduit not indicated on the Drawings or in the Specifications, but required by the controls supplier, shall be paid for by the Contractor at no additional cost to the Owner.

F. Cable Supports
1. Provide cable supports that meet UL, NEC and TIA/EIA requirements for structured cabling systems.
2. The cable support system shall provide support for various types of low voltage cables fiber optic cables, innerduct, and temperature control cabling.
3. The support system shall attach to the building structural elements or be wall mounted.
4. The supports shall be made of fire retardant and low smoke emission products, which meet UL 2034 requirements for air plenum spaces.
5. The support products shall have a minimum of a 1-inch-wide platform for the cable to rest. Bridle rings or bridle rings with 1” inserts are not acceptable.
6. Individual supports shall be installed at intervals not greater than 60 inches.
7. Cable supports shall be installed a minimum of 6 inches above lay-in ceiling system. Cable sags shall not allow the cable to touch ceiling grid or tiles.
8. Minimum clearances from sources of EMI and RFI must be as specified in TIA/EIA568C, TIA/EIA-569 and the latest version of the BICSI TDMM.
9. Approved Manufacturers:
    a. Caddy by Erico
    b. Siemens
    c. CPI
    d. Panduit
    e. Garvin Industries
    f. B-line

G. Cable Ties
1. Provide plenum rated cable ties for cables in/or above ceiling.
2. Cable ties shall be of appropriate length to loosely bundle and secure the low-voltage cables. Cable ties are not to be pulled so tight that they damage or distort the cables in the bundles. Trim cable tie loose ends.
3. Cable ties shall meet UL 94V-O.
4. Approved Manufacturers:
    a. Panduit
    b. Hubbell
    c. Leviton

H. Cable Hook and Loop Fasteners
1. Provide cable hook and loop fasteners to secure cable bundle at equipment cabinets, panels, and controllers.
2. Hook and loop fasteners may be used above ceiling if they are plenum rated.
3. UL listed.
4. Approved Manufacturers:
    a. Panduit
    b. Hubbell
    c. Leviton

I. Innerduct (Indoor)
1. Provide 1.0-inch I.D. plenum rated corrugated innerduct above ceiling for all nonarmored fiber optic cable.
2. Innerduct shall be UL listed and plenum rated.
3. Approved Manufacturers:

a. Endot-Endocor
b. Carlon
c. Pyramid Industries
d. Eastern

J. Innerduct (Outdoor)
1. Provide 1.0-inch I.D. non-plenum polyethylene-type, ribbed inside tube, innerduct in the conduit as shown on the Drawings.
2. Innerduct shall be UL listed.
3. Provide a nylon pull string in all empty innerduct runs.
4. Approved Manufacturers:
a. Enduct Ribbed (for outside applications)
b. Carlon
c. Pyramid Industries
d. Eastern

K. Contractor shall refer to all Divisions 23 and 26 Project Manual sections for unique requirements for each piece of equipment.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Control of all new mechanical equipment indicated on the Drawings shall be accomplished through DDC control.

B. All sensors and devices shall be labeled. All labels and designations shall match designations in controls software and as-built drawings.

C. Mount all wall mounted sensing devices at 44 inches A.F.F. to the bottom of the device unless noted otherwise on the drawings. Coordinate exact location with all trades.

D. Temperature Control Cabling
1. Cabling shall be supported by products that meet BICSI, EIA, TIA requirements or installed in cable tray.
2. Where applicable, sleeves and cable trays shown on the Technology Drawings may be used by the Temperature Control Contractor; however, their use is strictly voluntary. Deviation from these pathways is acceptable but any additional sleeves, coring, supports etc. are the responsibility of this contractor. Deviations must be clearly noted on the Record Drawings.
3. Materials installed under this Specification shall be attached to the building structure, independent of other pipe, duct, equipment, ceiling grid, or other installations. Cable supports are not to be attached to ceiling grid wires or fire sprinkler piping supports. Cables are not to rest on or be supported by masonry or other building structural members.
4. Cables in exposed ceiling areas such as auditorium, gymnasium, art rooms, classrooms, locker rooms, corridors, etc. shall be installed in conduit from the device to the nearest accessible lay-in ceiling or the nearest telecommunication room. The Contractor is responsible for coordinating these conduit installations to minimize cable distances.
5. Cables installed in rooms with architectural “clouds” may be installed without conduit, but the cabling must be routed so that it cannot be seen from the floor.

3.2 SEQUENCE OF OPERATION

A. Refer to Specification Section 230993 for all equipment sequences of operation.

3.3 GUARANTEE/WARRANTY

A. It is intended that the Contractor include as part of his bid one (1) year full-service warranty. All labor and material shall be guaranteed against defects in workmanship for the one (1) year period from the date of Substantial Completion as determined by Architect/Engineer. Any material

proving defective shall be repaired or replaced during that period. This shall not, however, apply to material that has been damaged due to willful negligence. Materials furnished but not installed by the BAS contractor shall be covered to the extent of the product only. Installation labor shall be the responsibility of the trade contractor performing the installation. All corrective software modifications made during warranty periods shall be updated on all user documentation and on user and manufacturer archived software disks.

B. The Contractor will provide hardware and software support during the one (1) year guarantee after the date of acceptance. Hardware support includes replacing of any major or minor components, relays, sensors, etc., that fail to operate properly. Software support includes upgrading of software during warranty period such that system is loaded with latest available revision at end of warranty period.

C. Support is also defined to include Owner personnel training needed to operate the system effectively as outlined in this Specification. Explicitly included is the training needed to analyze a building's operation with a view to minimizing energy costs.

3.4 OWNERSHIP 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. 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 project developed software and documentation shall become the property of the owner. These include, but are not limited to project graphic images, record drawings, project database, project specific application programming code, and all other associated documentation.

B. Ownership of Proprietary Materials, such as Controller and Database Software backups are to be housed at the building.

3.5 ON-SITE ASSISTANCE

A. Occupancy Adjustments: Within (1) year of date of Substantial Completion, provide up to four Project site visits (minimum of 4 hours per site visit), when requested by Owner, to adjust and calibrate components and to assist Owner's personnel in making program changes and in adjusting sensors and controls to suit actual conditions. This time is in addition to time necessary for warranty related work.
   1. If the above site visits are not utilized by the owner, the contractor is to visit each building during the first heating or cooling season to make repairs and adjustments to provide uniform conditions throughout.
   2. Prepare and submit a report for each visit documenting conditions found, and corrective action taken. Report to be signed by owner for documentation.

3.6 COMPLETION

A. Prior to final inspection, this Contractor shall perform the following service work, including, but not limited to, the following items:
   1. Check and oil electric motors furnished under control system.
   2. Lubricate damper bearings as required.
   3. Check damper travel, adjust and tighten set screws.
   4. Lubricate valve stems, as required, check packing; repair as required.
   5. Calibration of instruments.
   6. Check and verify circuitry.
   7. Calibrate and checkout controllers, fusing, etc.
   8. Test and debug microprocessor and software.

3.7 When the work is completed, and at a time directed by the Owner or the Architect/Engineer, the Contractor shall carefully adjust all parts of the equipment and systems. This includes adjustment of automatic controls and safety devices, proper setting of adjustable devices, dampers and valves, and other necessary operations so the systems are fully operable and automatic in

operation. Upon completion of the Work, notify the Owner, and/or Architect/Engineer that system is ready for final tests and inspection.

A. At the time of final inspection, this Contractor shall be represented by a person with the proper authority, who shall demonstrate, as directed by the Architect/Engineer, that his Work fully complies with the purpose and intent of the Specifications and Drawings. Labor, services, instruments, and tools necessary for demonstrations and tests shall be provided by the Contractor.

B. The Contractor shall test and adjust each instrument specialty and equipment furnished by him, prior to final acceptance. The Contractor shall demonstrate, for approval by the Architect/Engineer, that subsystems operate as a coordinated and properly functioning, integrated system.

C. The Contractor shall furnish labor, provide adjustments and incidentals necessary to obtain the desired and intended results.

D. The Contractor shall turn over a printed copy and electronic copy of the completed and debugged operating software to the Owner at the conclusion of the warranty and extended preventative material and labor warranty.

END OF SECTION 23 09 00

SECTION 23 09 93 – HVAC SEQUENCE OF OPERATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. The provisions of the General Conditions, Sections included under Division 1, General Requirements, and Section 230500 of this Division are included as a part of this Section as though bound herein.

C. Refer to Division 01 Section “Alternates” that may affect the Work of this Section.

D. Refer to the details and schedules on the Drawings for additional requirements.

E. Refer to Construction Documents.

1.2 SUMMARY

A. This Section includes the Sequences of Operation for the HVAC Equipment and Systems. These sequences in narrative format are intended to be utilized as required guidelines for the installed systems operation; Temperature Controls Contractor is responsible for a completely functional and highly efficient system operation in line with these stated guidelines.
   1. Correspondence with the design engineer may be necessary and is expected to be coordinated by the contractor if additional information is necessary in conversion of the below described narratives into electronic system programmed operating code.
   2. All controlled actions are to be calculated by a proportional integral derivative (PID) function with the response times of each action appropriate for the purpose, to prevent unnecessary overworking the operating devices.

B. Temperature Control Contractor shall read all other Drawings and Specifications, become familiar with requirements and Project direct digital control (DDC) scope.

C. Refer to other Division 23 Specifications Sections, Drawing Layouts, Schedules and Details for additional information and requirements of the controlled devices, equipment and systems.

1.3 SUBMITTALS

A. Submittals are required and shall include detailed descriptions of the proposed sequence of operations for all HVAC systems specific to the project.

B. Control Diagrams:
   1. Prior to installation and as required in Section 01330, submit to Architect/Engineer a complete system diagram, showing control connections and devices and their connection to other equipment, together with a clearly written description of the system and an outline of its function under conditions of operation.
   2. DDC logic and control diagrams included for all equipment and sequences of control.

C. Closeout Submittals:
   1. Prior to installation and as required in Section 01330, submit to the Architect/Engineer a complete system diagram, showing control connections and devices and their connection to other equipment, together with a clearly written description of the system and an outline of its function under conditions of operation.
      a. Submittals shall be prepared on, or folded to, 8 1/2 inch by 11 inch size and bound in brochure form.
   2. DDC logic and control diagrams included for all equipment and sequences of control.

3. Screen captures shall be included to demonstrate the unique graphical interfaces for operator input and monitoring of the various types of installed equipment.
4. Upon completion of the Work, provide the complete, accurate, and approved diagrammatic blueprinted layouts on the automatic control system specified herein and as installed.
    a. Layouts shall show all control equipment including job installation changes, and the function of each system shall be indicated. Layouts and descriptions shall be included in the project record set and in the operating and maintenance manuals. Labels shall be identified on the submittals, field tags and on the “As-Built” document in common language such that devices are easily identified by non-technical reviewers.

1.4 BUILDING SET POINTS

A. All set points and other variables noted in the sequences are to be adjustable. Integrate new sequences into the existing building automation system (BAS).

B. Refer to sequence of operations of individual equipment for set points specific to each designated zone.

PART 2 – SEQUENCE OF OPERATIONS

2.1 EXISTING AHU-7

1. Space and return air humidity sensors to be provided and installed as indicated on the Drawings. Humidity reading shall be viewable as part of the AHU graphics. If a sensor detects humidity levels in excess of set-point, an alarm shall be sent to the BAS.
2. The following sequences shall be added to the existing air handling unit sequences for dehumidification control.
    a. The space or return air duct humidity sensor(s) will enable the unit and shall place the unit into dehumidification mode anytime the humidity rises above 60 percent RH (adj.). The supply fan shall run and the cooling coil control valve shall open initially to 100 percent and then shall be modulated as required to maintain a supply air temperature above 55 degrees (min.). The VAV terminals primary air dampers and heating water control valves shall be modulated to maintain occupied/unoccupied space temperatures. If the outside air enthalpy is below the return air enthalpy, outside air shall be used in conjunction with the chilled water coil. If the outside air enthalpy is above the return air enthalpy, the outside air damper(s) shall remain at minimum position. Once both the space and return air duct humidity levels reach set point, the system shall return to occupied mode. Minimum unit run-time of 30 min. (adj.) is required.
        1) The BAS shall generate an alarm if it does not permit the unit to enter the dehumidification mode because it detects that the hot water system is not enabled and cannot provide the reheat necessary for dehumidification. A visible graphic to be displayed on the BAS.
            a) Temperature Control Contractor shall modify the existing boiler plant sequences to ensure the heating hot water system is active during cooling months to provide reheat for dehumidification. Coordinate with existing equipment and sequences.

2.2 FAN COIL UNITS

A. The Fan Coil Units to be equipped with its own control package. The unit controls shall be fully integrated into the BAS. The BAS system shall provide complete communication for the controls

and supervisory monitoring of the unit with the capability to change temperature set points in each space. The BAS shall be wired into the packaged controls provided by the unit manufacturer.

1. An electronic thermostat and humidity sensor shall be included in the fan coil unit control package.
2. All actuators shall spring return to their normal position upon a loss of power
3. A low limit discharge temperature sensor shall prevent the discharge air from dropping below 50 degrees F. (adj.).
4. Supply and return air temperature sensors, provided by the manufacturer, shall be monitored and shown on the BAS graphics.

B. Fan coil units are to be utilized for dehumidification and cooling only.
1. A space mounted humidity sensor shall place the unit into dehumidification mode anytime the space humidity rises above setpoint. The supply fan shall run and the DX cooling shall be staged on to maintain reduced space temperature. Once the space humidity level reaches set point, the system shall be turned off.
2. A space mounted temperature sensor shall place the unit into cooling mode anytime the space temperature rises above setpoint. The supply fan shall run and the DX cooling shall be staged on to maintain reduced space temperature. Once the space temperature reaches set point, the system shall be turned off.

C. Fan Coil Setpoints
1. Summer Mode
   a. Months May through September (adj.). Coordinate months with the Owner.
   b. Cooling setpoint shall be set at 5°F (adj.) above the VAV thermostat setpoint for the respective room.
   c. Dehumidification setpoint shall be set at 5% RH (adj.) above the AHU-7 humidity setpoint.
2. Winter Mode
   a. Months October through April (adj.). Coordinate months with the Owner.
   b. Cooling Setpoint shall be set at 72°F (adj.).
   c. Dehumidification Setpoint shall be set at 55% RH (adj.).
3. BAS graphics shall have button/switch to toggle between Auto mode (automatically switches between Summer and Winter modes) and Winter mode.

D. The Temperature Control Contractor shall be responsible to install all sensors, controllers, and interconnecting wiring as required for a fully functioning system. Coordinate all requirements with unit manufacturer.

E. Scheduling, set points, and override control to be accomplished by the BAS, and all programming required to be the responsibility of the Temperature Control Contractor. Coordinate all requirements with unit manufacturer.

F. BAS to provide supervisory monitoring of all points provided by the unit manufacturer. All information is to be provided graphically. Coordinate all requirements with unit manufacturer.

G. Safeties
1. To prevent short cycling, the unit shall run for a minimum adjustable time and shall be off for a minimum adjustable time.
2. DX cooling shall be staged off on detection of condensate overflow. Alarm the BAS.
3. The system provided must be capable of manually positioning heating valve actuator, if all levels of DDC control fail.
4. A fan proving device will indicate the fan status for each fan and send an alarm to the central BAS panel indicating fan failure.
5. All safeties must be reset prior to fans operating in either automatic or hand mode.

2.3 EMERGENCY SHUTDOWN

A. All new mechanical equipment shall have the ability to shut down when initiated through the Building Automation System. Coordinate with existing sequences and BAS.

2.4 CRITICAL ALARMS

A. The following will be considered critical alarms and should be added/integrated into the existing BAS:
   1. Any fan coil unit fan failure.
   2. Any other alarm deemed critical by school district and/or Architect/Engineer.
   3. Refer to all sequences of operation for additional alarms.

END OF SECTION 23 09 93

SECTION 23 21 13 - HYDRONIC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes pipe and fitting materials, joining methods, special-duty valves, and specialties for the following:
   1. Hot-water heating piping.
   2. Chilled-water piping.
   3. Condensate-drain piping.
   4. Air-vent piping.
   5. Safety-valve-inlet and -outlet piping.
   6. Balancing valves.
   7. Pressure reducing valves
   8. Safety valves
   9. Air control devices

B. Related Sections include the following:
   1. Division 23 Section “General Duty Valves” for hydronic valves.

1.2 PERFORMANCE REQUIREMENTS

A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature:
   1. Hot-Water Heating Piping: 125 psig at 200 deg F.
   2. Chilled-Water Piping: 125 psig at 200 deg F.
   3. Condensate-Drain Piping: 150 deg F.
   4. Air-Vent Piping: 200 deg F.
   5. Safety-Valve-Inlet and -Outlet Piping: Equal to the pressure of the piping system to which it is attached.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of the following:
   1. Valves. Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow-control valves.
   2. Air control devices.
   3. Chemical treatment.
   4. Hydronic specialties.
   5. Grooved fittings and joint couplings, provide applicable styles used.

B. Schedule:
   1. Hydronic piping schedule indicating piping material, hydronic system type, fitting/joint style.

1.4 CLOSEOUT SUBMITTALS

A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals.
   1. Operation and Maintenance Data: For air control devices, hydronic specialties, and special-duty valves to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installers of Pressure-Sealed Joints: Installers shall be certified by the pressure-seal joint manufacturer as having been trained and qualified to join piping with pressure-seal pipe couplings and fittings.

B. Steel Support Welding: Qualify processes and operators according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

C. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.
1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

D. All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.
1. All castings used for coupling housings, fittings, valve bodies, etc., shall be date stamped or identified for quality assurance and traceability.

E. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 01.

1.6 EXTRA MATERIALS

A. Differential Pressure Meter: For each type of balancing valve and automatic flow control valve, include flowmeter, probes, hoses, flow charts, and carrying case.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tubing: ASTM B 88, Type L.

B. Wrought-Copper Fittings: ASME B16.22.

C. Grooved-Copper Fittings option: ASME B16.22.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Tyco-Grinnell
b. Anvil Gruvlok.
c. Victaulic Company of America.
2. Grooved-End Copper Fittings: ASME B16.22 wrought copper and ASTM B 75, copper tube or ASME B16.18 and ASTM B 584, bronze casting, manufactured to copper tube dimensions. Flaring of tube or fitting ends to accommodate alternate sized couplings is not permitted.
3. Grooved-End-Tube Couplings: Rigid pattern, unless otherwise indicated; gasketed fitting. Ductile-iron housing with keys matching pipe and fitting grooves, EHP gasket rated for maximum 250 deg F for use with housing, and electroplated steel bolts and nuts.

D. Copper or Bronze Pressure-Seal Fittings:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Stadler-Viega (ProPress)
b. Nibco
c. Elkhart

2. Housing: Copper.
3. O-Rings and Pipe Stops: EPDM.
4. Tools: Manufacturer's special tools.
5. Minimum 200-psig working-pressure rating at 250 deg F.

E. Copper, Mechanically Formed Tee Option: For forming T-branch on copper water tube.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. T-DRILL Industries Inc.

F. Wrought-Copper Unions: ASME B16.22.

2.2 STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel with plain ends; type, grade, and wall thickness as indicated in Part 3 "Piping Applications" Article.

B. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125 and 250 as indicated in Part 3 "Piping Applications" Article.

C. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300 as indicated in Part 3 "Piping Applications" Article.

D. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in Part 3 "Piping Applications" Article.

E. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 25, 125, and 250; raised ground face, and bolt holes spot faced as indicated in Part 3 "Piping Applications" Article.

F. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.

G. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
1. Material Group: 1.1.
2. End Connections: Butt welding.
3. Facings: Raised face.

H. Grooved Mechanical-Joint Fittings and Couplings:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Tyco-Grinnell.
b. Anvil Gruvlok.
c. Victaulic Company of America.
2. Joint Fittings: ASTM A 536, Grade 65-45-12 ductile iron; ASTM A 47/A 47M, Grade 32510 malleable iron; ASTM A 53/A 53M, Type F, E, or S, Grade B fabricated steel; or ASTM A 234, Grade WPB steel fittings with grooves or shoulders constructed to accept grooved-end couplings; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.
3. Couplings: Rigid pattern, unless otherwise indicated, ductile- or malleable-iron housing and synthetic rubber gasket of central cavity pressure-responsive design; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.

a. NPS 2 through NPS 12:
   1) Rigid Type: Housings shall be cast with bolt pads to provide rigidity and system support and haning in accordance with ANSI B31.1 and B31.9.
      a) NPS 2 through NPS 6: Installation-Ready, for direct stab installation without field disassembly, with grade EHP gasket rated to +230 deg. F.
      b) Zero-Flex Style.
   2) Flexible Type: For use in locations where vibration attenuation and stress relief air required. Three flexible couplings may be used in lieu of a flexible connector. The couplings shall be placed in close proximity to the source of the vibration.
   3) Flange Adapter: Flat face, ductile iron housings with elastomer pressure responsive gasket, for direct connection to ANSI Class 125 or 150 flanged components.

b. 14 inch through 24 inch with lead-in chamfer on housing key and wide width FlushSeal® gasket.
   1) Rigid Type: Housing key shall fill the wedge shaped AGS groove and provide rigidity and system support and hanging in accordance with ANSI B31.1 and B31.9.
   2) Flexible Type: Housing key shall fit into the wedge shaped AGS groove and allow for linear and angular pipe movement.
   3) Flange Adapter: Flat face, ductile iron housings with elastomer pressure responsive gasket, for direct connection to ANSI Class 125 or 150 flanged components.

I. Steel Pipe Nipples: ASTM A 733, made of same materials and wall thicknesses as pipe in which they are installed.

2.3 PVC PIPE AND FITTINGS

A. PVC Material: The material used in the manufacture of the pipe shall be a rigid polyvinyl chloride (PVC) compound, Type I Grade I, with a Cell Classification of 12454 as defined in ASTM D1784. This compound shall be light gray in color.

B. Pipe Dimensions: All sizes of PVC Schedule 80 pipe shall be manufactured by and ISO 9001 certified manufacture in strict accordance to the requirements of ASTM D1785 for physical dimensions and tolerances. Each production run of pipe manufactured in compliance to the standard, shall also meet or exceed the test requirements for materials, workmanship, burst pressure, flattening, and extrusion quality defined in ASTM D1785.

C. Pipe Markings: Product marking shall meet the requirements of ASTM D1785 and shall include: the manufacturer's name (or the manufacturer's trademark when privately labeled); the nominal pipe size; the material designation code; the pipe schedule and pressure rating in PSI for water @ 73°F; the ASTM designation D1785.

D. Threaded metal to plastic connections are not permitted. Where transitions between plastic and metal pipe and fittings occur, compression style metal to plastic unions, flanges, or grooved connections shall be utilized.

E. Grooved Mechanical-Joint Fittings and Couplings:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Tyco-Grinnell.
b. Anvil Gruvlok.
c. Victaulic Company of America.

2. Joint Fittings: ASTM A 536, Grade 65-45-12 ductile iron; ASTM A 47/A 47M, Grade 32510 malleable iron; ASTM A 53/A 53M, Type F, E, or S, Grade B fabricated steel; or ASTM A 234, Grade WPB steel fittings with grooves or shoulders constructed to accept grooved-end couplings; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.
3. Couplings: Rigid pattern, unless otherwise indicated, ductile- or malleable-iron housing and synthetic rubber gasket of central cavity pressure-responsive design; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.
   a. NPS 2 through NPS 12:
      1) Flexible Type: For use in locations where vibration attenuation and stress relief air required. Three flexible couplings may be used in lieu of a flexible connector. The couplings shall be placed in close proximity to the source of the vibration.

2.4 CPVC PIPE AND FITTINGS

A. CPVC Material: The material used in the manufacture of the pipe shall be a rigid polyvinyl chloride (PVC) compound, Type IV Grade I, with a Cell Classification of 23447 as defined in ASTM D1784. This compound shall be light gray in color.

B. Pipe Dimensions: All sizes of CPVC Schedule 80 pipe shall be manufactured in strict accordance to the requirements of ASTM F 441 for physical dimensions and tolerances. Each production run of pipe manufactured in compliance to the standard, shall also meet or exceed the test requirements for materials, workmanship, burst pressure, flattening, and extrusion quality defined in ASTM D1784.

C. Pipe Markings: Product marking shall meet the requirements of ASTM F 441 and shall include: the manufacturer's name (or the manufacturer's trademark when privately labeled); the nominal pipe size; the material designation code; the pipe schedule and pressure rating in PSI for water @ 73°F; the ASTM designation D1784.

2.5 JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
   a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
   b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

B. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.

F. Grooved Joint Lubricants: Lubricate gaskets in accordance with the manufacturer's recommendations with lubricant supplied by the coupling manufacturer that is suitable for the gasket elastomer and system media.

G. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

H. Gasket Material: Thickness, material, and type suitable for fluid to be handled and working temperatures and pressures.

I. PVC solvent Joints: Solvent-cemented joints should be utilized in a two step process with primer manufactured for thermoplastic piping systems conforming to ASTM F656 and solvent cement conforming to ASTM 2564. Primer shall be clear. Solvent-cement shall be clear, medium-bodied and medium-setting and formulated for PVC piping.

J. CPVC solvent joints: Solvent-cemented joints should be utilized in a two step process with primer manufactured for thermoplastic piping systems and solvent cement conforming to ASTM F493. Primer shall be clear. Solvent-cement shall be clear, medium-bodied and medium-setting and formulated for CPVC piping.

K. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

2.6 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
   1. Manufacturers:
      a. Advance Products & Systems, Inc.
      b. Calpico, Inc.
      c. Link-Seal
      d. Metraflex Co.
      e. Pipeline Seal and Insulator, Inc.
   2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
   3. Pressure Plates: Stainless steel. Include two for each sealing element.
   4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating or Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.7 SLEEVES

A. Galvanized-Steel Sheet: 24-gauge minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
   1. Underdeck Clamp: Clamping ring with set screws.

2.8 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper-alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Capitol Manufacturing Company.
b. Central Plastics Company.
c. Hart Industries International, Inc.
d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
e. Zurn Plumbing Products Group; AquaSpec Commercial Products Division.
2. Factory-fabricated union assembly, for 250-psig minimum working pressure at 180 deg F.

D. Dielectric Flanges:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Capitol Manufacturing Company.
b. Central Plastics Company.
c. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Factory-fabricated companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

E. Dielectric-Flange Kits:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Central Plastics Company.
d. Pipeline Seal and Insulator, Inc.
2. Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
3. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.

F. Dielectric Couplings:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Calpico, Inc.
b. Lochinvar Corporation.
2. Galvanized-steel coupling with inert and noncorrosive thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

G. Dielectric Nipples:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Tyco-Grinnell
b. Anvil Gruvlok
c. Perfection Corporation; a subsidiary of American Meter Company.
d. Precision Plumbing Products, Inc.
e. Sioux Chief Manufacturing Company, Inc.
f. Victaulic Company of America.
2. Electroplated steel nipple or ductile iron casing with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

2.9 VALVES

A. Globe, Check, Ball, and Butterfly Valves: Comply with requirements specified in Division 23 Section "General-Duty Valves for HVAC Piping."

B. Automatic Temperature-Control Valves, Actuators, and Sensors: Comply with requirements specified in Division 23 Section "Instrumentation and Control for HVAC."

C. Bronze, Calibrated-Orifice, Balancing Valves:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Armstrong Pumps, Inc.
      b. Bell & Gossett Domestic Pump; a division of ITT Industries.
      c. Flow Design Inc.
      d. Griswold Controls.
      e. Taco.
      f. Nexus.
      g. Tour & Andersson.
      h. Tyco-Grinnell.
      i. Victaulic Company
   2. Body: Bronze or a metal copper alloy, ball, globe, or plug type with calibrated orifice or venturi.
   3. Ball: Brass or stainless steel.
   4. Disc: A metal copper-alloy.
   5. Plug: Resin.
   6. Seat: PTFE or EPDM.
   7. End Connections: Threaded or socket.
   8. Pressure Gauge Connections: Integral seals for portable differential pressure meter.
   9. Handle Style:
      a. Lever, with memory stop to retain set position.
      b. Hand wheel, with memory stop to retain set position.
   10. CWP Rating: Minimum 300 psig.
   11. Maximum Operating Temperature: 230 deg F.
   12. Valve shall be selected between 2 and 6 feet water pressure drop. Verify optimal sizing with manufacturer.

D. Cast-Iron or Steel, Calibrated-Orifice, Balancing Valves:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Armstrong Pumps, Inc.
      b. Bell & Gossett Domestic Pump; a division of ITT Industries.
      c. Flow Design Inc.
      d. Griswold Controls.
      e. Taco.
      f. Nexus.
      g. Tour & Andersson; available through Victaulic Company of America.
      h. Tyco-Grinnell.
      i. Victaulic Company
   2. Body: Cast-iron, ductile iron, or steel body, ball, plug, or globe pattern with calibrated orifice or venturi.
   3. Ball: Brass or stainless steel.
   4. Stem Seals: EPDM O-rings.
   5. Disc: A metal copper-alloy or glass and carbon-filled PTFE.
   6. Seat: PTFE or EPDM.
   7. End Connections: Flanged or grooved.
   8. Pressure Gauge Connections: Integral seals for portable differential pressure meter.
   9. Handle Style:
      a. Lever, with memory stop to retain set position.
      b. Hand wheel, with memory stop to retain set position.
   10. CWP Rating: Minimum 250 psig.
   11. Maximum Operating Temperature: 230 deg F.
   12. Valve shall be selected between 2 and 6 feet water pressure drop. Verify optimal sizing with manufacturer.

E. Diaphragm-Operated, Pressure-Reducing Valves:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Amtrol, Inc.
      b. Armstrong Pumps, Inc.

c. Bell & Gossett Domestic Pump; a division of ITT Industries.
d. Conbraco Industries, Inc.
e. Spence Engineering Company, Inc.
f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Body: Bronze or brass.
3. Disc: Glass and carbon-filled PTFE.
4. Seat: Brass.
5. Stem Seals: EPDM O-rings.
6. Diaphragm: EPT.
7. Low inlet-pressure check valve.
8. Inlet Strainer: removable without system shutdown.
9. Valve Seat and Stem: Noncorrosive.
10. Sized for a maximum operating temperature 225 degrees F.
11. Sized for a maximum operating pressure of 125 psig.
12. Valve Size and Capacity: Selected to suit system in which installed. Refer to detail in Contract Documents.
13. Operating Pressure: Inlet pressure up to 300 psig. Outlet pressure field adjustable from 10 to 35 psig.

F. Diaphragm-Operated Safety Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Amtrol, Inc.
b. Armstrong Pumps, Inc.
c. Bell & Gossett Domestic Pump; a division of ITT Industries.
d. Conbraco Industries, Inc.
e. Spence Engineering Company, Inc.
f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Body: Bronze or brass.
3. Disc: Glass and carbon-filled PTFE.
4. Seat: Brass.
5. Stem Seals: EPDM O-rings.
6. Diaphragm: EPT.
7. Wetted, Internal Work Parts: Brass and rubber.
8. Inlet Strainer: removable without system shutdown.
9. Valve Seat and Stem: Noncorrosive.
10. Valve Size, Capacity, and Operating Pressure: Comply with ASME Boiler and Pressure Vessel Code: Section IV, and selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

G. Automatic Flow-Control Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Bell & Gossett Domestic Pump; a Division of ITT Industries.
b. Flow Design Inc.
c. Nexus
d. Griswold Controls.
2. Body: Brass or ferrous metal.
3. Piston and Spring Assembly: Stainless steel, tamper proof, self cleaning, and removable.
4. Combination Assemblies: Include bonze or brass-alloy ball valve.
5. Identification Tag: Marked with zone identification, valve number, and flow rate.
6. Size: Same as pipe in which installed.
7. Performance: Maintain constant flow, plus or minus 5 percent over system pressure fluctuations.
8. Minimum CWP Rating: 175 psig.
9. Maximum Operating Temperature: 200 deg F.
10. Valve size to be selected between 2 and 6 feet water pressure drop (WPD). Verify optimal sizing to minimize pressure drop with unit manufacturer.
11. Removable flow cartridge.

2.10 AIR CONTROL DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Amtrol, Inc.
   2. Armstrong Pumps, Inc.
   3. Bell & Gossett Domestic Pump; a division of ITT Industries.
   4. Flamco
   5. Spirotherm, Inc.
   6. Taco.
   7. Wessels.

B. Manual Air Vents:
   1. Body: Bronze.
   2. Internal Parts: Nonferrous.
   3. Operator: Screwdriver or thumbscrew.
   4. Inlet Connection: NPS 1/2.
   5. Discharge Connection: NPS 1/8.
   6. CWP Rating: 150 psig.
   7. Maximum Operating Temperature: 225 deg F.

C. Automatic Air Vents:
   1. Body: Bronze or cast iron.
   2. Internal Parts: Nonferrous.
   3. Operator: Noncorrosive metal float.
   4. Inlet Connection: NPS 1/2.
   5. Discharge Connection: NPS 1/4.
   6. CWP Rating: 150 psig.
   7. Maximum Operating Temperature: 240 deg F.

D. Air Purgers:
   1. Body: Cast iron with internal baffles that slow the water velocity to separate the air from solution and divert it to the vent for quick removal.
   2. Maximum Working Pressure: 150 psig.
   3. Maximum Operating Temperature: 250 deg F.

2.11 HYDRONIC PIPING SPECIALTIES

A. Y-Pattern Strainers:
   1. Body: ASTM A 536, Grade 65-45-12, ductile iron with coupled cover or ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
   2. End Connections: Threaded ends for NPS 2 and smaller; grooved or flanged ends for NPS 2-1/2 and larger.
   3. Strainer Screen: 40 or 60-mesh startup strainer, and perforated stainless-steel basket with 50 percent total free area.
   4. CWP Rating: 300 psig.
   5. Include blow down valve with cap and chain.

B. Basket Strainers:
   1. Body: ASTM A 126, Class B, high-tensile cast iron with bolted cover and bottom drain connection.
   2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
   3. Strainer Screen: 40 or 60-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
   4. CWP Rating: 125 psig.
   5. Include blow down valve with cap and chain.

C. T-Pattern Strainers:
   1. Body: Ductile or malleable iron with removable access coupling and end cap or factory fabricated steel body with T-bolt hinged closure for strainer maintenance.

2. End Connections: Grooved ends.
3. Strainer Screen: 40 or 60-mesh startup strainer, and perforated stainless-steel basket with 57 percent free area.
4. CWP Rating: 750 psig.
5. Include blow down valve with cap and chain.

D. Stainless-Steel Bellow, Flexible Connectors:
1. Body: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket.
2. End Connections: Threaded or flanged to match equipment connected.
3. Performance: Capable of 3/4-inch misalignment.
4. CWP Rating: 150 psig.
5. Maximum Operating Temperature: 250 deg F.
6. Three flexible style couplings may be used in lieu of flexible connectors for vibration attenuation and stress relief for services to 230 deg. F. The couplings shall be placed in close proximity to the source of the vibration.

E. Spherical, Rubber, Flexible Connectors:
1. Body: Fiber-reinforced rubber body.
2. End Connections: Steel flanges drilled to align with Classes 150 and 300 steel flanges.
3. Performance: Capable of misalignment.
4. CWP Rating: 150 psig.
5. Maximum Operating Temperature: 250 deg F.
6. Three flexible style couplings may be used in lieu of flexible connectors for vibration attenuation and stress relief for services to 230 deg. F. The couplings shall be placed in close proximity to the source of the vibration.

2.12 STAINLESS-STEEL BRAIDED FLEXIBLE HOSES
1. Nexus
2. Griswold Controls.

B. Hoses shall be made of stainless steel braid over Kevlar reinforced EPDM for sizes ½" through 1" and Rayon reinforced EPDM for sizes 1¼" through 2". Hoses constructed with thermoplastics or EPTF is not acceptable.

C. Hoses shall be designed for a minimum 400 PSIG working pressure for sizes ½" to 1" and 300 PSIG working pressure sizes 1¼" to 2"; and 5 to 248 degrees F. operating temperature.

D. Hoses shall meet or exceed ASTM E 84-00 fire rating for building materials (NFPA 255, ANSI/UL 723 & UBC 8-1). Hoses rated UL 94 V-O for plastics used in manufacturing of consumer electronic products is not acceptable. Hoses shall be of double swivel design for sizes ½", ¾" and 1"; and MNPT x swivel for sizes 1¼", 1½" and 2".

E. End fittings ½" through 2" shall be made of brass.

F. Hose adapters shall be provided where necessary. Hose adapters shall be brass with MNPT threads pre-coated with LocTite 516 thread sealant, Copper sweat or Push.

G. Ferrules shall be stainless steel for sizes ½" through 2".

H. Hoses shall be permanently marked so that the manufacturer of the hose is easily identified. Hoses shall also be permanently marked with pressure rating, temperature rating and date of manufacture.

I. Hoses shall carry a minimum 5-year product warranty.

J. Maximum Length: 24 inches

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Hot-water heating piping, aboveground, NPS 2 and smaller, shall be any of the following:
   1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered or pressure-seal joints.
   2. Schedule 40 steel pipe; Class 125, cast-iron fittings; cast-iron flanges and flange fittings; and threaded joints.

B. Hot-water heating piping, aboveground, NPS 2-1/2 and larger, shall be any of the following:
   1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered or pressure seal joints.
   2. Type L, drawn-temper copper tubing, grooved, mechanical joint coupling and fittings, and grooved mechanical joints.
   3. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.
   4. Schedule 40 steel pipe; grooved, mechanical joint coupling and fittings; and grooved, mechanical joints.

C. Chilled-water piping, aboveground, NPS 2 and smaller, shall be any of the following:
   1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered or pressure-seal joints.
   2. Schedule 40 steel pipe; Class 125, cast-iron fittings; cast-iron flanges and flange fittings; and threaded joints.

D. Chilled-water piping, aboveground, NPS 2-1/2 and larger, shall be any of the following:
   1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered or pressure seal joints.
   2. Type L, drawn-temper copper tubing, grooved, mechanical joint coupling and fittings, and grooved, mechanical joints.
   3. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.
   4. Schedule 40 steel pipe; grooved, mechanical joint coupling and fittings; and grooved, mechanical joints.

E. Condensate-Drain Piping: Type M, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

F. Air-Vent Piping:
   1. Inlet: Same as service where installed with metal-to-plastic transition fittings for plastic piping systems according to the piping manufacturer's written instructions.
   2. Outlet: Type K, annealed-temper copper tubing with soldered or flared joints.

G. Safety-Valve-Inlet and -Outlet Piping for Hot-Water Heating Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed. **<**

H. Install shutoff-duty valves at each branch connection to supply mains, and at supply connection to each piece of equipment.

I. Install calibrated-orifice, balancing valves at each branch connection to return main as denoted on Drawings.

J. Install calibrated-orifice, balancing valves or automatic flow control valves in the return pipe of each heating or cooling terminal as denoted on Drawings.

K. Install check valves at each pump discharge and elsewhere as required to control flow direction.

L. Install safety valves at hot-water generators and elsewhere as required by ASME Boiler and Pressure Vessel Code. Install drip-pan elbow on safety-valve outlet and pipe without valves to the outdoors; and pipe drain to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 01, for installation requirements.

M. Install pressure-reducing valves at makeup-water connection to regulate system fill pressure.

N. Insulation: Where insulation is indicated, install extended stem valves arranged in a proper manner to receive insulation.

3.2 PIPING INSTALLATIONS

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicate piping locations and arrangements if such were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings. Minor offsets, lowering or raising the piping shall be routed to accommodate field conditions at no expense to the project.

B. Make connections according to the following, unless otherwise indicated:
   1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
   2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
   3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
   4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

M. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap and chain, at low points in piping system mains and elsewhere as required for system drainage.

N. Reduce pipe sizes using eccentric reducer fitting installed with level side up for horizontal piping.

O. Sleeves are not required for core-drilled holes.

P. Permanent sleeves are not required for holes formed by removable PE sleeves.

Q. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
   1. Cut sleeves to length for mounting flush with both surfaces.
      a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
   2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
   3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
      a. Steel Pipe Sleeves: For pipes smaller than NPS 6.
      b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
      c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing and Trim" for flashing.
         1) Seal space outside of sleeve fittings with grout.
   4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.

R. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.

S. Verify final equipment locations for roughing-in.

T. Install valves according to Division 23 Section "General-Duty Valves for HVAC Piping."

U. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.

V. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.
   1. Unions or flanges are not required in installations using grooved mechanical joint couplings. (The couplings shall serve as unions and disconnect points).

W. Install strainers on inlet side of each control valve, pressure-reducing valve, solenoid valve, in-line pump, and elsewhere as indicated. Install NPS 3/4 nipple and ball valve in blowdown connection of strainers NPS 2 and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2. All strainers shall contain blow down valve.

X. Identify piping as specified in Division 23 Section "Identification for HVAC Piping and Equipment."

Y. Freeze Protection

1. Do not install any hydronic piping which includes domestic cold and hot water, fire and sprinkler water, chilled water, heating water, condenser water piping, etc. within 12 feet of an exterior wall or roof opening utilized for fresh air intake or building relief air.
2. Any piping installed closer than 12 feet of an exterior wall or roof opening shall be moved or rerouted around the perimeter of the opening in order to prevent possible freezing of hydronic piping.

Z. Install dielectric fittings as specified between connections of all dissimilar metals.

3.3 HANGERS AND SUPPORTS

A. Hanger, support, and anchor devices are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment." Comply with the following requirements for maximum spacing of supports.

B. Pipe attachments shall be located adjacent to fittings at each offset or change in direction, at ends of branches over 5 feet long, at riser pipes, and along piping where necessary to prevent sags, bends, or vibration. Piping risers shall be supported at each floor level.

C. Hanger rod must hang perpendicular before and after pipe covering or insulation is applied.
1. Support piping from rolled steel beams or channels from any point on either top or bottom flanges.
2. Support piping from open web steel joists from hangers connected to either top or bottom chords within 3 inches of center of chord panel points (intersection of diagonal or vertical chord with top or bottom chord). Joist reinforcement will be required if hangers are not installed at panel points. Refer to structural details.
3. In addition to maximum spacing of hangers or supports specified below, the number and spacing of hangers and supports shall be such as to equally distribute loads to all structural members in the system.
4. Connections to structural members shall be clamping devices which do not damage or deform structural elements. Welding to or drilling holes in structural members is not permitted unless specifically approved by Architect.
5. Threaded rod shall not be bent. Provide swivel connection or other means to prevent stress on threaded rod.

D. Install the following pipe attachments:
1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
2. Adjustable roller hangers for individual horizontal piping 20 feet or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
4. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

E. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:
1. NPS 3/4: Maximum span, 7 feet; minimum rod size, 1/4 inch.
2. NPS 1: Maximum span, 7 feet; minimum rod size, 1/4 inch.
3. NPS 1-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
4. NPS 2: Maximum span, 10 feet; minimum rod size, 3/8 inch.
5. NPS 2-1/2: Maximum span, 11 feet; minimum rod size, 3/8 inch.
6. NPS 3: Maximum span, 12 feet; minimum rod size, 3/8 inch.
7. NPS 4: Maximum span, 14 feet; minimum rod size, 1/2 inch.
8. NPS 6: Maximum span, 17 feet; minimum rod size, 1/2 inch.

F. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:
1. NPS 3/4: Maximum span, 5 feet; minimum rod size, 1/4 inch.
2. NPS 1Maximum span, 6 feet; minimum rod size, 1/4 inch.
3. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
4. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
5. NPS 2-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
6. NPS 3: Maximum span, 10 feet; minimum rod size, 3/8 inch.

G. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

H. In grooved installations, use rigid couplings with offsetting angle-pattern bolt pads, which permit support and hanging in accordance with ANSI B31.1, B31.3, and B31.9.

3.4 PIPE JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
   2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

I. Grooved Joints: Assemble joints with coupling and gasket, lubricant, and bolts. Cut or roll grooves in ends of pipe based on pipe and coupling manufacturer's written instructions for pipe wall thickness. Use grooved-end fittings and rigid, grooved-end-pipe couplings.
   1. Grooved joints shall be installed in accordance with the manufacturer’s latest published installation instructions.
   2. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove.
   3. Gaskets shall be of an elastomer grade suitable for the intended service and shall be molded and produced by the coupling manufacturer.
   4. The grooved coupling manufacturer’s factory trained representative shall provide on-site training for contractor’s field personnel in the use of grooving tools and installation of grooved joint products.
      a. The representative shall periodically visit the jobsite and review contractor is following best recommended practices in grooved product installation. (A distributor’s representative is not considered qualified to conduct the training of jobsite visit(s).)

J. Mechanically Formed, Copper-Tube-Outlet Joints: Use manufacturer-recommended tool and procedure, and brazed joints.

K. Pressure-Sealed Joints: Use manufacturer-recommended PFT series tool and procedure. Leave insertion marks on pipe after assembly.

L. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
   1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
   2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
   3. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
   4. PVC Nonpressure Piping: Join according to ASTM D 2855.

M. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

N. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

O. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
   1. Plain-End Pipe and Fittings: Use butt fusion.
   2. Plain-End Pipe and Socket Fittings: Use socket fusion.

P. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.5 HYDRONIC SPECIALTIES INSTALLATION

A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.

B. Install automatic air vents at high points of system piping in mechanical equipment rooms only. Manual vents at heat-transfer coils and elsewhere as required for air venting.

3.6 TERMINAL EQUIPMENT CONNECTIONS

A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.

B. Install control valves in accessible locations close to connected equipment.

C. Install ports for pressure gauges and thermometers at coil inlet and outlet connections according to Division 23 Section "Meters and Gauges for HVAC Piping."

D. Stainless steel braided flexible hoses may be utilized on terminal equipment connections into the following equipment only:
   1. FCU
   2. VVR
   3. PUH
   4. CUH

E. Stainless steel braided flexible hoses shall adhere to the following installation instructions:
   1. Never install the hose in tension. The hose is made to hold internal pressure, not to act as a means of support. Always allow an extra 5% in actual hose length to allow for shrinkage when the hose is subjected to internal pressure.
   2. The rigid piping attached to flexible hose should be anchored immediately to the hose connection to avoid imposing piping support and vibration loads on the flexible hose.
   3. Avoid tight bends in the flexible hose. Tight bends can reduce the flow capacity of the hose, induce high pressure drops, and may lead to failure.
   4. The bend in a flexible hose should all be in one plane. Example; A hose may be bent downwards or upwards to handle an offset in piping, but should not bend downward and then to the right or left. Bends create a torsional load on the hose.
   5. Verify the exact requirements for bending the flexible hose. Do not bend the hose more than the manufacturer recommendations or requirements.

3.7 FIELD QUALITY CONTROL

A. Prepare hydronic piping according to ASME B31.9 and as follows:
   1. Leave joints, including welds, uninsulated and exposed for examination during test.
   2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
   3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens. All piping in the entire building is to be flushed, regardless of installation method.
      a. Clean water shall be water that has been through the permanent project softener and permanent project domestic water filtration, or from an approved public water supply, by A/E.
      b. All rooms, branch piping, and equipment will be isolated prior to initiating flush/clean/fill.
      c. The main piping will be filled with clean water and mild cleaning agents.
      d. A water quality sample will be taken by the chemical treatment company.
      e. The drain valve(s) at the end of each pipe run will be opened, with a hose routed outside the building.
      f. Utilizing the main circulating pumps, this water will be re-circulated for a minimum of 48 hours.
      g. After initial flush, this water will be removed and the process repeated until water sample is deemed acceptable by F/H and/or CxA.
      h. Once the main piping is approved clean, the drain valves to each room or branch will be opened individually until clean water is flowing from the drain valve.
      i. The individual strainers will be removed, cleaned, and reinstalled. Multiple strainer cleanings may be required during the flush/clean/fill procedure.
      j. At that point, the isolation valves to each room will be opened and the total system will be filled.
      k. Utilizing the main circulating pumps, this water will be re-circulated for a minimum of 48 hours.
      l. The drain valves to each room or branch will be opened individually until clean water is flowing from the drain valve.
      m. The individual strainers will be removed, cleaned, and reinstalled. Multiple strainer cleanings may be required during the flush/clean/fill procedure.
      n. The process is to be repeated until water sample is deemed acceptable by F/H and/or CxA.
   4. Isolate all equipment and all equipment coils from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
   5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.
   6. Corrosion inhibitor to be applied after flushing and before filling the piping system.

B. Perform the following tests on hydronic piping:
   1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
   2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
   3. Isolate expansion tanks and determine that hydronic system is full of water.
   4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
   5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
   6. Prepare written report of testing.

C. Perform the following before operating the system:
   1. Open manual valves fully.
   2. Inspect pumps for proper rotation.
   3. Set makeup pressure-reducing valves for required system pressure.
   4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
   5. Set temperature controls so all coils are calling for full flow.
   6. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.
   7. Verify lubrication of motors and bearings.

3.8 PREPARATION AND CLEANING PROCEDURES

A. Preparation
   1. Systems shall be operational, filled, started, and vented prior to cleaning. Use water meter to record capacity in each system.
   2. Place terminal control valves in open position during cleaning.

B. Cleaning Sequence
   1. Add cleaner to closed systems at concentration recommended by manufacturer. Hot Water Heating Systems: Apply heat while circulating, slowly raising temperature to 160 degrees F and maintain for 12 hours minimum. Remove heat and circulate to 100 degrees F or less; drain systems as quickly as possible and refill with clean water. Circulate for 6 hours at design temperatures, then drain. Refill with clean water and repeat until system cleaner is removed.
   2. Chilled Water Systems: Circulate for 48 hours, then drain systems as quickly as possible. Refill with clean water, circulate for 24 hours, then drain. Refill with clean water and repeat until system cleaner is removed.
   3. Use neutralizer agents on recommendation of system cleaner supplier and approval of A/E.
   4. Remove, clean, and replace strainer screens.
   5. Inspect, remove sludge, and flush low points with clean water after cleaning process is completed. Include disassembly of components as required.

C. Closed System Treatment and Cleaning
   1. Provide one shot feeder on each system. Install isolating and drain valves and necessary piping. Install around circulating pumps unless indicated otherwise.

END OF SECTION 23 21 13

SECTION 23 23 00 - REFRIGERANT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes refrigerant piping used for air-conditioning applications.

1.2 PERFORMANCE REQUIREMENTS

A. Line Test Pressure: Refer to manufacturer’s requirements.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop, based on manufacturer's test data, for the following:
1. Thermostatic expansion valves.
2. Solenoid valves.
3. Hot-gas bypass valves.
4. Filter dryers.
5. Strainers.
6. Pressure-regulating valves.

B. Shop Drawings: Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, oil traps, double risers, wall and floor penetrations, and equipment connection details. Show interface and spatial relationships between piping and equipment.
1. Shop Drawing Scale: 1/4 inch equals 1 foot.
2. Refrigerant piping indicated on Drawings is schematic only. Size piping and design actual piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.

1.4 CLOSEOUT DOCUMENTS

A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
1. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

B. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."

C. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

D. UL 207 Refrigerant Containing Components and Accessories.

1.6 PRODUCT STORAGE AND HANDLING

A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

1.7 COORDINATION

A. Coordinate size and location of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Copper Tube: ASTM B 280, Type ACR.

B. Wrought-Copper Fittings: ASME B16.22.

C. Wrought-Copper Unions: ASME B16.22.

D. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.

E. Brazing Filler Metals: AWS A5.8.

F. Flexible Connectors:
1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.
2. End Connections: Socket ends.
3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch- long assembly.
4. Pressure Rating: Factory test at minimum 500 psig.
5. Maximum Operating Temperature: 250 deg F.

2.2 VALVES AND SPECIALTIES

A. Diaphragm Packless Valves:
1. Body and Bonnet: Forged brass or cast bronze; globe design with straight-through or angle pattern.
2. Diaphragm: Phosphor bronze and stainless steel with stainless-steel spring.
3. Operator: Rising stem and hand wheel.
4. Seat: Nylon.
5. End Connections: Socket, union, or flanged.
6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 275 deg F.

B. Packed-Angle Valves:
1. Body and Bonnet: Forged brass or cast bronze.
2. Packing: Molded stem, back seating, and replaceable under pressure.
3. Operator: Rising stem.
4. Seat: Nonrotating, self-aligning polytetrafluoroethylene.
5. Seal Cap: Forged-brass or valox hex cap.
6. End Connections: Socket, union, threaded, or flanged.
7. Working Pressure Rating: 500 psig.
8. Maximum Operating Temperature: 275 deg F.

C. Check Valves:
1. Body: Ductile iron, forged brass, or cast bronze; globe pattern.
2. Bonnet: Bolted ductile iron, forged brass, or cast bronze; or brass hex plug.
3. Piston: Removable polytetrafluoroethylene seat.
4. Closing Spring: Stainless steel.
5. End Connections: Socket, union, threaded, or flanged.
6. Maximum Opening Pressure: 0.50 psig.
7. Working Pressure Rating: 500 psig.
8. Maximum Operating Temperature: 275 deg F.

D. Service Valves:
   1. Body: Forged brass with brass cap including key end to remove core.
   2. Core: Removable ball-type check valve with stainless-steel spring.
   3. Seat: Polytetrafluoroethylene.
   4. End Connections: Copper spring.
   5. Working Pressure Rating: 500 psig.

E. Solenoid Valves: Comply with ARI 760 and UL 429; listed and labeled by an NRTL.
   1. Body and Bonnet: Plated steel.
   2. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
   3. Seat: Polytetrafluoroethylene.
   4. End Connections: Threaded.
   5. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch conduit adapter, and 24, 115, or 208-V ac coil.
   6. Working Pressure Rating: 400 psig.
   7. Maximum Operating Temperature: 240 deg F.
   8. Manual operator.

F. Safety Relief Valves: Comply with ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.
   1. Body and Bonnet: Ductile iron and steel, with neoprene O-ring seal.
   2. Piston, Closing Spring, and Seat Insert: Stainless steel.
   3. Seat Disc: Polytetrafluoroethylene.
   4. End Connections: Threaded.
   5. Working Pressure Rating: 400 psig.
   6. Maximum Operating Temperature: 240 deg F.

G. Thermostatic Expansion Valves: Comply with ARI 750.
   1. Body, Bonnet, and Seal Cap: Forged brass or steel.
   2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
   3. Packing and Gaskets: Non-asbestos.
   4. Capillary and Bulb: Copper tubing filled with refrigerant charge.
   5. Suction Temperature: 40 deg F.
   6. Superheat: Adjustable.
   7. Reverse-flow option (for heat-pump applications).
   8. End Connections: Socket, flare, or threaded union.
   9. Working Pressure Rating: 700 psig.

H. Hot-Gas Bypass Valves: Comply with UL 429; listed and labeled by an NRTL.
   1. Body, Bonnet, and Seal Cap: Ductile iron or steel.
   2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
   3. Packing and Gaskets: Non-asbestos.
   4. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
   5. Seat: Polytetrafluoroethylene.
   6. Equalizer: External.
   7. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch conduit adapter, and 24, 115, or 208-V ac coil.
   8. End Connections: Socket.
   9. Set Pressure: As required by system.
   10. Throttling Range: Maximum 5 psig.
   11. Working Pressure Rating: 500 psig.
   12. Maximum Operating Temperature: 240 deg F.

I. Straight-Type Strainers:
   1. Body: Welded steel with corrosion-resistant coating.
   2. Screen: 100-mesh stainless steel.
   3. End Connections: Socket or flare.
   4. Working Pressure Rating: 500 psig.
   5. Maximum Operating Temperature: 275 deg F.

J. Angle-Type Strainers:

1. Body: Forged brass or cast bronze.
2. Drain Plug: Brass hex plug.
3. Screen: 100-mesh monel.
4. End Connections: Socket or flare.
5. Working Pressure Rating: 500 psig.
6. Maximum Operating Temperature: 275 deg F.

K. Moisture/Liquid Indicators:
1. Body: Forged brass.
2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
3. Indicator: Color coded to show moisture content in ppm.
4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
5. End Connections: Socket or flare.
6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 240 deg F.

L. Replaceable-Core Filter Dryers: Comply with ARI 730.
1. Body and Cover: Painted-steel shell with ductile-iron cover, stainless-steel screws, and neoprene gaskets.
2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
3. Desiccant Media: Activated alumina or charcoal.
4. Designed for reverse flow (for heat-pump applications).
5. End Connections: Socket.
6. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.
7. Maximum Pressure Loss: 2 psig.
8. Rated Flow: As required by system.
9. Working Pressure Rating: 500 psig.
10. Maximum Operating Temperature: 240 deg F.

M. Permanent Filter Dryers: Comply with ARI 730.
1. Body and Cover: Painted-steel shell.
2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
3. Desiccant Media: Activated alumina or charcoal.
4. Designed for reverse flow (for heat-pump applications).
5. End Connections: Socket.
6. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.
7. Maximum Pressure Loss: 2 psig.
8. Rated Flow: As required by system.
9. Working Pressure Rating: 500 psig.
10. Maximum Operating Temperature: 240 deg F.

N. Mufflers:
1. Body: Welded steel with corrosion-resistant coating.
2. End Connections: Socket or flare.
3. Working Pressure Rating: 500 psig.
4. Maximum Operating Temperature: 275 deg F.

O. Receivers: Comply with ARI 495.
1. Comply with ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.
2. Comply with UL 207; listed and labeled by an NRTL.
3. Body: Welded steel with corrosion-resistant coating.
4. Tappings: Inlet, outlet, liquid level indicator, and safety relief valve.
5. End Connections: Socket or threaded.
6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 275 deg F.

P. Liquid Accumulators: Comply with ARI 495.
1. Body: Welded steel with corrosion-resistant coating.

2. End Connections: Socket or threaded.
3. Working Pressure Rating: 500 psig.
4. Maximum Operating Temperature: 275 deg F.

2.3 REFRIGERANTS

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:
1. Atofina Chemicals, Inc.
2. DuPont Company; Fluorochemicals Div.
3. Honeywell, Inc.; Genetron Refrigerants.
4. INEOS Fluor Americas LLC.

B. ASHRAE 34, R-32: Difluoromethane.

C. ASHRAE 34, R-454B: 1,1- Difluoromethane and 2,3,3,3-Tetrafluoroprop-1-EN

D. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

E. Refrigerant must be CFC free.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS FOR REFRIGERANT R-32, R-454B

A. Suction Lines NPS 1-1/2 and Smaller for Conventional Air-Conditioning Applications: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed or soldered joints.

B. Suction Lines NPS 2 to NPS 4 for Conventional Air-Conditioning Applications: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with joints.

C. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications NPS 1-1/2 and Smaller: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed or soldered joints.

D. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications NPS 2 and Larger: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.

E. Safety-Relief-Valve Discharge Piping: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with soldered joints.

3.2 VALVE AND SPECIALTY APPLICATIONS

A. Install diaphragm packless valves in suction and discharge lines of compressor.

B. Install service valves for gauge taps at inlet and outlet of hot-gas bypass valves and strainers if they are not an integral part of valves and strainers.

C. Install a check valve at the compressor discharge and a liquid accumulator at the compressor suction connection.

D. Except as otherwise indicated, install diaphragm packless valves on inlet and outlet side of filter dryers.

E. Install a full-sized, three-valve bypass around filter dryers.

F. Install solenoid valves upstream from each expansion valve and hot-gas bypass valve. Install solenoid valves in horizontal lines with coil at top.

G. Install thermostatic expansion valves as close as possible to distributors on evaporators.
   1. Install valve so diaphragm case is warmer than bulb.
   2. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.
   3. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.

H. Install safety relief valves where required by ASME Boiler and Pressure Vessel Code. Pipe safety-relief-valve discharge line to outside according to ASHRAE 15.

I. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.

J. Install strainers upstream from and adjacent to the following unless they are furnished as an integral assembly for device being protected:
   1. Solenoid valves.
   2. Thermostatic expansion valves.
   3. Hot-gas bypass valves.
   4. Compressor.

K. Install filter dryers in liquid line between compressor and thermostatic expansion valve.

L. Install receivers sized to accommodate pump-down charge.

M. Install flexible connectors at compressors.

3.3 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

B. Install refrigerant piping according to ASHRAE 15.

C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping adjacent to machines to allow service and maintenance.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Select system components with pressure rating equal to or greater than system operating pressure.

J. Refer to Division 23 Sections "Instrumentation and Control for HVAC" and "Sequence of Operation" for solenoid valve controllers, control wiring, and sequence of operation.

K. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

L. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Division 08 Section "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.

M. Install refrigerant piping in protective conduit where installed belowground.

N. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.

O. Slope refrigerant piping as follows:
1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
2. Install horizontal suction lines with a uniform slope downward to compressor.
3. Install traps and double risers to entrain oil in vertical runs.
4. Liquid lines may be installed level.

P. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

Q. Install pipe sleeves at penetrations in exterior walls and floor assemblies.

R. Seal penetrations through fire and smoke barriers according to Division 07 Section "Penetration Firestopping."

S. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

T. Install sleeves through floors, walls, or ceilings, sized to permit installation of full-thickness insulation.

U. Seal pipe penetrations through exterior walls according to Division 07 Section "Joint Sealants" for materials and methods.

V. Identify refrigerant piping and valves according to Division 23 Section "Identification for HVAC Piping and Equipment."

W. Insulate refrigerant piping the full length and cover piping insulation with jacket according to Division 23 Section “HVAC Insulation”.

X. Refrigerant piping shall be sized per manufacturers requirements.

3.4 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing, to prevent scale formation.

D. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
1. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper pipe.
2. Use Type BAg, cadmium-free silver alloy for joining copper with bronze or steel.

F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.5 HANGERS AND SUPPORTS

A. Hanger, support, and anchor products are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

B. Install the following pipe attachments:
1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
2. Roller hangers and spring hangers for individual horizontal runs 20 feet or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.
5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:
1. NPS 1/2: Maximum span, 60 inches; minimum rod size, 1/4 inch.
2. NPS 5/8: Maximum span, 60 inches; minimum rod size, 1/4 inch.
3. NPS 1: Maximum span, 72 inches; minimum rod size, 1/4 inch.
4. NPS 1-1/4: Maximum span, 96 inches; minimum rod size, 3/8 inch.
5. NPS 1-1/2: Maximum span, 96 inches; minimum rod size, 3/8 inch.
6. NPS 2: Maximum span, 96 inches; minimum rod size, 3/8 inch.
7. NPS 2-1/2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
8. NPS 3: Maximum span, 10 feet; minimum rod size, 3/8 inch.
9. NPS 4: Maximum span, 12 feet; minimum rod size, 1/2 inch.

D. Support multifloor vertical runs at a minimum of each floor.

3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:
1. Comply with ASME B31.5, Chapter VI.
2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.
    a. Fill system with nitrogen to the required test pressure.
    b. System shall maintain test pressure at the manifold gauge throughout duration of test.
    c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
    d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

3.7 SYSTEM CHARGING

A. Charge system using the following procedures:
1. Install core in filter dryers after leak test but before evacuation.
2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
4. Charge system with a new filter-dryer core in charging line.

3.8 ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.

B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

C. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.

D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:
   1. Open shutoff valves in condenser water circuit.
   2. Verify that compressor oil level is correct.
   3. Open compressor suction and discharge valves.
   4. Open refrigerant valves except bypass valves that are used for other purposes.
   5. Check open compressor-motor alignment and verify lubrication for motors and bearings.

E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION 23 23 00

SECTION 23 31 13 - METAL DUCTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes metal ducts for supply, return, outside, and exhaust air-distribution systems in pressure classes from minus 2- to plus 10-inch wg. Metal ducts include the following:
   1. Rectangular ducts and fittings.
   2. Single-wall, round, and flat-oval spiral-seam ducts and formed fittings.

B. Related Sections include the following:
   1. Division 07 Section "Penetration Firestopping."
   2. Division 09 Section "Interior Painting."
   3. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.
   4. Division 23 Section "HVAC Insulation" for duct liners.

1.2 SYSTEM DESCRIPTION

A. Duct system design, as indicated, has been used to select size and type of air-moving and -distribution equipment and other air system components. Changes to layout or configuration of duct system must be specifically approved in writing by A/E. Accompany requests for layout modifications with calculations showing that proposed layout will provide original design results without increasing system total pressure.

B. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.3 ACTION SUBMITTALS

A. Shop Drawings: Drawn to 1/4 inch equals 1 foot scale. Show fabrication and installation details for metal ducts.
   1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
   2. Duct layout indicating sizes and pressure classes.
   3. Elevations of top and bottom of ducts.
   4. Dimensions of main duct runs from building grid lines.
   5. Fittings.
   6. Reinforcement and spacing.
   7. Seam and joint construction.
   8. Penetrations through fire-rated and other partitions.
   9. Equipment installation based on equipment being used on Project.
   10. Duct accessories, including access doors and panels.
   11. Hangers and supports, including methods for duct and building attachment, vibration isolation, and restraints.

B. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
   1. Ceiling suspension assembly members.
   2. Other systems installed in same space as ducts.
   3. Ceiling- and wall-mounting access doors and panels required to provide access to dampers and other operating devices.
   4. Ceiling-mounting items, including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
   5. In general, the piping and ductwork shown on the drawings shall be considered as diagrammatic for clearness in indicating the general run and connections required, and

may not be shown in its true position. The piping and ductwork equipment may have to be offset, lowered, or raised as required to accommodate field conditions.

1.4 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel," for hangers and supports, AWS D1.2, "Structural Welding Code--Aluminum," for aluminum supporting members, and AWS D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

B. NFPA Compliance:
1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."
2. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 – Systems and Equipment" and Section 7 – "Construction and System Start-up."

D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 – "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. 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, but are not limited to, manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 SHEET METAL MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having G90 coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.

C. Carbon-Steel Sheets: ASTM A 366, cold-rolled sheets; commercial quality; with oiled, matte finish for exposed ducts.

D. Stainless Steel: ASTM A480, Type 304 and having a No. 20 finish for concealed ducts, and a finish to match kitchen or dishwasher hoods for exposed ducts.

E. Aluminum Sheets: ASTM B 209, alloy 3003, temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

F. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts.

G. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.3 SEALANT MATERIALS

A. Joint and Seam Sealants, General: The term "sealant" is not limited to materials of adhesive or mastic nature but includes tapes and combinations of open-weave fabric strips and mastics.

B. Tape Sealing System: Woven-fiber tape impregnated with gypsum mineral compound and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.

C. Water-Based Joint and Seam Sealant: Flexible, adhesive sealant, resistant to UV light when cured, UL 723 listed, and complying with NFPA requirements for Class 1 ducts.

D. Solvent-Based Joint and Seam Sealant: One-part, nonsag, solvent-release-curing, polymerized butyl sealant formulated with a minimum of 75 percent solids.

E. Flanged Joint Mastic: One-part, acid-curing, silicone, elastomeric joint sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use O.

F. Flange Gaskets: Butyl rubber or EPDM polymer with polyisobutylene plasticizer.

2.4 HANGERS AND SUPPORTS

A. Hanger Materials: Galvanized sheet steel or threaded steel rod.
1. Hangers Installed in Corrosive Atmospheres: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
2. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for steel sheet width and thickness and for steel rod diameters.
3. Galvanized-steel straps attached to aluminum ducts shall have contact surfaces painted with zinc-chromate primer.

B. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

C. Trapeze and Riser Supports: Steel shapes complying with ASTM A 36/A 36M.
1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel support materials.
3. Supports for Aluminum Ducts: Aluminum support materials unless materials are electrolytically separated from ducts.

D. Contractor may use load rated cable suspension system. Suspension system shall have a specified manufacturers safe working load and supplemental safety factor of at least five times the safe working load.
1. Suspension system shall be verified by SMACNA Testing and Research Institute to be in compliance with SMACNA Duct Construction Standards Guidelines (1995 CH.4).

2.5 RECTANGULAR DUCT FABRICATION

A. Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" and complying with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals.

1. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure class.
2. Deflection: Duct systems shall not exceed deflection limits according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

B. Transverse Joints: Prefabricated slide-on joints and components constructed using manufacturer's guidelines for material thickness, reinforcement size and spacing, and joint reinforcement.
1. Manufacturers:
   a. Ductmate Industries, Inc.
   b. Nexus Inc.
   c. Ward Industries, Inc.

C. Formed-On Flanges: Construct according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," Figure 1-4, using corner, bolt, cleat, and gasket details.
1. Manufacturers:
   a. Ductmate Industries, Inc.
   b. Lockformer.
2. Duct Size: Maximum 30 inches wide and up to 2-inch wg pressure class.
3. Longitudinal Seams: Pittsburgh lock sealed with noncuring polymer sealant.

D. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches and larger and 0.0359 inch thick or less, with more than 10 sq. ft. of nonbraced panel area unless ducts are lined.

2.6 APPLICATION OF LINER IN RECTANGULAR DUCTS

A. Division 23 Section "HVAC Insulation" for installation requirements for duct liners.

2.7 ROUND AND FLAT-OVAL DUCT AND FITTING FABRICATION

A. Diameter as applied to flat-oval ducts in this Article is the diameter of a round duct with a circumference equal to the perimeter of a given size of flat-oval duct.

B. Round, Longitudinal- and Spiral Lock-Seam Ducts: Fabricate supply ducts of galvanized steel according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

C. Flat-Oval, Spiral Lock-Seam Ducts: Fabricate supply ducts according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

D. Duct Joints:
1. Ducts up to 20 Inches in Diameter: Interior, center-beaded slip coupling, sealed before and after fastening, attached with sheet metal screws.
2. Ducts 21 to 72 Inches in Diameter: Three-piece, gasketed, flanged joint consisting of two internal flanges with sealant and one external closure band with gasket.
3. Ducts Larger Than 72 Inches in Diameter: Companion angle flanged joints per SMACNA "HVAC Duct Construction Standards--Metal and Flexible," Figure 3-2.
4. Round Ducts: Prefabricated connection system consisting of double-lipped, EPDM rubber gasket. Manufacture ducts according to connection system manufacturer's tolerances.
   a. Manufacturers:
      1) Ductmate Industries, Inc.
      2) Lindab Inc.

5. Flat-Oval Ducts: Prefabricated connection system consisting of two flanges and one synthetic rubber gasket.
    a. Manufacturers:
        1) Ductmate Industries, Inc.
        2) McGill AirFlow Corporation.
        3) SEMCO Incorporated.

E. 90-Degree Tees and Laterals and Conical Tees: Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," with metal thicknesses specified for longitudinal-seam straight ducts.

F. Diverging-Flow Fittings: Fabricate with reduced entrance to branch taps and with no excess material projecting from fitting onto branch tap entrance.

G. Fabricate elbows using die-formed, gored, pleated, or mitered construction. Bend radius of die-formed, gored, and pleated elbows shall be 1-1/2 times duct diameter. Unless elbow construction type is indicated, fabricate elbows as follows:
1. Mitered-Elbow Radius and Number of Pieces: Welded construction complying with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.
2. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from minus 2- to plus 2-inch wg:
    a. Ducts 3 to 36 Inches in Diameter: 0.034 inch.
    b. Ducts 37 to 50 Inches in Diameter: 0.040 inch.
    c. Ducts 52 to 60 Inches in Diameter: 0.052 inch.
    d. Ducts 62 to 84 Inches in Diameter: 0.064 inch.
3. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from 2- to 10-inch wg:
    a. Ducts 3 to 26 Inches in Diameter: 0.034 inch.
    b. Ducts 27 to 50 Inches in Diameter: 0.040 inch.
    c. Ducts 52 to 60 Inches in Diameter: 0.052 inch.
    d. Ducts 62 to 84 Inches in Diameter: 0.064 inch.
4. Flat-Oval Mitered Elbows: Welded construction with same metal thickness as longitudinal-seam flat-oval duct.
5. 90-Degree, 2-Piece, Mitered Elbows: Use only for supply systems or for material-handling Class A or B exhaust systems and only where space restrictions do not permit using radius elbows. Fabricate with single-thickness turning vanes.
6. Round Elbows 8 Inches and Less in Diameter: Fabricate die-formed elbows for 45- and 90-degree elbows and pleated elbows for 30, 45, 60, and 90 degrees only. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
7. Round Elbows 9 through 14 Inches in Diameter: Fabricate gored or pleated elbows for 30, 45, 60, and 90 degrees unless space restrictions require mitered elbows. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
8. Round Elbows Larger Than 14 Inches in Diameter and All Flat-Oval Elbows: Fabricate gored elbows unless space restrictions require mitered elbows.
9. Die-Formed Elbows for Sizes through 8 Inches in Diameter and All Pressures 0.040 inch thick with 2-piece welded construction.
10. Round Gored-Elbow Metal Thickness: Same as non-elbow fittings specified above.
11. Flat-Oval Elbow Metal Thickness: Same as longitudinal-seam flat-oval duct specified above.
12. Pleated Elbows for Sizes through 14 Inches in Diameter and Pressures through 10-Inch wg: 0.022 inch.

PART 3 - EXECUTION

3.1 DUCT APPLICATIONS

A. Static-Pressure Classes: Unless otherwise indicated, construct ducts according to the following:
   1. Supply Ducts: 2-inch wg.
   2. Supply Ducts (before Air Terminal Units): 3-inch wg.
   3. Supply Ducts (after Air Terminal Units): 2-inch wg.
   4. Return Ducts (Negative Pressure): 1-inch wg.
   5. Exhaust Ducts (Negative Pressure): 2-inch wg.

B. All ducts shall be galvanized steel.

3.2 DUCT INSTALLATION

A. Construct and install ducts according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.

B. Install round and flat-oval ducts in lengths not less than 12 feet unless interrupted by fittings.

C. Install ducts with fewest possible joints.

D. Install fabricated fittings for changes in directions, size, and shape and for connections.

E. Install couplings tight to duct wall surface with a minimum of projections into duct. Secure couplings with sheet metal screws. Install screws at intervals of 12 inches, with a minimum of 3 screws in each coupling.

F. Install ducts, unless otherwise indicated, vertically and horizontally and parallel and perpendicular to building lines; avoid diagonal runs.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

I. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions unless specifically indicated.

J. Coordinate layout with suspended ceiling, fire- and smoke-control dampers, lighting layouts, and similar finished work.

K. Seal all joints and seams. Apply sealant to male end connectors before insertion, and afterward to cover entire joint and sheet metal screws.

L. Electrical Equipment Spaces: Route ducts to avoid passing through transformer vaults and electrical equipment spaces and enclosures.

M. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls and are exposed to view, conceal spaces between construction openings and ducts or duct insulation with sheet metal flanges of same metal thickness as ducts. Overlap openings on 4 sides by at least 1-1/2 inches.

N. Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, install appropriately rated fire dampers, sleeves, and firestopping sealant. Fire and smoke dampers are specified in Division 23 Section "Air Duct Accessories." Firestopping materials and installation methods are specified in Division 07 Section "Penetration Firestopping."

O. Protect duct interiors from the elements and foreign materials until building is enclosed. Follow SMACNA's "Duct Cleanliness for New Construction."

P. Paint interiors of metal ducts, that do not have duct liner, for 24 inches upstream of registers and grilles. Apply one coat of flat, black, latex finish coat over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 09 painting Sections.

Q. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

3.3 SEAM AND JOINT SEALING

A. Seal duct seams and joints according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for duct pressure class indicated and in compliance with ASHRAE/IESNA 90.1.
   1. For pressure classes lower than 2-inch wg, seal transverse joints.

B. Seal ducts before external insulation is applied.

3.4 HANGING AND SUPPORTING

A. Comply with SMACNA's "HVAC Duct Construction Standards – Metal and Flexible," Chapter 5, "Hangers and Supports," unless otherwise noted.

B. Support horizontal ductwork runs on 6 foot centers and within 24 inches of each elbow and within 48 inches of each branch intersection. Where duct weight for the 6 foot length is less than 40 pounds, support hangers may be on 8 foot centers.

C. Support vertical ducts at maximum intervals of 16 feet and at each floor.

D. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.

3.5 CONNECTIONS

A. Make connections to equipment with flexible connectors according to Division 23 Section "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections according to SMACNA's "HVAC Air Duct Leakage Test Manual" and prepare test reports. Leak testing is required for all medium pressure ductwork rated with a static-pressure class that exceeds 2-inch wg. Low-pressure ductwork rated below 2-inch wg will not require pressure testing.
   1. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
   2. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If pressure classes are not indicated, test entire system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure. Give seven days' advance notice for testing.

3. Maximum Allowable Leakage: Comply with requirements for Leakage Class 3 for round and flat-oval ducts, Leakage Class 12 for rectangular ducts in pressure classes lower than and equal to 2-inch wg (both positive and negative pressures), and Leakage Class 6 for pressure classes from 2- to 10-inch wg.
4. Remake leaking joints and retest until leakage is equal to or less than maximum allowable.

3.7 CLEANING NEW SYSTEMS

A. Mark position of dampers and air-directional mechanical devices before cleaning, and perform cleaning before air balancing.

B. Use service openings, as required, for physical and mechanical entry and for inspection.
1. Create other openings to comply with duct standards.
2. Disconnect flexible ducts as needed for cleaning and inspection.
3. Remove and reinstall ceiling sections to gain access during the cleaning process.

C. Vent vacuuming system to the outside. Include filtration to contain debris removed from HVAC systems, and locate exhaust down wind and away from air intakes and other points of entry into building.

D. Clean the following metal duct systems by removing surface contaminants and deposits:
1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, and actuators except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

E. Mechanical Cleaning Methodology:
1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet.
5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.

F. Cleanliness Verification:
1. Visually inspect metal ducts for contaminants.
2. Where contaminants are discovered, re-clean and reinspect ducts.

3.8 CLEANING EXISTING SYSTEMS

A. Use service openings, as required, for physical and mechanical entry and for inspection.
1. Use existing service openings where possible.
2. Create other openings to comply with duct standards.
3. Disconnect flexible ducts as needed for cleaning and inspection.

4. Reseal rigid fiberglass duct systems according to NAIMA recommended practices.
5. Remove and reinstall ceiling sections to gain access during the cleaning process.

B. Mark position of dampers and air-directional mechanical devices before cleaning, and restore to their marked position on completion.

C. Particulate Collection and Odor Control:
1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron size (or larger) particles.
2. When venting vacuuming system to the outside, use filtration to contain debris removed from HVAC system, and locate exhaust down wind and away from air intakes and other points of entry into building.

D. Clean the following metal duct systems by removing surface contaminants and deposits:
1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, and actuators except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

E. Mechanical Cleaning Methodology:
1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide operative drainage system for washdown procedures.
7. Biocidal Agents and Coatings: Apply biocidal agents if fungus is present. Apply biocidal agents according to manufacturer's written instructions after removal of surface deposits and debris.

F. Cleanliness Verification:
1. Verify cleanliness after mechanical cleaning and before application of treatment, including biocidal agents and protective coatings.
2. Visually inspect metal ducts for contaminants.
3. Where contaminants are discovered, re-clean and reinspect ducts.

G. Gravimetric Analysis: At discretion and expense of Owner, sections of metal duct system, chosen randomly by Owner, may be tested for cleanliness according to NADCA vacuum test gravimetric analysis.
1. If analysis determines that levels of debris are equal to or lower than suitable levels, system shall have passed cleanliness verification.
2. If analysis determines that levels of debris exceed suitable levels, system cleanliness verification will have failed and metal duct system shall be re-cleaned and re-verified.

H. Verification of Coil Cleaning: Cleaning must restore coil pressure drop to within 10 percent of pressure drop measured when coil was first installed. If original pressure drop is not known, coil will be considered clean only if it is free of foreign matter and chemical residue, based on thorough visual inspection.

END OF SECTION 23 31 13

SECTION 23 33 00 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Manual volume dampers.
2. Flange connectors.
3. Turning vanes.
4. Flexible connectors.
5. Flexible ducts.
6. Duct accessory hardware.

B. Related Sections:
1. Division 28 Section "Fire Detection and Alarm" for duct-mounted fire and smoke detectors.

1.2 ACTION SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from Installers of the items involved.

B. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

1.3 QUALITY ASSURANCE

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with AMCA 500-D testing for damper rating.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
1. Galvanized Coating Designation: G60.
2. Exposed-Surface Finish: Mill phosphatized.

C. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304.

D. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

E. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6.

F. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

G. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.2 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Air Balance Inc.; a division of Mestek, Inc.
   b. American Warming and Ventilating; a division of Mestek, Inc.
   c. Flexmaster U.S.A., Inc.
   d. McGill AirFlow LLC.
   e. METALAIRE, Inc.
   f. Nailor Industries Inc.
   g. Pottorff; a division of PCI Industries, Inc.
   h. Ruskin Company.
   i. Trox USA Inc.
   j. Vent Products Company, Inc.
2. Standard leakage rating, with linkage outside airstream.
3. Suitable for horizontal or vertical applications.
4. Frames:
   a. Hat-shaped, galvanized-steel channels, 0.064-inch minimum thickness.
   b. Mitered and welded corners.
   c. Flanges for attaching to walls and flangeless frames for installing in ducts.
5. Blades:
   a. Multiple or single blade.
   b. Opposed-blade design.
   c. Stiffen damper blades for stability.
   d. Galvanized-steel, 0.064 inch thick.
6. Blade Axles: Galvanized steel.
7. Bearings:
   a. Oil-impregnated bronze or molded synthetic.
   b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
8. Tie Bars and Brackets: Galvanized steel.

B. Standard, Aluminum, Manual Volume Dampers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Air Balance Inc.; a division of Mestek, Inc.
   b. American Warming and Ventilating; a division of Mestek, Inc.
   c. Flexmaster U.S.A., Inc.
   d. McGill AirFlow LLC.
   e. METALAIRE, Inc.
   f. Nailor Industries Inc.
   g. Pottorff; a division of PCI Industries, Inc.
   h. Ruskin Company.
   i. Trox USA Inc.
   j. Vent Products Company, Inc.
2. Standard leakage rating.
3. Suitable for horizontal or vertical applications.
4. Frames: Hat-shaped, 0.10-inch thick, aluminum sheet channels; frames with flanges for attaching to walls and flangeless frame for installing in ducts.
5. Blades:
   a. Multiple or single blade.
   b. Opposed-blade design.
   c. Stiffen damper blades for stability.
   d. Roll-Formed Aluminum Blades: 0.10-inch thick aluminum sheet.
6. Blade Axles: Nonferrous metal.
7. Bearings:
   a. Oil-impregnated bronze or molded synthetic.
   b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
8. Tie Bars and Brackets: Galvanized steel.

C. Low-Leakage, Steel, Manual Volume Dampers:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Air Balance Inc.; a division of Mestek, Inc.
      b. American Warming and Ventilating; a division of Mestek, Inc.
      c. Flexmaster U.S.A., Inc.
      d. McGill AirFlow LLC.
      e. METALAIRE, Inc.
      f. Nailor Industries Inc.
      g. Pottorff; a division of PCI Industries, Inc.
      h. Ruskin Company.
      i. Trox USA Inc.
      j. Vent Products Company, Inc.
   2. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.
   3. Suitable for horizontal or vertical applications.
   4. Frames:
      a. Hat-shaped
      b. Galvanized-steel channels, 0.064 inch thick.
      c. Mitered and welded corners.
      d. Flanges or attaching to walls and flangeless frames for installing in ducts.
   5. Blades:
      a. Multiple or single blade.
      b. Opposed-blade design.
      c. Stiffen damper blades for stability.
      d. Galvanized, roll-formed steel, 0.064 inch thick.
   6. Blade Axles: Galvanized steel.
   7. Bearings:
      a. Oil-impregnated bronze or molded synthetic.
      b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
   8. Blade Seals: Vinyl.
   9. Jamb Seals: Flexible metal.
   10. Tie Bars and Brackets: Galvanized steel.
   11. Accessories:
      a. Include locking device to hold single-blade dampers in a fixed position without vibration.

D. Low-Leakage, Aluminum, Manual Volume Dampers:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Air Balance Inc.; a division of Mestek, Inc.
      b. American Warming and Ventilating; a division of Mestek, Inc.
      c. Flexmaster U.S.A., Inc.
      d. McGill AirFlow LLC.
      e. METALAIRE, Inc.
      f. Nailor Industries Inc.
      g. Pottorff; a division of PCI Industries, Inc.
      h. Ruskin Company.
      i. Trox USA Inc.
      j. Vent Products Company, Inc.
   2. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.
   3. Suitable for horizontal or vertical applications.
   4. Frames: Hat-shaped, 0.10-inch thick, aluminum sheet channels; frames with flanges for attaching to walls and flangeless frames for installing in ducts.
   5. Blades:
      a. Multiple or single blade.
      b. Opposed-blade design.
      c. Roll-Formed Aluminum Blades: 0.10-inch thick aluminum sheet.
   6. Blade Axles: Nonferrous metal.

7. Bearings:
    a. Oil-impregnated bronze or molded synthetic.
    b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
8. Blade Seals: Vinyl.
9. Jamb Seals: Cambered aluminum.
10. Tie Bars and Brackets: Aluminum.
11. Accessories:
    a. Include locking device to hold single-blade dampers in a fixed position without vibration.

E. Jackshaft:
1. Size: 1-inch diameter.
2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

F. Damper Hardware:
1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
2. Include center hole to suit damper operating-rod size.
3. Include elevated platform for insulated duct mounting.

2.3 FLANGE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Ductmate Industries, Inc.
2. Nexus PDQ; Division of Shilco Holdings Inc.
3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

C. Material: Galvanized steel.

D. Gauge and Shape: Match connecting ductwork.

2.4 TURNING VANES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. METALAIRE, Inc.
4. SEMCO Incorporated.
5. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-3, "Vanes and Vane Runners," and 2-4, "Vane Support in Elbows."

D. Vane Construction: Double wall.

2.5 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Ductmate Industries, Inc.
   2. Duro Dyne Inc.
   3. Ventfabrics, Inc.
   4. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Materials: Flame-retardant or noncombustible fabrics.

C. Coatings and Adhesives: Comply with UL 181, Class 1.

D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to 2 strips of 2-3/4-inch wide, 0.028-inch thick, galvanized sheet steel or 0.032-inch thick aluminum sheets. Provide metal compatible with connected ducts.

E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
   1. Minimum Weight: 26 oz./sq. yd.
   2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
   3. Service Temperature: Minus 40 to plus 200 deg F.

F. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
   1. Minimum Weight: 24 oz./sq. yd..
   2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
   3. Service Temperature: Minus 50 to plus 250 deg F.

G. High-Corrosive-Environment System, Flexible Connectors: Glass fabric with chemical-resistant coating.
   1. Minimum Weight: 14 oz./sq. yd..
   2. Tensile Strength: 450 lbf/inch in the warp and 340 lbf/inch in the filling.
   3. Service Temperature: Minus 67 to plus 500 deg F

H. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression, and with a load stop. Include rod and angle-iron brackets for attaching to fan discharge and duct.
   1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
   2. Outdoor Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
   3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
   4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
   5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
   6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
   7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch movement at start and stop.

2.6 FLEXIBLE DUCTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Atco
   2. Flexmaster U.S.A., Inc.
   3. Hercules Industries, Inc.
   4. McGill AirFlow LLC.
   5. Tuttle & Bailey; A Division of Hart & Cooley, Inc.
   6. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Low Pressure Insulated, Flexible Duct: UL 181, Class 1, multiple layers of aluminum laminate supported by helically wound, spring-steel wire; fibrous-glass insulation; aluminized vapor-barrier film.
   1. Pressure Rating: 4-inch wg positive and 0.5-inch wg negative.
   2. Maximum Air Velocity: 4000 fpm.
   3. Temperature Range: Minus 20 to plus 175 deg F.

C. Medium Pressure Insulated, Flexible Duct: UL 181, Class 1, multiple layers of aluminum laminate supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene or aluminized vapor-barrier film.
   1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
   2. Maximum Air Velocity: 4000 fpm.
   3. Temperature Range: Minus 20 to plus 210 deg F.

D. Flexible Duct Connectors:
   1. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action or nylon strap in sizes 3 through 18 inches, to suit duct size.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
   1. Coordinate subparagraphs below with Division 23 Section "Metal Ducts."Install steel volume dampers in steel ducts.
   2. Install aluminum volume dampers in aluminum ducts.

D. Set dampers to fully open position before testing, adjusting, and balancing.

E. Install test holes at fan inlets and outlets and elsewhere as indicated.

F. Install flexible connectors to connect ducts to equipment.

G. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

H. Flexible duct shall not be acceptable for use in exhaust system or negative pressure applications.

I. Connect terminal units to supply ducts with maximum 12-inch lengths of medium pressure flexible duct. Do not use flexible ducts to change directions.

J. Connect diffusers to low-pressure ducts with maximum 5 foot lengths of flexible duct clamped or strapped in place.

K. Connect flexible ducts to metal ducts with draw bands.

L. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop of fans.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:
   1. Operate dampers to verify full range of movement.
   2. Inspect turning vanes for proper and secure installation.

END OF SECTION 23 33 00

SECTION 23 37 13 - DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes ceiling- and wall-mounted diffusers, registers, and grilles.

B. Related Sections include the following:
1. Division 23 Section "Air Duct Accessories" for volume-control dampers not integral to diffusers, registers, and grilles.

1.2 ACTION SUBMITTALS

A. Product Data: For each product indicated, include the following:
1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.

B. Diffuser, Register, and Grille Schedule: In a tabulated schedule, indicate type mark, inlet size, diffuser/grille size, border type, overall size, mounting options, finish (color), finish (material), and all accessories.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified. A model number is indicated for each product as an example of the device required.
a. A-J Manufacturing Co., Inc.
b. Anemostat; a Mestek Company.
c. Carnes.
d. Dayus Register & Grille.
e. Greenheck
f. Hart & Cooley, Inc.; Hart & Cooley Div.
g. Krueger.
h. METALAIRE, Inc.; Metal Industries Inc.
i. Nailor Industries of Texas Inc.
j. Price Industries.
k. Titus.
l. Tuttle & Bailey.

2.2 SQUARE PANEL CEILING DIFFUSER (TYPE A AND B)

A. All 18 gauge steel diffuser, 24 inch by 24 inch module size, 18 inch by 18 inch face panel.

B. Round neck connection, dimension as scheduled on Drawings.

C. Solid face panel with curved back pan designed for VAV usage. Face panel shall be easily removed.

D. Back pan shall be one-piece die-formed with smooth surfaces and no corner joints.

E. Color shall match ceiling tile color on Drawings. Provide color chart for selection.

F. Provide blank-off plates to convert diffuser to 2-way or 3-way blow where indicated on Drawings.

G. Equivalent to Titus “Omni.”

2.3 AIR TRANSFER GRILLES, RETURN GRILLES, AND EXHAUST GRILLES (TYPE C)

A. All aluminum construction.

B. 35 degree louvers spaced 1/2 inch on center.

C. One set of fixed louver’s parallel to long dimension.

D. Color shall match ceiling tile color on Drawings. Provide color chart for selection. Provide wall mounted and exposed duct mounted installation with primed finish for field painting.

E. Size of grille as indicated on Drawings.

F. Equivalent to Titus “355-FL”

2.4 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practicable. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 23 37 13

SECTION 23 62 00 - PACKAGED COMPRESSOR AND CONDENSER UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes air-cooled condensing units.

1.2 ACTION SUBMITTALS

A. Product Data: For each condensing unit, include rated capacities, operating characteristics, furnished specialties, and accessories. Include equipment dimensions, weights and structural loads, required clearances, electrical requirements – control wiring, method of field assembly, components, and location and size of each field connection.

B. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
1. Structural members to which condensing units will be attached.
2. Liquid and vapor pipe sizes.
3. Refrigerant specialties.
4. Piping including connections, oil traps, and double risers.
5. Evaporators.

1.3 INFORMATIONAL/QUALITY ASSURANCE/CONTROL SUBMITTALS

A. Warranty: Special warranty specified in this Section.

1.4 CLOSEOUT DOCUMENTS

A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
1. Operation and Maintenance Data: For condensing units to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of condensing units and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Fabricate and label refrigeration system according to ASHRAE 15, "Safety Code for Mechanical Refrigeration."

1.6 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."

C. Coordinate location of piping and electrical rough-ins.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of condensing units that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Compressor failure.
   2. Warranty Period (Compressor only): Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CONDENSING UNITS, AIR COOLED, 1 TO 5 TONS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Carrier Corporation; Carrier Air Conditioning Div.
   2. Daikin.
   3. Trane Co. (The); Worldwide Applied Systems Group.
   4. York International Corp.

B. Description: Factory assembled and tested, consisting of compressor, condenser coil, fan, motors, refrigerant reservoir, and operating controls.

C. Compressor: Scroll, hermetically sealed, with rubber vibration isolators.
   1. Motor: Single or two speed, and includes thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
   2. Two-Speed Compressor: Include manual-reset, high-pressure switch and automatic-reset, low-pressure switch.
   3. Accumulator: Suction tube.
   4. Refrigerant Charge: R-32 or R-454b

D. Condenser Coil: Seamless copper-tube, aluminum-fin coil; circuited for integral liquid subcooler, with removable drain pan and brass service valves with service ports.

E. Condenser Fan: Direct-drive, aluminum propeller fan; with permanently lubricated, totally enclosed fan motor with thermal-overload protection and ball bearings.

F. Accessories:
   1. Crankcase heater.
   2. Cycle Protector: Automatic-reset timer to prevent rapid compressor cycling.
   3. Evaporator Freeze Thermostat: Temperature-actuated switch that stops unit when evaporator reaches freezing temperature.
   4. Filter-dryer.
   5. High-Pressure Switch: Automatic-reset switch cycles compressor off on high refrigerant pressure.
   6. Liquid-line solenoid.
   7. Low Ambient Controller/Kit: Controls condenser fan speed to permit operation down to minus 0 deg F.
   8. Low-Pressure Switch: Automatic-reset switch cycles compressor off on low refrigerant pressure.
   9. Precharged and insulated suction and liquid tubing.
   10. Thermostatic expansion valve.
   11. Time-Delay Relay: Continues operation of evaporator fan after compressor shuts off.

G. Unit Casing: Galvanized steel, finished with baked enamel; with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Mount service valves, fittings, and gauge ports on exterior of casing.

H. Division 26 shall provide a fused disconnect, factory mounted and wired, for single external electrical power connection.

2.2 MOTORS

A. General requirements for motors are specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."
   1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
   2. Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 26 Sections.

2.3 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate condensing units according to ARI 210/240 or ARI 340/360.
   1. Coefficient of Performance: Equal to or greater than prescribed by ASHRAE/IESNA 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."
   2. Energy-Efficiency Ratio: Equal to or greater than prescribed by ASHRAE/IESNA 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."

B. Test and inspect shell and tube condensers according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

C. Testing Requirements: Factory test sound-power-level ratings according to ARI 270.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of condensing units.

B. Examine roughing-in for refrigerant piping systems to verify actual locations of piping connections before equipment installation.

C. Examine walls, floors, and roofs for suitable conditions where condensing units will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install units level and plumb, firmly anchored in locations indicated; maintain manufacturer's recommended clearances.

B. Install roof-mounting units on prefabricated equipment supports. Refer to Section 230529 Hangers and Supports.

C. Maintain manufacturer's recommended clearances for service and maintenance.

D. Loose Components: Install electrical components, devices, and accessories that are not factory mounted.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to machine to allow service and maintenance.

C. Connect precharged refrigerant tubing to unit's quick-connect fittings. Install tubing so it does not interfere with access to unit. Install furnished accessories.

D. Connect refrigerant piping to air-cooled condensing units; maintain required access to unit. Install furnished field-mounted accessories. Refrigerant piping and specialties are specified in Division 23 Section "Refrigerant Piping."

E. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

F. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:
1. Perform electrical test and visual and mechanical inspection.
2. Leak Test: After installation, charge systems with refrigerant and oil and test for leaks. Repair leaks, replace lost refrigerant and oil, and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation, product capability, and compliance with requirements.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
5. Verify proper airflow over coils.

B. Verify that vibration isolation and flexible connections properly dampen vibration transmission to structure.

C. Remove and replace malfunctioning condensing units and retest as specified above.

3.5 STARTUP SERVICE

A. Complete installation and startup checks according to manufacturer's written instructions and perform the following:
1. Inspect for physical damage to unit casing.
2. Verify that access doors move freely and are weathertight.
3. Clean units and inspect for construction debris.
4. Verify that all bolts and screws are tight.
5. Adjust vibration isolation and flexible connections.
6. Verify that controls are connected and operational.

B. Lubricate bearings on fans.

C. Verify that fan wheel is rotating in the correct direction and is not vibrating or binding.

D. Start unit according to manufacturer's written instructions and complete manufacturer's startup checklist.

E. Measure and record airflow over coils.

F. Verify proper operation of condenser capacity control device.

G. Verify that vibration isolation and flexible connections properly dampen vibration transmission to structure.

H. After startup and performance test, lubricate bearings.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain condensing units. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 23 62 00

SECTION 23 82 19 - FAN COIL UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes fan-coil units and accessories.

1.2 DEFINITIONS

A. BAS: Building automation system.

1.3 ACTION SUBMITTALS

A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: Show installation details for wall penetrations.
   1. Wiring Diagrams: Power, signal, and control wiring.

C. Coordination Drawings: Floor plans, reflected ceiling plans, and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
   1. Ceiling suspension components.
   2. Structural members to which fan-coil units will be attached.
   3. Method of attaching hangers to building structure.
   4. Size and location of initial access modules for acoustical tile.
   5. Items penetrating finished ceiling, including the following:
      a. Lighting fixtures.
      b. Air outlets and inlets.
      c. Speakers.
      d. Sprinklers.
      e. Access panels.
   6. Perimeter moldings for exposed or partially exposed cabinets.

1.4 INFORMATIONAL/QUALITY ASSURANCE/CONTROL SUBMITTALS

A. Field quality-control test reports.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for self-contained fan coil units.

C. Operation and Maintenance Data: For self-contained fan coil units to include in emergency, operation, and maintenance manuals.

D. Warranties: Special warranties specified in this Section.

1.5 CLOSEOUT DOCUMENTS

A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
   1. Operation and Maintenance Data: For fan-coil units to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
      a. Maintenance schedules and repair part lists for motors, coils, integral controls, and filters.

1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.7 COORDINATION

A. Coordinate layout and installation of fan-coil units and suspension system components with other construction that penetrates or is supported by ceilings, including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.

B. Coordinate layout and installation of fan coil units and wall construction with other construction that penetrates walls or is supported by them.

1.8 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. Fan-Coil-Unit Filters: Furnish 1 set of spare filters for each unit.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of self-contained fan coil units that fail in materials or workmanship within specified warranty period.

PART 2 - PRODUCTS

2.1 DUCTED FAN-COIL UNITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Carrier Corporation.
   2. Daikin.
   3. Trane.
   4. Johnson Controls.

B. Description: Factory-packaged and -tested units rated according to ARI 440, ASHRAE 33, and UL 1995.

C. Coil Section Insulation: 1/2-inch thick coated or foil-faced glass fiber complying with ASTM C 1071 and attached with adhesive complying with ASTM C 916.
   1. Fire-Hazard Classification: Insulation and adhesive shall have a combined maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E 84.

D. Drain Pans: Plastic or stainless steel formed to slope from all directions to the drain connection as required by ASHRAE 62.

E. Chassis: Galvanized steel where exposed to moisture, with baked-enamel finish and removable access panels.

F. Cabinets: Steel with baked-enamel finish in manufacturer's standard paint color.
   1. Supply-Air Plenum: Sheet metal plenum finished and insulated to match the chassis.
   2. Return-Air Plenum: Sheet metal plenum finished to match the chassis.
   3. Mixing Plenum: Sheet metal plenum finished and insulated to match the chassis with outdoor- and return-air, formed-steel dampers.

4. Dampers: Galvanized steel with extruded-vinyl blade seals, flexible-metal jamb seals, and interlocking linkage.

G. Filters: Minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.
1. Glass Fiber Treated with Adhesive: 80 percent arrestance and MERV 4.

H. Hydronic Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch, rated for a minimum working pressure of 200 psig and a maximum entering-water temperature of 220 deg F. Include manual air vent and drain.

I. Indoor Refrigerant Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch, and brazed joints at fittings. Comply with ARI 210/240, and leak test to minimum 450 psig for a minimum 300-psig working pressure. Include thermal expansion valve.

J. Direct-Driven Fans: Double width, forward curved, centrifugal; with permanently lubricated, multispeed motor resiliently mounted in the fan inlet. Aluminum or painted-steel wheels, and painted-steel or galvanized-steel fan scrolls.

K. Remote condensing units are specified in Division 23 Section "Packaged Compressor and Condenser Units."

L. Electrical Connection: Factory wire motors and controls for a single electrical connection.
1. Disconnect switch.
2. Motor speed controller.

M. Provide automatic condensate pump where denoted on the Drawings.
1. Manufacturers:
a. Aurora Pump; Division of Pentair Pump Group.
b. Beckett Corporation.
c. Flowserve Corporation; Div. of Ingersoll-Dresser Pumps.
d. Hartell Pumps Div.; Milton Roy Co.
e. Little Giant Pump Co.; Subsidiary of Tecumseh Products Co.
f. Bell & Gossett: Division of ITT Industries
g. MEPCO (Marshall Engineered Products Co.).
2. Description: Packaged units with corrosion-resistant pump, plastic tank with cover, and automatic controls. Include factory- or field-installed check valve. Condensate pump to be hardwired to/powered off of the fan coil unit and shall be plenum rated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive fan-coil units for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in for piping and electrical connections to verify actual locations before fan-coil-unit installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install fan-coil units level and plumb.

B. Install fan-coil units to comply with NFPA 90A.

C. Suspend fan-coil units from structure with vibration isolators provided by manufacturer..

D. Install new filters in each fan-coil unit within two weeks after Substantial Completion.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties. Specific connection requirements are as follows:
   1. Install piping adjacent to machine to allow service and maintenance.
   2. Connect condensate drain to indirect waste.
      a. Install condensate trap of adequate depth to seal against the pressure of fan. Install cleanouts in piping at changes of direction.

B. Connect supply and return ducts to fan-coil units with flexible duct connectors specified in Division 23 Section "Air Duct Accessories." Comply with safety requirements in UL 1995 for duct connections.

C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:
   1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
   2. Operate electric heating elements through each stage to verify proper operation and electrical connections.
   3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units and retest as specified above.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fan-coil units. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 23 82 19

DIVISION 26

ELECTRICAL

SECTION 26 00 05 – ELECTRICAL DEMOLITION

PART 1 - GENERAL

1.1 DEMOLITION SUMMARY

A. This Section Includes Electrical Demolition which includes but is not limited to:
   1. Mechanical equipment.
   2. Luminaires.
   3. Electrical receptacles.
   4. Fire Alarm System or devices.
   5. Conduit
   6. Grounding

B. Refer to drawings for additional requirements

1.2 DEFINITIONS

A. Refer to abbreviations on Symbol Legend drawings

B. Refer to Demolition Coded Notes on drawings

1.3 COORDINATION

A. Contractor shall visit project site before bidding. Verify all conditions, electrical equipment required for demolition and additional demolition that would interfere with new construction.

B. Refer to architectural, mechanical and plumbing demolition drawings for electrical equipment that will be removed or disconnected, and include in bid.

C. Coordinate arrangement, mounting, and support of electrical equipment.

D. Electrical service to the building or any section of this building shall be maintained at all times. If any outage is required, contractor shall obtain written approval from owner or cm at least 48 hours prior to outage.

E. The integrity and functionality of the fire alarm system shall be maintained to provide continuous operation during construction. If an outage is required it must be approved in writing by the authority having jurisdiction.

PART 2 - ELECTRICAL NOTES

2.1 All equipment and conduit shown on the demolition drawings is existing and shall remain in service unless noted otherwise.

2.2 All exposed conduit noted to be removed shall be removed in its entire length, unless noted otherwise.

2.3 All concealed conduit noted to be removed shall be removed for exposed portions and abandoned in concealed location, unless noted otherwise. Remove all conductors and cap remaining conduit at both ends.

2.4 All underground conduit noted to be removed shall be removed for exposed portions and abandoned in underground location, unless noted otherwise. Remove all conductors and cap remaining conduit at both ends.

2.5 All conductors noted to be removed, or in conduit which is noted to be removed, shall be removed in its entirety

2.6 All conductors scheduled to be removed shall be disposed of, unless noted below or otherwise.

2.7 All luminaires scheduled to be removed, shall be carefully removed by contractor and disposed of, unless noted below or otherwise. Remove conduit drop to fixture.

2.8 Panel and equipment designations indicated are existing. Refer to new drawing panel board schedule for any new designations. Provide new nameplate as required.

2.9 Provide blank cover plates where devices are removed and flush box will remain.

2.10 Where walls to remain are damaged by demolition of electrical equipment, patch or repair to match adjacent surfaces and repaint.

2.11 All conduit that is reused shall be re-supported as required per National Electrical Code.

2.12 When existing circuit conductors are required to be reused, verify continuity, intercept in a new or existing junction box or wireway. Extend new conductors as required per National Electrical Code. Do not splice existing conductors in panelboards. Label conductors as each end.

PART 3 - EXECUTION

3.1 When existing equipment that is required to be removed shall be removed by Contractor and disposed of offsite unless noted otherwise. Non Hazardous demolition and construction waste related to the electrical scope of work shall be salvaged, or recycled as much as possible. See specification section 017419-“Construction Waste Management and Disposal” for requirements.

3.2 When existing equipment that is required to be relocated it shall be carefully removed with all components, stored in a dry location, protected, cleaned and re-installed where shown.

3.3 When existing luminaires are required to be relocated, they shall be cleaned and re-lamped with the appropriate lamp.

3.4 The following equipment shall be turned over to Owner, unless noted otherwise on drawings. Coordinate with Owner.

A. Luminaires

3.5 Hazardous Demolition Waste. Hazardous demolition and construction waste related to the electrical scope of work shall be disposed of or recycled. See specification section 017419-“Construction Waste Management and Disposal” for requirements. The following materials may be present and if so must be disposed of in compliance with statutory requirements.

A. Polychlorinated Bi-phenol liquids, (PCB’s) such as but not limited to Askarel.

B. Liquid filled transformers with liquids such as but not limited to mineral oil, high molecular weight hydrocarbons (MWHC), Silicone, etc

C. PCB ballasts or capacitors

D. Asbestos insulation on conductors.

E. Fluorescent lamps containing phosphors and lamps containing mercury, such as but not limited to compact fluorescent (CFL), mercury vapor, etc

F. Rechargeable batteries with heavy metals such as but not limited to Nickel Cadmium, etc

G. Lead acid batteries

END OF SECTION 26 00 05

SECTION 26 00 50 - GENERAL ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Electrical equipment coordination and installation.
2. Substitutions
3. Sleeves for raceways and cables.
4. Grout.
5. Common electrical installation requirements.
6. Plywood backing panels.

1.2 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

C. Provide: Furnish and Install

1.3 SUBSTITUTIONS

A. Refer Division 01, Section 012500, Substitution Procedures for contractual requirements

B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. Submission of the "Substitution Request Form" and complete technical data for evaluation must accompany requests for A/E's approval. All materials for evaluation must be received by the Project Manager and Specification Department at least ten days prior to bid due date. If a manufacturer substitution is approved and allowed, it will be issued by Addendum.

C. It is the Contractors responsibility to prove that the product submitted for substation is equal or exceeds the requirements. The Engineer's decision will be based on samples submitted and technical literature presented. If the information provided is not adequate, then the substation shall be denied.

1.4 COORDINATION

A. Coordinate arrangement, mounting, and support of electrical equipment:
1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping and conduit installed at required slope.
4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

B. Equipment, furnished by others but installed by Division 26 shall include, but is not limited to: variable frequency controllers, variable speed controllers, motor starters, pump controllers, disconnect switches, flow switches, pressure switches and other control devices. Refer to Mechanical system drawings and specifications, such as Division 23, which shall require equipment to be furnished by them, but installed by others. Division 26 Contractor shall review those documents and make provisions to install that equipment. Refer to specification section 26 29 13 for additional requirements.

C. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

D. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."

E. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Firestopping."

PART 2 - PRODUCTS

2.1 SLEEVES FOR RACEWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel.
   1. Minimum Metal Thickness:
      a. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches, thickness shall be 0.052 inch.
      b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches and 1 or more sides equal to, or more than, 16 inches, thickness shall be 0.138 inch.

2.2 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.3 PLYWOOD BACKING PANELS

A. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, not less than 3/4-inch nominal thickness.
   1. Fire-Retardant-Treated Materials: Comply with performance requirements in AWPA C27.
      a. Use Interior Type A, unless otherwise indicated.
      b. Fire retardant treated wood products shall be free of halogens, sulfates, amononium phosphate, and formaldehyde.
   2. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

E. Cut sleeves to length for mounting flush with both surfaces of walls.

F. Extend sleeves installed in floors 2 inches above finished floor level.

G. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable, unless indicated otherwise.

H. Seal space outside of sleeves with grout for penetrations of concrete and masonry
   1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."

J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Firestopping."

K. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

L. Interior Sleeves for Fiber Optical and Voice and Data Communications Cables: Construct of 2-inch metallic conduit, unless otherwise indicated, with insulated bushings on each end.
   1. Length: 12 inches longer than width of wall.
   2. Location: Install 12 inches above finished ceiling.

3.3 PLYWOOD BACKING PANEL INSTALLATION

A. Provide in main cross-connect/equipment rooms, telecommunication rooms, and other locations indicated.

B. Install vertically, 12 inches above finished floor.

C. Paint plywood backing panels with two coats of fire-retardant paint. Do not paint over classification marking of testing and inspecting agency.

3.4 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Firestopping."

END OF SECTION 26 05 00

SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Building wires and cables rated 600 V and less.
   2. Connectors, splices, and terminations rated 600 V and less.

B. Related Sections include the following:
   1. Division 26 Section "Common Work Results for Electrical" for sleeves for cables.
   2. Division 27 Section "Communications Copper Horizontal Cabling" for cabling used for voice and data circuits.

1.2 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Copper Conductors: Comply with NEMA WC 70.

B. Conductor Insulation: Comply with NEMA WC 70 for Types THW, THHN-THWN, XHHW, and SO
   1. Provide No. 6 AWG and smaller conductors with color-coded insulation.

C. Multiconductor Cable: Comply with NEMA WC 70 for metal-clad cable, Type MC and Type SO with ground wire.

2.2 CONNECTORS AND SPLICES

A. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper, No. 10 AWG, minimum.
   1. Feeder Conductor sizes indicated on drawings are for copper conductors, unless indicated otherwise.
   2. Branch Circuits: Copper. No. 12 AWG, minimum.

B. Class 1 Control Circuits: Copper. No. 14 AWG, minimum.

C. Class 2 Control Circuits: Copper. No. 16 AWG, minimum.

D. Voltage drop shall not exceed 3 percent from panelboard to farthest outlet.
   1. Maximum permitted length of 20 amp, 120, 208, and 240 volt circuits using No. 12 AWG copper wire is 100 feet.

2. Maximum permitted length of 20 amp, 120, 208, and 240 volt circuits using No. 10 AWG copper wire is 140 feet.
3. Maximum permitted length of 20 amp, 277 and 480 volt circuits using No. 12 AWG copper wire is 170 feet.
4. Maximum permitted length of 20 amp, 277 and 480 volt circuits using No. 10 AWG copper wire is 250 feet.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Exposed Feeders: Type THHN-THWN, single conductors in raceway; or Type XHHW, single conductors in raceway.

B. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN-THWN, single conductors in raceway; or Type XHHW, single conductors in raceway.

C. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway; or Type XHHW, single conductors in raceway.

D. Exposed Branch Circuits, Including in Crawlspaces: Type THHN-THWN, single conductors in raceway.

E. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.

F. Branch Circuits Installed in Accessible Ceiling Spaces and Gypsum-Board Partitions: Type THHN-THWN, single conductors in raceway.

G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.

H. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

I. Class 1 Control Circuits: Type THHN-THWN, in raceway.

J. Class 2 Control Circuits: Type THHN-THWN, in raceway; power-limited cable, concealed in building finishes; or power-limited tray cable, in cable tray.
1. Exposed-Structure Type Ceiling Spaces: Install Class 2 control circuits in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Comply with NECA 1.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

D. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."

E. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

F. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

G. Support cables according to Division 26 Section "Hangers and Supports for Electrical Systems."

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
   1. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:
   1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.
   2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

C. Test Reports: Prepare a written report to record the following:
   1. Test procedures used.
   2. Test results that comply with requirements.
   3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

D. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 26 05 19

SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes methods and materials for grounding systems and equipment.

1.2 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with UL 467 for grounding and bonding materials and equipment.

C. Voice and Data Communications Equipment Grounding: Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter, and comply with ANSI-J-STD-607-A.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:
1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

C. Grounding Bus: Rectangular bars of annealed copper, 1/4 by 4 inches in cross section, unless otherwise indicated; with insulators.

2.2 CONNECTORS

A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.
1. Pipe Connectors: Clamp type, sized for pipe.

C. All cable to cable, cable to rod, cable to steel connection shall be welded connectors: Use exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions. Exothermic welds shall use powdered copper oxide and aluminum to form a molded homogeneous copper joint connection between the copper conductor and the material being bonded to.

PART 3 - EXECUTION

3.1 APPLICATIONS

3.2 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with feeders and branch circuits.

B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

C. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

3.3 TECHNOLOGY SYSTEM GROUNDING

A. Voice and Data Communication Equipment: For telephone, video, voice and data, and other communication equipment.
   1. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
   2. Comply with ANSI-J-STD-607-A.
   3. Refer to grounding details on drawings which take precedence. If no drawing details are included, then provide the following:
      a. MC/ER: Install 1/4-by-4-by-20-inch copper TMGB. Bond TMGB to the following:
         1) Electrical service entrance grounding bus with No. 3/0 AWG TMBC.
         2) Structural steel with No. 2 AWG insulated grounding conductor.
         3) Cable trays and metallic pathways.
   4. Refer to grounding details on drawings which take precedence. If no drawing details are included, then provide the following:
      a. TR: Install 1/4-by-2-by-12-inch copper TGB. Bond TGB to the following:
         1) TMGB with No. 3/0 AWG TBB.
         2) Structural steel with No. 2 AWG insulated grounding conductor.
         3) Cable trays and metallic pathways.

B. Refer to grounding details on drawings which take precedence. If no drawing details are included, then provide the following. Signal and Communication Equipment: For sound, alarm, security, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
   1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch grounding bus.

3.4 INSTALLATION

A. Comply with NECA 331.

B. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

3.5 VARIABLE FREQUENCY MOTOR CONTROLLERS

A . Ensure that VFC and motor frame are properly bonded to the grounding conductor and that equipment grounding conductor is provided in the feeder conduit to the VFC and motor.

3.6 IDENTIFICATION

A. Identify voice and data communications equipment grounding components, complying with TIA/EIA-606-A.

B. Comply with requirements in Division 26 Section "Identification for Electrical Systems."

C. Excessive Ground Resistance: If resistance to ground exceeds 5 ohms, notify Architect/Engineer promptly. Provide additional grounds to reduce ground resistance.

END OF SECTION 26 05 26

SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Hangers and supports for electrical equipment and systems.

B. Related Sections include the following:
   1. Division 26 Section “Identification for Electrical Systems” for cable ties.

1.2 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. IMC: Intermediate metal conduit.

C. RMC: Rigid metal conduit.

1.3 PERFORMANCE REQUIREMENTS

A. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

C. 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 times the applied force.

1.4 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Comply with NFPA 70.

1.5 COORDINATION

A. 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. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
   2. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
   3. Channel Dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. 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.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
   1. Powder-Actuated Fasteners: Not permitted.
   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.
   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.
   8. Wire Rope Systems: Galvanized steel wire rope with spring-loaded, key-releasable locking device with the following rated strength:
      a. 0.059-inch (1.5-mm): 44 pounds.
      b. 5/64-inch (2-mm): 100 pounds.
      c. 1/8-inch (3-mm): 200 pounds.

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 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 with single-bolt conduit clamps using spring friction action for retention in support channel.

3.2 SLOTTED SUPPORT SYSTEMS APPLICATIONS

A. Heated Interior Spaces: Painted steel.

B. Non-Heated Interior Spaces and Outdoors: Hot-dipped galvanized steel.

3.3 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, EMT, IMC, and RMC 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.

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. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
   6. To Light Steel: Sheet metal screws.
   7. 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.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

F. Exposed Conduits: Use two-hole straps 8 feet or less AFF. Conduit clamps and hangers that project past the conduit wall are limited to above 8 feet AFF.

G. Do not use wood plugs, perforated metal bands, chain, or wire to support electrical equipment, unless otherwise indicated.

H. Open-Web Joists: Install supports only at panel points. Fasten supports to top of bottom chord of joist. Do not exceed 100 pounds working load per panel point.

I. Roof and Elevated Floor Decks: Do not fasten supports to roof decks or elevated floor decks.

3.4 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.

3.5 PAINTING

A. 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. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 26 05 29

SECTION 26 05 33 - CONDUIT AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes conduits, fittings, boxes, outlet boxes, enclosures, and cabinets for electrical wiring. The term raceway shall also apply to conduit and boxes.

B. Related Sections include the following:
   1. Division 26 Section "Wiring Devices" for mounting heights of devices.
   2. Division 26 Section "Surface Raceways for Electrical Systems" for multioutlet assemblies wireways and surface raceways.

1.2 DEFINITIONS

A. BICSI: Building Industry Consulting Service International.

B. EMT: Electrical metallic tubing.

C. ER: Equipment room (Telecommunications.)

D. FMC: Flexible metal conduit.

E. IMC: Intermediate metal conduit.

F. LFMC: Liquidtight flexible metal conduit.

G. MC: Main cross-connect (Telecommunications.)

H. RMC: Rigid metal conduit.

I. RNC: Rigid nonmetallic conduit.

J. TDMM: Telecommunications Distribution Methods Manual, published by BICSI.

K. TR: Telecommunications room.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

C. Voice and Data Communications Pathways: Install conduit, raceways, and boxes according to BICSI TDMM, "Horizontal Distribution Systems" Chapter, and comply with NECA 568.

1.4 COORDINATION

A. HVAC Control and Monitoring: Verify locations of temperature control panels with Building Management System installer.

B. MC/ER and TR: Verify locations of backboards, cable trays, equipment cabinets and racks, and conduit stub-outs with Voice and Data Communications Cable installer

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

A. RMC: ANSI C80.1.

B. IMC: ANSI C80.6.

C. EMT: ANSI C80.3.

D. FMC: Zinc-coated steel or aluminum.

E. LFMC: Flexible steel conduit with PVC jacket.

F. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
   1. Die-cast type, pot-metal type, and indenter type fittings are not permitted.
   2. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
   3. Fittings for EMT: Steel, compression type.

G. Joint Compound for RMC or IMC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

2.2 NONMETALLIC CONDUIT

A. RNC: NEMA TC 2, Type EPC-40-PVC, unless otherwise indicated.

B. Fittings for RNC: NEMA TC 3; match to conduit or tubing type and material.

2.3 BOXES, ENCLOSURES, AND CABINETS

A. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
   1. Gangable boxes are not permitted.

B. Cast-Metal Outlet and Device Boxes: NEMA FB 1, aluminum, Type FD, with gasketed cover.

C. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

D. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.

E. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.
   1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
   2. Nonmetallic Enclosures: Plastic.

F. Cabinets:
   1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
   2. Hinged door in front cover with flush latch and concealed hinge.
   3. Key latch to match panelboards.
   4. Metal barriers to separate wiring of different systems and voltage.
   5. Accessory feet where required for freestanding equipment.

2.4 TELCOMMUNICATIONS CONDUIT BODIES

A. General Description: Conduit bodies specifically designed to maintain the required bend radius for data and communications cabling, complying with BISCI TDMM “Horizontal Distribution Systems” Chapter.
   1. Material: Die-cast aluminum.

PART 3 - EXECUTION

3.1 CONDUIT APPLICATION

A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:
   1. Exposed Conduit: RMC or IMC.
   2. Concealed Conduit, Aboveground: RNC, Type EPC-40-PVC.
   3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
   4. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Comply with the following indoor applications, unless otherwise indicated:
   1. Exposed, Not Subject to Physical Damage: EMT.
   2. Exposed and Subject to Physical Damage: RMC. Includes raceways in the following locations:
      a. Loading dock.
      b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
      c. Kitchens.
   3. Concealed in Ceilings and Interior Walls and Partitions: EMT.
   4. Concealed in Exterior Walls: RNC, Type EPC-40-PVC
   5. Concealed Under Slabs-on-Grade: RNC, Type EPC-40-PVC.
   6. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
   7. Damp or Wet Locations: RMC or IMC.
   8. Conduits for Optical Fiber or Communications Cable in Spaces Used for Environmental Air: EMT.
   9. Conduits for Optical Fiber or Communications Cable Risers in Vertical Shafts: EMT.
   10. Conduits for Concealed General Purpose Distribution of Optical Fiber or Communications Cable: EMT.
   11. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, stainless steel in damp or wet locations.

C. Minimum RMC, IMC, EMT, or RNC, Type EPC-40-PVC Size: 1/2-inch trade size, unless indicated otherwise.

D. Minimum FMC or LFMC Size: 1/2-inch trade size, unless indicated otherwise.

E. Conduit Fittings: Compatible with raceways and suitable for use and location.
   1. RMC or IMC: Use threaded rigid steel conduit fittings, unless otherwise indicated.

3.2 OUTLET AND DEVICE BOX APPLICATION

A. Flush Boxes in Masonry Walls and Partitions: Use masonry boxes at least 3.5 inches deep.

B. Flush Boxes in Gypsum-Board Partitions: Use square boxes at least 2.125 inches deep with raised box covers.

C. Flush Device Boxes in Ceilings: Use square boxes at least 2.125 inches deep with raised box covers.

D. Flush Outlet Boxes in Ceilings: Use 4-inch round or octagonal boxes at least 2.125 inches deep.

E. Surface Boxes: Use cast-metal type with matching cover. Provide knock-out plugs in unused openings.

3.3 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.

B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Support conduits as specified in Division 26 Section "Hangers and Supports for Electrical Systems."

E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

F. Conceal conduit and EMT within finished walls, ceilings, and below floors, unless otherwise indicated.

G. Conduits Beneath Concrete Slabs:
1. Install conduit parallel or at right angles building lines, at least 1 inch below top of drainage fill.
2. Arrange conduits to cross building expansion joints at right angles with expansion fittings.
3. Do not embed conduits in concrete slabs.

H. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

I. Conduit Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.

J. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.

K. Install conduit sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed conduits, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install conduit sealing fittings at the following points:
1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where otherwise required by NFPA 70.

L. Expansion-Joint Fittings for RNC: Install in each run of aboveground conduit that is located where environmental temperature change may exceed 30 deg F, and that has straight-run length that exceeds 25 feet.
1. Install expansion-joint fittings for each of the following locations, and provide type and quantity of fittings that accommodate temperature change listed for location:
   a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
   b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
2. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change.
3. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.

M. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for recessed and semirecessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
   1. Use LFMC in damp or wet locations.

N. Recessed Boxes in Masonry Walls: Coordinate work with masonry contractor. Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Box shall be vertically plumb and flush with plane of wall, or slightly recessed. All boxes installed improperly will be replaced at Contractors expense. Provide oversized plate for all boxes that have exposed joints.

O. Recessed Boxes in Gypsum-Board Partitions: Coordinate work with drywall contractor. Box shall be vertically plumb and flush with plane of wall, or slightly recessed. All boxes installed improperly will be replaced at Contractors expense. Provide oversized plate for all boxes that have exposed joints.

P. Conduits less than 3-inch trade size may be field bent, unless indicated otherwise. Use factory 45 and 90 degree, and special radius elbows for conduits 3-inch and larger.

Q. Conduits for Feeders: Electrically continuous, terminated with grounding and insulating bushings.

R. Conduits for Branch Circuits: Electrically continuous.

S. Finished Spaces: Provide escutcheons where conduits penetrate surfaces of finished spaces. Match finish of adjacent surfaces.

T. Conduits for Optical Fiber and Voice and Data Communications Cable: Install raceways, metallic and nonmetallic, rigid and flexible, as follows:
   1. 3/4-Inch Trade Size and Smaller: Install raceways in maximum lengths of 50 feet.
   2. 1-Inch Trade Size and Larger: Install raceways in maximum lengths of 75 feet.
   3. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.
   4. Elbows: Use factory elbows. Field bent elbows are not permitted for optical fiber and communications cables.
      a. Radii of Elbows for Conduits 1-1/2-inches and Larger: At least 10 times inside diameter of conduit.
   5. Conduit Bodies: Use telecommunications conduit bodies.

3.4 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
   1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
   2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 26 05 33

SECTION 26 05 35 – SURFACE RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes raceways and surface raceways, fittings, multioutlet assemblies, service poles, floor mounted surface raceways etc. for electrical devices or wiring. The term raceway may also apply to conduit.

B. Related Sections include the following:
   1. Division 26 Section "Wiring Devices" for mounting heights of device and outlet boxes.
   2. Division 26 Section "Conduit and Boxes for Electrical Systems" for conduit, boxes, metal and nonmetallic floor boxes, poke through service fitting, high capacity floor boxes, etc.

1.2 DEFINITIONS

A. BICSI: Building Industry Consulting Service International.

B. TDMM: Telecommunications Distribution Methods Manual, published by BICSI.

C. TR: Telecommunications room.

1.3 SUBMITTALS

A. Quality Assurance/Control Submittals:
   1. Product Data: Provide product data sheet for each raceway type, boxes, service poles, multi-outlet assemblies in this Section and on the Drawings that are specifically applicable to this project. Provide an arrow stamp pointing to the exact catalog number or product and do not merely highlight the information.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

C. Voice and Data Communications Pathways: Install conduit, raceways, and boxes according to BICSI TDMM, "Horizontal Distribution Systems" Chapter, and comply with NECA 568.

1.5 COORDINATION

A. HVAC Control and Monitoring: Verify locations of temperature control panels with Building Management System installer.

B. Telephone and Cable Television: Verify location of entrance facilities and exterior underground pathways with Telephone and Cable Television Utility Companies.

C. MC/ER and TR: Verify locations of backboards, cable trays, equipment cabinets and racks, and conduit stub-outs with Voice and Data Communications Cable installer.

PART 2 - PRODUCTS

2.1 SURFACE MOUNTED METALLIC RACEWAY-SINGLE CHANNEL

A. Finish Type Surface Raceways:

1. Size as required for cables installed in raceway.
2. Provide with manufacturer's matching finish type surface backbox, finish to match raceway, gang requirements per device requirements.
3. Provide for device or equipment locations on existing walls in finished spaces.
4. Finish type surface metal raceway shall not be used for new construction work.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Panduit Corp.
2. Hubbell Incorporated.
3. Wiremold Company (The)

C. Components of Assemblies: Products from a single manufacturer designed for use as a complete, matching assembly of raceways and receptacles. Provide all required fittings for a complete raceway system.

D. Configuration: Single channel raceway with surface mounted backboxes (for use on existing wall only), ganging requirements per application.

E. Raceway Material: Metal with Off-White finish.

F. Backboxes: Metal surface mount type backboxes with Off-White finish with all dividers and/or accessories to wiring to pass through the backbox via the raceway/backbox system.

G. Power Receptacles: NEMA WD 6, Configuration 5-20R, off-white finish (finish to match raceway).

H. See Drawings for additional installation information.

2.2 SURFACE MOUNTED METALLIC POWER/TECHNOLOGY DIVIDED RACEWAY- DUAL CHANNEL

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Panduit Corp. LD2P10IW Series Divided Raceway.
2. Hubbell MT8 Series Divided Raceway.
3. Wiremold 2300BACD Series Divided Raceway.

B. Components of Assemblies: Products from a single manufacturer designed for use as a complete, matching assembly of raceways and receptacles. Provide all required fittings for a complete raceway system.

C. Configuration: Divided raceway with surface mounted one-gang or two-gang deep divided backboxes (for use on existing wall only).

D. Raceway Material: Metal with Off-White finish.

E. Backboxes: Metal surface mount type backboxes with Off-White finish with all dividers and/or accessories to wiring to pass through the backbox via the raceway/backbox system.

F. Power Receptacles: NEMA WD 6, Configuration 5-20R, off-white finish.

G. Voice and Data Communications Outlets: Standard one-gang device bracket for accepting standard one gang devices.
1. Wall plates, bezels, and inserts are specified in Division 27 Section "Communications Copper Horizontal Cabling."

H. Wire: No. 12 AWG.

I. See Drawings for additional product and installation information.

2.3 MULTIOUTLET ASSEMBLIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Hubbell Incorporated; Premise Wiring MT11 Series.
2. Panduit Corp. TG-70 Series.
3. Wiremold Company (The) DS4000 Series.

B. Components of Assemblies: Products from a single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.

C. Configuration: Two compartment.

D. Raceway Material: White PVC or ivory painted steel

E. Power Receptacles: NEMA WD 6, Configuration 5-20R, finish to match raceway.

F. Voice and Data Communication Outlets: Rectangular face device covers and one-gang device brackets suitable for accepting rectangular face device type 106-module frames

1. Inserts and 106-module frames are specified in Division 27 Section "Communications Copper Horizontal Cabling."

G. Wire used internally: No. 12 AWG.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:
1. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Comply with the following indoor applications, unless otherwise indicated:
1. Finished spaces.
2. Kitchens
3. In Labs
4. Damp or Wet Locations:
Raceways for Optical Fiber or Communications Cable

C. Raceway Fittings: Compatible with raceways and suitable for use and location.

3.2 OUTLET AND DEVICE BOX APPLICATION

A. Surface Boxes: Provide surface box in same material as single or dual channel raceway with dividers as required.

3.3 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.

B. Refer to plan drawings and Symbol Legend for mounting height.

C. Coordinate mounting height with Owners Representative.

D. Surface raceways shall be level when in the horizontal, and plumb when in the vertical position.

E. Complete raceway installation before starting conductor installation.

F. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."
   1. Finish type surface raceways to be attached to walls with mechanical fasteners. Use of adhesive backing only to mount raceway is not acceptable.

G. Provide approved conduit connections within finished walls, ceilings, and below floor.

H. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.

I. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
   1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
   2. Where otherwise required by NFPA 70.

J. Finished Spaces: When noted on drawings, provide color to match walls or paint to match finish of adjacent surfaces.

K. Provide covers for all surface raceways, fittings and boxes. Conductors shall never be exposed or accessible.

L. Raceways for Optical Fiber and Voice and Data Communications Cable: Raceways shall have adequate space from fiber-optic cable bend radii.

3.4 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
   1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
   2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 26 05 35

SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Identification for conductors and control cable.
   2. Miscellaneous identification products.

1.2 QUALITY ASSURANCE

A. Comply with ANSI A13.1 and ANSI C2.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.145.

1.3 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 RACEWAY IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Color for Printed Legend:
   1. Power Circuits: Black letters on an orange field.
   2. Legend: Indicate system or service and voltage, if applicable.

C. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

D. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.2 CONDUCTOR AND COMMUNICATION- AND CONTROL-CABLE IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

B. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

2.3 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. in. and 1/8 inch thick for larger sizes.
   1. Engraved legend with black letters on white face.
   2. Punched or drilled for mechanical fasteners.
   3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.4 IDENTIFICATION LABELS

A. All labels required below in Part 3.0 shall meet the following requirements.
   a. Indoor Equipment: Engraved, laminated acrylic, melamine label or metal. Mounted with corrosion-resistant screws or permanent adhesive.
   b. Outdoor Equipment: Engraved, laminated acrylic, melamine label or metal. Mounted with corrosion-resistant screws.
   c. Nameplates shall have a black or dark-gray background with white engraved letters and numbers
   d. Nameplates for emergency systems or power transfer equipment shall have a red background with white engraved letters and numbers.
   e. Minimum letter height shall be 3/8 inch.
   f. Do not use Kroy labels, paper labels
   g. Do not use double stick tape to attach laminated labels.

2.5 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, fluoropolymer cable ties suitable for ducts or plenums; and other spaces used for environmental air.
   1. Flammability Rating: UL94V-0.
   2. Minimum Width: 3/16 inch .
   3. Tensile Strength: 50 lb, minimum.
   4. Temperature Range: Minus 40 to plus 185 deg F.
   5. Color: Maroon.

B. Paint: Paint materials and application requirements are specified in Division 09 painting Sections.

C. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 APPLICATION

A. Accessible Raceways and Cables of Fire Alarm Systems: Identify junction boxes by painting boxes and covers red.

B. Power-Circuit Conductor Identification: For primary and secondary conductors No. 4 AWG and larger in vaults, pull and junction boxes, manholes, and handholes use marker tape. Identify source and circuit number of each set of conductors. For single conductor cables, identify phase in addition to the above.

C. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in same junction or pull box, use marker tape. Identify each ungrounded conductor according to source and circuit number.

D. Conductors to Be Extended in the Future: Attach marker tape to conductors and list source and circuit number.

E. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
   1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
   2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
   3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and Operation and Maintenance Manual.

F. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with drawings, wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
   1. Labeling Instructions:
      a. Indoor Equipment: Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where 2 lines of text are required, use labels 2 inches high.
         1) For single-gang motor starting switches use 3/8-inch high letters on 3/4-inch high by 2.25-inch wide label.
         2) For two-gang motor starting switches, use 3/8-inch high letters on 3/4-inch high by 4 inch wide label.
      b. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
      c. (For example) PANEL 1AL1, 1AL2.
   2. Equipment to Be Labeled:
      a. Panelboards, electrical cabinets, and enclosures.
      b. Access doors and panels for concealed electrical items.
      c. Emergency system boxes and enclosures.
      d. Disconnect switches.
      e. Contactors.
      f. Remote-controlled switches, dimmer modules, and control devices.

G. Electrical Energy Source Identification Labels: On each unit of equipment, install unique label to identify the energy source that is consistent with drawings, wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
   1. Labeling Instructions:
      a. Indoor Equipment: Unless otherwise indicated, provide a single line of text with 3/8-inch- high letters on 3/4-inch- high label; where 2 lines of text are required, use labels 1.5 inches high.
      b. (For example) FED FROM MAIN SWITCHBOARD MSBL.
   2. Equipment to Be Labeled:
      a. Panelboards, electrical cabinets, and enclosures.
      b. Emergency system boxes and enclosures.
      c. Disconnect switches.
      d. Contactors.
      e. Voice and data cable terminal equipment.
      f. Master clock and program equipment.
      g. Intercommunication equipment.
      h. Audio components, racks, and controls.
      i. Fire-alarm control panel and annunciators.
      j. Terminals, racks, and patch panels for voice and data communication and for signal and control functions.
      k. Junction boxes and pull boxes with covers larger than 5-by-5-inches.
   3. For wiring devices: On inside (back) of cover plate, write the panel name for energy source and circuit number with permanent, indelible ink.

4. For small Pull Boxes, and small Junction Boxes (less than 5-by-5-inches): On front of cover plate, write the panel name for energy source and circuit number with permanent, indelible ink.

H. Panelboard Circuit Directories: Provide type-written or laser printed circuit directory on heavy card stock. Arrange in two columns with odd numbered circuits on left and even numbered circuits on right. Include panelboard identification at the top and installation date. Indicate spare circuit breakers: "SPARE". Install in metal frame with clear plastic cover over directory. Handwritten directories are not acceptable. Indicating the load description for all circuit numbers installed.

I. Feeder and Branch Circuit Load Identification Labels: On each overcurrent protective device, install unique load designation label that is consistent with drawings, wiring diagrams, schedules, and Operation and Maintenance Manual.
   1. Labeling Instructions:
      a. Panelboard Circuit Directories: Provide type-written or laser printed circuit directory on heavy card stock. Arrange in two columns with odd numbered circuits on left and even numbered circuits on right. Include panelboard identification at the top and installation date. Indicate spare circuit breakers: "SPARE". Install in metal frame with clear plastic cover over directory. Handwritten directories are not acceptable. Indicating the load description for all circuit numbers installed.
      b. Lighting and Appliance Branch-Circuit Panelboards: Use room names and numbers furnished by Owner for the actual room numbers. **Do not** use room names and numbers indicated on Contract Drawings. Load description shall identify each circuit number with its clear, evident, and specific purpose. Load description shall include sufficient detail to allow each circuit to be distinguished from all others.
   2. GFI receptacles: Provide a self adhesive, factory furnished label on receptacles cover plate, "Protected from ground fault device" (or words to that effect). Apply for all standard receptacles that are fed from a ground fault circuit interrupting breaker or fed downstream from a ground fault circuit interrupting receptacle (as a thru feed device).

3.2 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Attach signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.

E. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Use the colors listed below for ungrounded service, feeder, and branch-circuit conductors.
   1. Color shall be factory applied or, for sizes larger than No. 6 AWG if authorities having jurisdiction permit, field applied.
   2. Colors for 208/120-V Circuits:
      a. Phase A: Black.
      b. Phase B: Red.
      c. Phase C: Blue.
      d. Neutral: White.
      e. Ground: Green.
   3. Colors for 480/277-V Circuits:
      a. Phase A: Brown.
      b. Phase B: Orange.
      c. Phase C: Yellow.
      d. Neutral: Gray.
      e. Ground: Green.

4. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

F. Painted Identification: Prepare surface and apply paint according to Division 09 painting Sections.

END OF SECTION 26 05 53

SECTION 26 08 00 – COMMISSIONING OF ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes specific requirements that apply to implementation of commissioning of electrical systems, assemblies, or components.

B. Related Sections:
   1. Division 01 Section "General Commissioning Requirements" for responsibilities of Contractor, Owner, and Commissioning Authority.

1.2 DEFINITIONS

A. Commissioning. Commissioning is a systematic process of ensuring that all building systems perform interactively according to the design intent and the owner's operational needs. This is achieved by beginning in the design phase and documenting design intent and continuing through construction, acceptance and the warranty period with actual verification of performance. The commissioning process shall encompass and coordinate the traditionally separate functions of system documentation, equipment startup, control system calibration, testing and balancing, performance testing and training.
   1. Commissioning during the construction phase is intended to achieve the following specific objectives according to the Contract Documents:
      a. Verify that applicable equipment and systems are installed according to the manufacturer's recommendations and to industry accepted minimum standards and that they receive adequate operational checkout by installing contractors.
      b. Verify and document proper performance of equipment and systems.
      c. Verify that operation and maintenance documentation left on site is complete.
      d. Verify that the Owner's operating personnel are adequately trained.
   2. The commissioning process does not take away from or reduce the responsibility of the installing contractors to provide a finished and fully functioning product.
   3. Refer to Division 01 Section "General Commissioning Requirements" for complete commissioning plan and specifications.

1.3 SYSTEMS TO BE COMMISSIONED

A. Contractor shall perform commissioning requirements specified in Section 010800 and other sections referenced in Section 010800.

B. The following systems will be commissioned in this project.
   1. Lighting Control Systems

1.4 TEST EQUIPMENT

A. Standard testing equipment required to perform startup and initial checkout and required functional performance testing shall be provided by the Contractor for the equipment being tested. For example, the electrical contractor shall ultimately be responsible for standard testing equipment for the electrical system, except for equipment specific to and used by Commissioning Authority in their commissioning responsibilities.

B. Testing equipment shall be of sufficient quality and accuracy to test and measure system performance with the tolerances specified in the Specifications.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 26 08 00

SECTION 26 09 23 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following lighting control devices:
   1. Indoor occupancy sensors.
   2. Internal emergency transfer devices, without battery.
   3. External Emergency transfer devices.

B. Related Sections include the following:
   1. Division 26 Section "Wiring Devices" for wall-box dimmers and manual light switches.
   2. Division 26 Section "Interior Lighting" for luminaires use in the interior of the building.

1.2 DEFINITIONS

A. LED: Light-emitting diode.

B. PIR: Passive infrared.

1.3 SUBMITTALS

A. Quality Assurance/Control Submittals:
   1. Product Data: For each type of product indicated.
   2. Field quality-control test reports.

1.4 CLOSEOUT DOCUMENTS

A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
   1. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.6 COORDINATION

A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where title below introduces lists, the following requirement applies for product selection:
   1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

B. Products of other manufacturers will be considered for acceptance only when allowed in Section 260050, General Electrical Requirements.

2.2 INDOOR OCCUPANCY SENSORS

A. Manufacturers:
   1. Hubbell Building Automation, Inc.
   2. Leviton Mfg. Co., Inc.; Lighting Control Division.
   3. Cooper Controls, Greengate Products; a Cooper Industries, Ltd. company.
   4. Sensor Switch, Inc.; an Acuity Brands company.

B. General Description: Wall- or ceiling-mounting, solid-state units with a separate relay unit, complying with NEMA WD 7.
   1. Operation: Unless otherwise indicated, self adjusting to turn lights on when covered area is occupied and off when unoccupied; with a time delay for turning lights off, manually adjustable over a minimum range of 1 to 15 minutes.
   2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
   3. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
      a. Provide dry contact for integration with building management system in addition to contact required for lighting control.
   4. Mounting:
      a. Sensor: Suitable for mounting in any position on a standard outlet box.
      b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
      c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
   5. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
   6. Bypass Switch: Override the on function in case of sensor failure.
   7. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc; keep lighting off when selected lighting level is present.

C. Dual-Technology Type (Plan Type “CT”): Ceiling mounting; detect occupancy by using a combination of PIR and ultrasonic detection methods in area of coverage. Particular technology or combination of technologies that controls on-off functions shall be selectable in the field by operating controls on unit.
   1. Sensitivity Adjustment: Separate for each sensing technology.
   2. Detector Sensitivity: Detect occurrences of 6-inch- minimum movement of any portion of a human body that presents a target of not less than 36 sq. in, and detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s .
   3. (Plan Type “CT”) 360 Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 2000 sq. ft. when mounted on a 96-inch- high ceiling.
   4. (Plan Type “W”) Hallway Detection Coverage: Detect occupancy anywhere within a 20 foot distance each direction (min.) when mounted on a 96-inch- high ceiling. Provide with ceiling mounting bracket if not supplied as standard with sensor

D. Wall-Switch Sensors, Passive-Infrared Type (Plan Type “SI”):
   1. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 20 minutes, manual override switch, 180-degree field of view, with a minimum coverage area of 900 sq. ft., complying with NEMA WD 7.
   2. Device color to match other supplied wiring devices. Refer to Division 26 Section “Wiring Devices” for requirements.

E. Power Pack: Self-contained power pack with transformer and relay (an ON/OFF switch controlled by a circuit) compatible with the supplied occupancy sensors designed for low-voltage 24 VDC occupancy sensors.
   1. Universal voltage input (100–277 VAC; 50/60Hz).
   2. Automatic voltage detection.
   3. Electrical load switching capability: maximum of 20 Amps.
   4. Regulated 24 VDC current; 150mA output; short circuit protected.

5. Zero Arc Point Switching.
6. Plenum rated.
7. Suitable for mounting inside or outside a junction box, or inside a ballast or driver cavity.
8. UL and cUL listed

2.3 EMERGENCY TRANSFER DEVICE (ETD), INTEGRAL TO LUMINAIRE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:
1. Cooper Lighting; Sure-Lites Division; a Division of Cooper Industries.
2. IOTA Engineering LLC.
3. McPhilben; a Philips group brand.
4. Philips Bodine.

B. Emergency Transfer Devices Integral to Luminaire: When the facility has an emergency generator, provide self-contained, modular, emergency transfer switch unit, factory mounted within luminaire body and compatible for either fluorescent ballast or solid-state lighting driver.
1. Comply with UL 924.
2. Provide 120 or 277 V, 60 Hz operation as required.
3. Provide painted steel or galvanized steel housing.
4. Provide temperature rating from 32 deg F to 122 deg F.
5. Provide device rated 2.0 W AC input power and 280 mA AC input current or less during normal operation.
6. Provide device capable of switching 3 amps, minimum, electronic fluorescent or incandescent load at 120 V or 277 V.
7. Provide 3 A overcurrent protection of control circuit input and switched load circuit.
8. Normal Mode Operation: Normal AC power is present. AC ballast or solid-state lighting driver operates fluorescent or LED lamp(s) as intended, controlled by wall switch.
9. Emergency Mode Operation: Normal AC power fails. Emergency transfer device senses normal AC power failure and automatically switches to emergency AC power, bypassing wall switch. When normal AC power is restored, emergency transfer device switches system back to normal mode operation.
10. Provide one device per emergency luminaire, unless otherwise indicated.

2.4 REMOTE EMERGENCY TRANSFER DEVICE (RTD), REMOTE FROM LUMINAIRE TO CONTROL A WHOLE CIRCUIT

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:
1. Watt Stooper.
2. Philips Bodine
3. McPhilben; a Philips group brand.

B. Whole Circuit Emergency Transfer Devices: When the facility has an emergency generator, provide a field mounted, emergency transfer switch unit, adjacent to emergency panel as shown on drawings.
1. Comply with UL 924.
2. Provide 120 or 277 V, 60 Hz operation as indicated.
3. Provide threaded hub to attach to electrical box.
4. Provide temperature rating from minus 4 deg F to 131 deg F.
5. Provide device capable of switching 20 amps, minimum, electronic fluorescent or incandescent load.
6. LED lamp(s) as intended shall display Normal Mode Operation: Normal AC power is present. AC load controlled by wall switch.
7. LED lamp(s) as intended shall display Emergency Mode Operation: Normal AC power fails. Emergency transfer device senses normal AC power failure and automatically switches to emergency AC power, bypassing wall switch. When normal AC power is restored, emergency transfer device switches system back to normal mode operation.

8. Unswitched Mode Operation: LED lamp(s) as intended shall display Emergency luminaires are normal off. Normal AC power fails. Emergency transfer device senses normal AC power failure and automatically switches power to energize emergency luminaires. This is accomplished by not connecting a conductor to the wall switch terminal on the unit. When normal AC power is restored, emergency transfer device switches emergency luminaires off.
9. Provide external push to test button.
10. Provide one device per each emergency circuit, unless otherwise indicated.

2.5 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 14 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

A. Provide occupancy sensors, power packs, and all associated accessories, backboxes, conduit, wiring, etc. for a complete installation of occupancy sensor controlled lighting for rooms indicated as requiring occupancy sensor control on the Drawings

B. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

C. Occupancy Adjustments: Adjust each sensor to suit occupied conditions. Adjust time delay on all occupancy sensors to its maximum setting, 30 minutes.. Adjust sensitivity to quickly pick up motion or presence of a person. Coordinate any required adjustments of occupancy sensors (as applicable for selected manufacturer) with the Owner and make any adjustments as directed.

D. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

E. Wire occupancy sensors per manufacturer’s recommendations to allow for both sensor and manual control of lighting as indicated on the Drawings.

F. Power packs shall be provided in the quantity required to serve occupancy sensor(s) with the switching and branch circuiting schemes indicated on the Drawings. Power pack locations/quantities are not indicated on the Drawings. Power packs shall be plenum rated. Install power pack on local branch circuit junction box serving local area lighting.

3.2 WIRING INSTALLATION

A. Wiring Method: Comply with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and non-power-limited conductors according to conductor manufacturer's written instructions.

C. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.

D. Splices, Taps, and Terminations: DO NOT SPLICE LOW VOLTAGE CONDUCTORS OUTSIDE OF A BOX. Make all connections only in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. Terminate on numbered terminal strips or use wire nuts if terminal strips are not available.

3.3 IDENTIFICATION

A. Identify components and power and control wiring according to Division 26 Section "Identification for Electrical Systems."
   1. Identify controlled circuits in lighting contactors.
   2. Identify circuits or luminaries controlled by photoelectric and occupancy sensors at each sensor.

B. Label time switches and contactors with a unique designation.

3.4 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:
   1. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
   2. Operational Test: Verify operation of each lighting control device, and adjust time delays.

B. Lighting control devices that fail tests and inspections are defective work.

END OF SECTION 26 09 23

SECTION 26 27 26 - WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Receptacles, receptacles with integral GFCI, and associated device plates.
   2. Twist-locking receptacles.
   3. Snap switches and wall-box dimmers.
   4. Wall-switch occupancy sensors.

B. Related Sections include the following:
   1. Division 26 Section "Conduit and Boxes for Electrical Systems" for conduit, metal and nonmetallic floor boxes, poke through service fitting, high capacity floor boxes, etc.
   2. Division 26 Section "Surface Raceways for Electrical Systems" for surface raceways, wireways, multioutlet assemblies, service poles, etc.
   3. Division 26 Section "Lighting Control Devices" for photoelectric switches and occupancy sensors other than wall-switch type.
   4. Division 27 Section "Communications Copper Horizontal Cabling" for workstation outlets.

1.2 DEFINITIONS

A. GFCI: Ground-fault circuit interrupter.

B. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

1.3 SUBMITTALS

A. Quality Assurance/Control Submittals:
   1. Product Data: Provide product data sheet for each wiring device or product in this Section and on the Drawings that are specifically applicable to this project. Provide an arrow stamp pointing to the exact catalog number or product and do not merely highlight the information.
   2. For special purpose NEMA type receptacles, Submittal shall indicate equipment served for each special purpose receptacle type (e.g. NEMA 15-50R-- “Kiln”).
   3. Field quality-control test reports.

1.4 CLOSEOUT DOCUMENTS

A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
   1. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
   1. Arrow Hart/Cooper Wiring Devices; a division of Cooper Industries, Ltd. (Arrow Hart).
   2. Hubbell Incorporated; Bryant Electric (Bryant).
   3. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
   4. Leviton Mfg. Co., Inc. (Leviton).
   5. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

B. Products of other manufacturers will be considered for acceptance only when allowed in Section 260050, General Electrical Requirements.

C. All wiring devices in this building shall be supplied from the same manufacturer. Use of multiple manufactures of wiring devices in the same building is not allowed.

2.2 STRAIGHT BLADE RECEPTACLES

A. Tamper-Resistant Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Arrow Hart; TR8300.
      b. Bryant; BRY8300TR.
      c. Hubbell; HBL8300SG.
      d. Leviton; 8300-SG.
      e. Pass & Seymour; TR63H, or PTR63H (with separable pigtailed connector).
   2. Description: Labeled to comply with NFPA 70, "Health Care Facilities" Article, "Pediatric Locations" Section.

2.3 GFCI RECEPTACLES

A. General Description: Straight blade, feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.

B. Tamper-Resistant Duplex GFCI Convenience Receptacles, 125 V, 20 A:
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Arrow Hart; TRVGF20.
      b. Hubbell; GFTR20.
      c. Leviton; T7899.
      d. Pass & Seymour; 2095-TR, or PT2095-TR (with separable pigtailed connector).

2.4 WALL-BOX DIMMERS

A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.

B. Control: Continuously adjustable slide or button type; with single-pole or three-way switching. Comply with UL 1472.

C. Contractor shall verify voltage and lamp source for the luminaire that is to be dimmed. Select from the following options and provide the matching required wall dimmer.

   1. For LED luminaires: 0 to 10 volt dimmers for solid state luminaires. Verify the maximum quantity of luminaires in each space that can be controlled from one dimmer. Provide each space with the required quantity of dimmers to control all luminaires in that space.

2.5 WALL PLATES

A. Single and combination types to match corresponding wiring devices.
   1. Plate-Securing Screws: Metal with head color to match plate finish.
   2. Material for Finished Spaces: 0.035-inch- thick, medium size, satin-finished stainless steel.

2.6 FINISHES

A. Color: Wiring device catalog numbers in Section Text do not designate device color. Color as defined by NEMA WD 1 unless otherwise indicated.
   1. Wiring Devices Connected to Normal Power System: Gray, unless otherwise indicated or required by NFPA 70 or device listing.
   2. Wiring Devices Connected to Emergency Power System: Red.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1.

B. Coordination with Other Trades:
   1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
   2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
   3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
   4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:
   1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
   2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
   3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
   4. Existing Conductors:
      a. Cut back and pigtail, or replace all damaged conductors.
      b. Straighten conductors that remain and remove corrosion and foreign matter.
      c. Pigtailing existing conductors is permitted provided the outlet box is large enough.

D. Device Installation:
   1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
   2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
   3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
   4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
   5. Connect grounding terminals of devices to device box and equipment grounding conductor using pigtails that are not less than 6 inches in length with factory-crimped flanged spade and ring terminals.
   6. When using side wiring with binding-head screw terminals, use solid conductor pigtails. Wrap conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
   7. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
   8. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
   9. Tighten unused terminal screws on the device.

10. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.
11. Install device boxes so that finish plates do not span different types of building finishes.

E. Receptacle Orientation:
1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the left.

F. Device Plates:
1. Install blank device plates on unused device boxes.
2. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening. Do not use oversized or extra-deep plates, unless approved by engineer.

G. Dimmers:
1. Install dimmers within terms of their listing.
2. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

I. GFCI Receptacles: Where double-duplex GFCI receptacles are indicated, provide one duplex GFCI receptacle and feed-through to standard straight blade convenience receptacle in same device box.
1. Unless indicated otherwise, do not feed-through to receptacles in other device boxes.

J. Mounting Heights: Refer to drawings for mounting heights. If heights are not shown on drawings, install as follows. Measured from finished floor to bottom of outlet or device box, unless indicated otherwise.
1. General Use Receptacles: 16 inches.
2. Snap Switches, Wall-Box Dimmers, Wall-Switch Sensors: 44 inches.
    a. Install on strike side of door, 6 to 12 inches from door, unless otherwise indicated.
3. Receptacles in Mechanical and Electrical Equipment Rooms: 48 inches.
4. Wiring Devices Above 30-Inch-High Countertops: 40 inches.
    a. Install at least 2 inches above backsplash.
5. Wiring Devices Above 36-Inch-High Countertops: 44 inches.
    a. Install at least 2 inches above backsplash.
6. Wiring Devices Above 42-Inch-High Countertops: 48 inches.
    a. Install at least 2 inches above backsplash.
7. Wiring Devices Above Lavatories: 44 inches.
8. Receptacles Serving Domestic Refrigerators: 56 inches.
9. Receptacles Serving Domestic Electric Clothes Dryers and Washing Machines: 32 inches.
10. Receptacles Serving Domestic Dishwashers: 2 inches.
    a. Install horizontally.
11. Recessed Motor Controls: 56 inches.
12. Pushbuttons: 44 inches.
13. Interior Wall Mounted Luminaire Outlets: 88 inches.
    a. Install at least 2 inches above mirrors.
14. Occupant Adjustable Thermostats: 44 inches.
15. Sensor Only Thermostats: 56 inches.
16. Fire Alarm Manual Stations: 44 inches.
    a. Install within 5’-0” of door.
    b. Install no higher than 48 inches to top of device.
17. Fire Alarm Notification Appliances: 80 inches, or 6 inches below ceiling. Whichever is lower.

K. Utilization Equipment: Refer to Shop Drawings for mounting height of special purpose devices serving, but not limited to, the following:
1. Commercial kitchen equipment.

2. Commercial clothes washers and dryers.
3. Drinking water coolers.
4. Sensor operated wash fountains and lavatories.
5. <**Insert equipment.**>

3.2 IDENTIFICATION

A. Comply with Division 26 05 53 Section "Identification for Electrical Systems" for the following:
   1. Receptacles: Identify panelboard and circuit number from which each receptacle is served.
   2. Provide external, manufacturers adhesive label outside of cover plate when a standard receptacle is served from an upstream GFI device.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

END OF SECTION 26 27 26

SECTION 26 51 00 – INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes the following:
   1. Interior luminaires, lamps, ballasts, and solid-state lighting drivers.
   2. Luminaire supports.

B. Related Sections include the following:
   1. Division 26 Section "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, emergency transfer devices and multipole lighting relays and contactors.
   2. Division 26 Section "Wiring Devices" for wall-box dimmers.

1.2 DEFINITIONS

A. BF: Ballast factor.

B. CEE: Consortium for Energy Efficiency, Inc.

C. CRI: Color-rendering index.

D. HID: High-intensity discharge.

E. LED: Light-emitting diode.

F. LER: Luminaire efficacy rating.

G. Luminaire: Complete lighting fixture, including ballast and driver housing if provided.

H. SSL: Solid-state lighting.

1.3 SUBMITTALS

A. Quality Assurance/Control Submittals:
   1. Product Data: For each type of luminaire, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:
      a. Physical description of lighting fixture including dimensions.
      b. Emergency lighting units including battery and charger.
      c. Ballast and solid-state lighting Drivers. Submit product data sheets marked or highlighted for the specific ballast or solid-state lighting driver manufacturers/models for applicable products being provided from Part 2 of this Section ”Generic” or “manufacturers choice” ballasts or solid-state lighting drivers are not acceptable. Submittals missing this information will be Rejected.
      d. Energy-efficiency data.
      e. Life, output, energy-efficiency data, and mercury content for lamps. Submit product data sheets marked or highlighted for the lamp manufacturer/models for applicable products being provided from Part 2 of this Section. Submittals missing this information will be Rejected.
      f. Photometric data, in IESNA format, based on laboratory tests of each lighting fixture type, outfitted with lamps, ballasts, solid-state lighting drivers, and accessories identical to those indicated for the lighting fixture as applied in this Project.
         1) Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program (NVLAP) for Energy Efficient Lighting Products.
   2. Field quality-control test reports.

1.4 CLOSEOUT DOCUMENTS

A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
   1. Operation and Maintenance Data: For lighting equipment and fixtures to include in operation and maintenance manuals.
   2. Warranties: Special warranties specified in this Section.
   3. Extra Materials: Receipt for extra materials.

1.5 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

1.6 COORDINATION

A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.7 WARRANTY

A. Special Warranty for solid-state lighting Luminaires and solid-state lighting Drivers: Manufacturer's standard form in which manufacturer of lighting unit agrees to repair or replace components that fail in materials or workmanship within specified warranty period.
   1. Warranty Period for Solid-state lighting Luminaires and Solid-State Lighting Drivers: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In the Luminaire Schedule where titles below are column or row headings that introduce lists, the following requirements apply to product selection:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

B. Products of other manufacturers will be considered for acceptance only when allowed in Section 260050, General Electrical Requirements.

2.2 LUMINAIRES AND COMPONENTS, GENERAL REQUIREMENTS

A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

B. LED Fixtures: Comply with UL 1598, in addition to the requirements contained in UL Subject 8750.

C. Metal Parts: Free of burrs and sharp corners and edges.

D. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.

E. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

F. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:
   1. White Surfaces: 85 percent.
   2. Specular Surfaces: 83 percent.
   3. Diffusing Specular Surfaces: 75 percent.
   4. Laminated Silver Metallized Film: 90 percent.

G. Plastic Diffusers, Covers, and Globes:
   1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
      a. Lens Thickness: At least 0.125 inch nominal unless different thickness is indicated.
      b. UV stabilized.
   2. Glass: Annealed crystal glass, unless otherwise indicated.

H. Tap Connections (Fixture Whips): Not longer than 6 feet, constructed of No. 12 AWG copper conductors.

2.3 DRIVERS FOR SOLID-STATE LIGHTING LUMINAIRES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:
   1. Sylvania.
   2. Philips Lighting Co.
   3. EldoLED (Acuity Brand).
   4. Energy Recovery Products (Cooper Brand).
   5. Thomas Research Products (Hubbell Brand).
   6. Lutron (1% dimming).

B. Electronic Drivers: Comply with ANSI C82.11, NEMA SSL 1, and UL 935 in addition to the requirements contained in UL Subject 8750; UL Class 2 listed power supply, isolated output, and designed for type and quantity of LEDs served.
   1. Input Rating: 120 to 277 V, 60 Hz, plus or minus 10 percent.
   2. Output Rating: 12 or 24 V dc, based on lumen output with minimum of 350 mA, plus or minus 5 percent.
   3. Sound Rating: Class A.
   4. Total Harmonic Distortion Rating: Less than 20 percent.
   5. Transient Voltage Protection: IEEE C62.41, Category A or better.
   6. Minimum Operating Temperature: minus 40 deg F.
   7. Power Factor: 0.90 or higher.

C. Drivers for Dimmer-Controlled Lighting Fixtures: Electronic type.
   1. Dimming Range: 100 to 10 percent of rated LED lumens.
   2. Driver Input Watts: Can be reduced to 25 percent of normal.
   3. Compatibility: Certified by manufacturer for use with specific dimming control system and lamp type indicated.
   4. Control: 0 to 10 V dc.

2.4 EMERGENCY TRANSFER DEVICE, GENERATOR TRANSFER DEVICE, and WHOLE CIRCUIT TRANSFER DEVICES.

A. Selected luminaires as shown on the drawings shall have a transfer device installed at the factory, or a whole circuit device installed in the field, to automatically transfer the branch circuit from a normal source to an emergency source. Refer to Division 26 Section "Lighting Control Devices" for additional details.

2.5 EXIT SIGNS

A. Description: Comply with UL 924; Comply with NEMA EM 1; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:
   1. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.

2.6 SOLID-STATE LIGHTING LUMINAIRES

A. LED Package (Component) Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers: Manufacturers of LED drivers and LED modules shall be tested by the Luminaire Manufacturers and the stated warranty shall be based on the compatibility of the tested components, and substituted manufacturers will not be allowed. Refer to the list of approved LED drivers above.

B. LED Luminaires: Photometric data complying with IES LM-79, Energy Star rated by the U.S. Department of Energy, CRI 80 (minimum), color temperature 4000 K, white light produced by binary complementary wavelength conversion. Color mixing red, green, and blue LEDs is not acceptable.
   1. LED Packages, Arrays, and Modules:
      a. Binned for color consistency per NEMA SSL 3; and B50, L70 rating of at least 50,000 hours when tested according to IES LM-80.
      b. LED packages, arrays or modules shall be field replaceable without having to replace the entire luminaire.

2.7 LUMINAIRE SUPPORT COMPONENTS

A. Comply with Division 26 Section "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.

C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

D. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

E. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

F. Chains: 12 gage, zinc-plated steel jack chain or double-loop chain.

G. Air-Craft Cable: 3/32-inch stainless steel cable with adjustable cable holder, adjustable plus or minus 6 inches.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 500 and NECA 502.

B. Protect all luminaires from dust, moisture and debris during construction with plastic or other suitable barriers. Clean all luminaire that are dirty.

C. Luminaires: Set level, plumb, and square with ceilings and walls. Install lamps in each luminaire.

D. Temporary Lighting: If it is necessary, and approved by A/E, to use permanent luminaires for temporary lighting, install and energize the minimum number of luminaires necessary. When construction is sufficiently complete, remove the temporary luminaires, disassemble, clean thoroughly, install new lamps, and reinstall.

E. Remote Mounting of Ballasts and Solid-State Lighting Drivers: Distance between the ballast or solid-state lighting driver and fixture shall not exceed that recommended by ballast or solid-state lighting driver manufacturer. Verify, with ballast and solid-state lighting driver manufacturers, maximum distance between ballast or solid-state lighting driver and luminaire.

F. Lay-in Ceiling Luminaires Supports: Use grid as a support element.
   1. Install ceiling support system wire cable or chains, independent of the ceiling suspension devices, for each fixture. Locate not more than 6 inches from lighting fixture corners.
   2. Support Clips: Fasten to luminaires and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
   3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
   4. Install at least four independent support jack chains from structure to tabs on lighting fixture. Chain shall have breaking strength of the weight of fixture at a safety factor of 3.

G. Suspended Luminaires Support:
   1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
   2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
   3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
   4. Do not use grid as support for pendant luminaires. Connect support wires or rods to building structure.

H. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

I. Install wire guards to exit signs and emergency lighting units in gymnasia, milt-purpose rooms, shops, and stage areas.

3.2 IDENTIFICATION

A. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL

A. Selected luminaires as shown on the drawings shall have emergency transfer capability and sensors installed. Refer to Division 26 Section "Lighting Control Devices" for all adjustments and tests required on these luminaires.

B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

END OF SECTION 26 51 00

DIVISION 27

COMMUNICATIONS

SECTION 27 01 00 - OPERATION MANUALS OF COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Operation manuals for systems, subsystems, and equipment.
   2. Equipment Spreadsheet

B. Related Sections include the following:
   1. Division 01 General Requirements
   2. Division 28 Electronic Safety and Security

1.3 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 SUBMITTALS

A. Format: Submit operations manuals in the following format:
   1. PDF electronic file. Assemble each manual into a composite electronically-indexed file.
      a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically-linked operation and maintenance directory.

B. Initial Submittal: Submit one (1) draft copy of each manual for each building per Division 01 General Requirements. Include a complete operation manual directory. The draft copies will be returned with notes indicating whether the general scope and content of the manuals are acceptable. Required additions and corrections will also be noted.
   1. If the project is being constructed in Phases, provide operating manuals at the completion of each Phase of work.

C. Final Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion or at least 15 days prior to commencing demonstration and training or as directed by Architect.

1.5 COORDINATION

A. Where operation documentation includes information on installations by more than one manufacturer or subcontractor, assemble and coordinate all required information under one heading for each system or subsystem.

PART 2 - NOT USED

PART 3 - EXECUTION

3.1 OPERATION DOCUMENTATION

A. Organization: Include a section in the directory for each of the following:

1. Table of contents.
2. List of documents.
3. List of systems.
4. List of equipment.

B. List of systems and subsystems: List systems by specification section number, then Article Number.

C. List of Equipment: List equipment for each system, by specification section number, then Article Number. For pieces of equipment not part of system, list by specification section number, then Article Number.

D. Table of Contents.

E. Identification: In the documentation directory and in each operation manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents.

3.2 REQUIREMENTS FOR OPERATIONS MANUALS

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Include the following information:
1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name and contact information for Contractor.
6. Name and contact information for Construction Manager, if applicable.
7. Name and contact information for A/E.
8. Name and contact information for Commissioning Agent, if applicable.

C. Table of Contents: List each product, system, or subsystem included in manual, identified by specification section number, then Article Number:
1. User Manuals
2. Warranty
3. Test Results
4. Manufacturer’s Certification
5. Training & Attic Stock Materials sign-off sheets
6. Approved Submittal

D. Manuals, Electronic Files: Submit manuals in the form of a multiple file electronic PDF.
1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Enable bookmarking of individual documents based upon file names.
3. File Names and Bookmarks: Enable bookmarking of individual documents based upon file names. Information in each digital file must be separated and identified in such a manner that individual manuals or other pieces of information can be easily located
4. Name document files to correspond to system, subsystem, and equipment names used in manual directory listed in the table of contents and specified in the Documents.
5. Configure electronic manual to display bookmark panel upon opening file.
6. Do not combine different closeout items in the same electronic files or folders. Operation and Maintenance Manuals are to be separate from Record Drawings, Test Results etc.

3.3 OPERATION MANUALS

A. Content: Include operation data required in individual Specification Sections and the following information:
   1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
   2. Operating procedures.
   3. Wiring diagrams.
   4. License requirements including renewal dates.
   5. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
   6. When using manufacturer’s standard printed data include only those sheets pertinent to products or components installed. If data includes information on more than one item clearly indicate only those items used on the project.
   7. Include drawings supplementing manufacturers' printed data to illustrate the relationship of individual components of a system and to illustrate interconnectivity. Coordinate these drawings with the information contained in the Record Drawings to ensure an accurate depiction of the actual installation.

B. Descriptions: Include the following:
   1. Product name and model number. Use designations for products indicated on Contract Documents.
   2. Manufacturer's name.
   3. Equipment identification with serial number of each component and owners room number where equipment is located.
   4. Equipment function.

C. Operating Procedures: Include the following, as applicable:
   1. Startup procedures.
   2. Routine and normal operating instructions.
   3. Regulation and control procedures.
   4. Normal shutdown instructions.
   5. Seasonal and weekend operating instructions.
   6. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

3.4 RECORD DRAWINGS

A. Record Drawings or As Built Drawings shall be provided to the Owner/Architect/Engineer in .pdf format. Marked up drawings or scanned field working drawings are not acceptable.

B. CAD files will be made available to the Contractor for use in completing the Record Drawings for a nominal fee.

C. Each drawing sheet of the record set is to be stamped “Record Drawing”.

D. The Contractor’s RCDD overseeing the project must stamp and sign each Record Drawing Sheet to confirm compliance with the Documents.

E. Notations and labels on the Record Drawings shall be typed. Hand written notes are not acceptable.

F. All deviations from the bid documents are to be noted. Indicate changes made by Addenda, Architect Supplemental Instructions (ASI), Change Orders, and Field Directives.

3.5 All devices are to be shown in their approximate installed location and labeled with the correct field designation.

3.6 EQUIPMENT SPREADSHEET

A. Provide a list of each piece of electronic equipment installed.
   1. Electronic equipment is defined as all active electronic equipment provided as part of this project.

B. The list must be in an Excel spreadsheet format with the following information:
   1. Room Number or Location
   2. Device Description
   3. Manufacturer Name
   4. Model Number
   5. Serial Number
   6. Date tested
   7. Special comments
   8. Additional Columns as required by owner. Submit a sample spreadsheet with draft operations manual.

C. The spreadsheet must be provided as a part of the close out documentation.

D. Update list after all equipment has been installed and tested.

3.7 DIGITAL REQUIREMENTS

A. Provide all operation and maintenance manuals of communications systems in electronic format (verify the file type with the Owner).

3.8 ELECTRONIC DRAWING FILES

A. Record Drawings shall be provided to the Architect in the latest Auto CAD releases. Marked-up drawings or scanned drawings are not acceptable.

B. Electronic drawings files will be available for all Contractors:

1.	Printed Sheet or set	Complete set of documents	Contact Printing Company
2.	AutoCAD .dwg file	Plan base sheet - .dwg drawing file of each floor. Includes base plans and equipment, etc.	$100 each – First 3 plans $75 each additional plan

C. Specifications Each Volume $200

3.9 MANUAL PREPARATION

A. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
   1. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

B. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a

tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

C. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

1. Do not use original project record documents as part of operation and maintenance manuals.
2. Comply with requirements of newly prepared record Drawings in Division 01 Section "Project Record Documents."

D. Comply with Division 01 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

3.10 COMMUNICATIONS SYSTEMS

A. Provide the operation and maintenance of communications systems for all communications systems specified.

END OF SECTION 27 01 00

SECTION 27 01 11 – DEMONSTRATION, TRAINING, AND WARRANTY OF COMMUNICATIONS SYSTEMS

PART 1 - GENERAL.

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
   1. Demonstration of operation of systems, subsystems, and equipment.
   2. Training in operation and maintenance of systems, subsystems, and equipment.
   3. Demonstration and training videos.
   4. Warranties.

B. Related Sections include the following:
   1. Division 01 General Requirements
   2. Division 27 Communication for specific requirements for demonstration and training for products in those Sections.
   3. Division 27 Operation Manuals of Communication Systems
   4. Division 28 Electronic Safety and Security for demonstration and training for products in those Sections.

C. Length of instruction time will be measured by actual time spent performing demonstration and training at required location. No payment will be made for time spent assembling educational materials, setting up, travel, or cleaning up.

1.3 CLOSEOUT SUBMITTALS

A. Instruction Program: Submit two (2) copies of the proposed training outline. Include length of instruction time, and instructors' name(s) and certifications. Include the objective of each training session.

B. Attendance Record: For each training session submit list of instructors name, instructors' certifications, participants signatures and length of instruction time.
   1. Include the lists with the Operation and Maintenance Manuals.

C. Demonstration and Training electronic paperwork files: Submit two (2) copies within seven (7) days of end of each training session.
   1. Identification: On each copy, provide a label with the following information:
      a. Name of Project.
      b. Name of Architect/Engineer/Consultant.
      c. Name of Contractor.
      d. Name of Spec Section training is covering
      e. Name and company of Instructor
      f. Signatures of all Attendees
      g. Length of time training lasted along with specified total training hours
      h. Date training was recorded.
   2. At the completion of the training, submit one (1) hard copy training manual and one manual in digital format (USB drive or DVD verify with owner) to the Construction Manager or Architect/Engineer for approval. If approved these manuals will be turned over to the Owner.

D. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.
   1. Identification: On each copy, provide an applied label with the following information:
      a. Name of Project.
      b. Name of A/E.
      c. Name of Construction Manager.
      d. Name of Contractor.
      e. Name of Spec Section or system
      f. Date of video recording.
   2. Transcript: Prepared in PDF electronic format. Include a cover sheet with same label information as the corresponding video recording and a table of contents with links to corresponding training components. Include name of Project and date of video recording on each page.
   3. At completion of training, submit complete training manual(s) for Owner's use in PDF electronic file format.

1.4 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 01 Section "Quality Requirements," experienced in operation and maintenance procedures and training.

C. Pre-instruction Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:
   1. Inspect and discuss locations and other facilities required for instruction.
   2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
   3. Review required content of instruction.

1.5 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations.

B. Coordinate size of instruction so as to not be too large for full attendee participation. Some training may need to be broken up for multiple sessions to accommodate large numbers of attendees.

C. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

D. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect/Engineer.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections, and as follows:
   1. Equipment, including projection screens.

2. Equipment Room and Communication systems overview, setup and labeling scheme.
3. 2 Way Intercom and program System.
4. Sound system.
5. Voice over IP telephone and voice mail system.
6. Network Electronics.
7. Wireless Access Points.
8. IP Video Distribution System.
9. Interactive video projectors and/or video monitors.
10. TV studio.
11. Radio Broadcasting.
12. Interactive White Boards.
13. Misc. video and audio equipment.
14. Etc.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following:
1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
    a. System, subsystem, and equipment descriptions.
    b. Operating and programming standards.
    c. Equipment function.
    d. Operating characteristics.
2. Documentation: Review the following items in detail:
    a. Operating manuals.
    b. Maintenance manuals.
    c. Project Record Documents.
    d. Identification systems.
    e. Warranties and bonds.
    f. Maintenance service agreements and similar continuing commitments.
3. Emergencies: Include the following, as applicable:
    a. Instructions on meaning of warnings, trouble indications, and error messages.
    b. Shutdown instructions for each type of emergency.
    c. Operating instructions for conditions outside of normal operating limits.
    d. Sequences for electric or electronic systems.
    e. Special operating instructions and procedures.
4. Operations: Include the following, as applicable:
    a. Startup procedures.
    b. Equipment or system break-in procedures.
    c. Routine and normal operating instructions.
    d. Safety procedures.
    e. Normal shutdown instructions.
    f. Operating procedures for emergencies.
    g. Operating procedures for system, subsystem, or equipment failure.
    h. Required sequences for electric or electronic systems.
    i. Special operating instructions and procedures.
5. Troubleshooting: Include the following:
    a. Diagnostic instructions.
    b. Test and inspection procedures.
6. Maintenance: Include the following:
    a. Inspection procedures.
    b. Types of cleaning agents to be used and methods of cleaning.
    c. List of cleaning agents and methods of cleaning detrimental to product.
    d. Procedures for routine cleaning
    e. Procedures for preventive maintenance.
    f. Procedures for routine maintenance.
    g. Instruction on use of special tools.
7. Repairs: Include the following:
    a. Diagnosis instructions.
    b. Repair instructions.

c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
d. Instructions for identifying parts and components.
e. Review of spare parts needed for operation and maintenance.

2.2 WARRANTY

A. Submit all warranties for each product, equipment as outlined and specified in the following section. Warranty shall include labor, materials, travel time, etc. Not all sections will be used on this project.

Section	Name and Number	2 year	3 year	5 year	20 year
270526	Grounding and Bonding for Communications Systems	yes	-	-	-
270528	Pathways for Communications Systems	yes	-	-	-
271100	Communications Equipment Room Fittings	-	-	yes	-
271113	Communications Entrance Protection	-	-	yes	-
271313	Communications Copper Backbone Cabling	-	-	-	yes
271323	Communications Fiber Optical Backbone Cabling	-	-	-	yes
271343	Communications Services Cabling (WAN)	-	-	-	yes
271511	Conductors and Cables For Intercom, Public Address and Mass Notification Systems	-	yes	-	-
271515	Communications Copper Horizontal Cabling (Category 6)	-	-	-	yes
271517	Communications Copper Horizontal Cabling (Augmented Category 6 Cable)	-	-	-	yes
271553	Miscellaneous Communications	-	-	-	yes
272129	Data Communications Switches and Chassis	yes	yes	-	-
272133	Data Communications Wireless Access Points	yes	yes	-	-
272219	Data Communications File Servers	yes	yes	-	-
272239	Wireless Communications Wide Area Network (WAN) System	yes	yes	-	-
273113	Integrated Voice Communications	yes	-	-	-
273125	Voice over IP Telephone System	yes	-	-	-
274112	Communication A/V Mounts	-	-	yes	-
274113	Integrated Audio and Video Distribution System (Head End Equipment)	yes	-	-	-
274114	Integrated Audio and Video Distribution System (IP Based Head End Equipment)	yes	-	-	-
274116	Integrated Audio – Video System and Equipment for Classrooms	yes	yes	-	-
274117	Integrated A/V Control Systems and Equipment (Quick Media)	yes	yes	-	-
274133	Integrated A/V Equipment (Video Projectors)	yes	-	-	-
274143	Integrated A/V Equipment (Televisions)	yes	-	-	-

274153	Integrated A/V Accessories (Blu Ray, Carts, HDMI, etc.)	yes	-	-	-
274154	Integrated A/V Accessories Remote Origination carts	yes	-	-	-
274163	Digital Television Studio	yes	-	-	-
274164	Television Studio	yes	-	-	-
274165	Radio Broadcasting	yes	-	-	-
274173	Presentation Communications	yes	-	-	-
274183	Multi-Media Control System	yes	-	-	-
274195	Media Management System		yes		
275116	Public Address and Mass Notification Systems	yes	-	-	-
275117	Sound Reinforcement System	-	-	yes	-
275121	Projector Audio System	yes	-	-	-
275123	Intercommunications and Program Systems	yes	-	-	-
275125	IP Based Intercommunications and Program Systems	yes	-	-	-
275315	Synchronous Wireless Clock Systems	yes	-	-	-
280523	Conductors and Cables for Electronic Safety and Security	-	-	-	yes
281310	Access Control	yes	-	-	-
281600	Intrusion Detection	yes	-	-	-
282300	Video Surveillance (DVR)	yes	-	-	-
282311	IP Video Surveillance	yes	-	-	-
282600	Area Of Refuge Intercom. System	yes	-	-	-

2.3 ADJUSTING, TESTING, DEMONSTRATION, AND TRAINING

A. Provide adjusting, testing, demonstration, and training of the systems as specified in the following sections. Not all sections will be used on this project.

Section	Name and Number	Testing	Demo	Training	Hours
271100	Communications Equipment Room Fittings	yes	yes	yes	2
271113	Communications Entrance Protection	yes	-	-	-
271313	Communications Copper Backbone Cabling	yes	-	-	-
271323	Communications Fiber Optical Backbone Cabling	yes	-	-	-
271333	Communications Coaxial Backbone Cabling	yes	-	-	-
271343	Communications Services Cabling (WAN)	yes	-	-	-
271511	Communications Paging Horizontal Cable	yes	-	-	-
271515	Communications Copper Horizontal Cabling (Category 6)	yes	-	-	2
271517	Communications Copper Horizontal Cabling (Augmented Category 6 Cable)	yes	-	-	2
271533	Communications Coaxial Horizontal Cabling	yes	-	-	-
271553	Miscellaneous Communications	yes	-	-	2
272129	Data Communications Switches and Chassis	yes	yes	yes	-

272133	Data Communications Wireless Access Points	yes	yes	yes	1
272219	Data Communications File Servers	yes	yes	yes	-
272239	Wireless Communications Wide Area Network (WAN) System	yes	yes	yes	-
273113	Integrated Voice Communications	yes	yes	yes	-
273125	Voice over IP Telephone System	yes	yes	yes	-
274112	Communications Audio-Video Mounts	yes	yes	-	2
274113	Integrated Audio and Video Distribution System (Head End Equipment)	yes	yes	yes	-
274114	Integrated Audio and Video Distribution System (IP Based Head End Equipment)	yes	yes	yes	-
274116	Integrated Audio and Video Systems and Equipment For Classrooms	yes	yes	yes	4
274117	Integrated A/V Control Systems and Equipment (Quick Media)	yes	yes	yes	2
274133	Integrated A/V Equipment (Video Projectors)	yes	yes	yes	-
274143	Integrated A/V Equipment (Televisions)	yes	yes	yes	2
274153	Integrated A/V Accessories (Bluetooth, Media Player, aux, etc.)	yes	yes	yes	2
274154	Integrated A/V Accessories Remote Origination carts	yes	yes	yes	-
274163	Digital Television Studio	yes	yes	yes	-
274164	Television Studio	yes	yes	yes	-
274165	Radio Broadcasting	yes	yes	yes	-
274173	Presentation Communications	yes	yes	yes	-
274183	Multi-Media Control System	yes	yes	yes	-
274195	Media Management System	yes	yes	yes	-
275116	Public Address and Mass Notification Systems	yes	yes	yes	4
275117	Sound Reinforcement System	yes	yes	yes	4
275121	Projector Audio System	yes	yes	yes	-
275123	Intercommunications and Program Systems	yes	yes	yes	-
275125	IP Based Intercommunications and Program Systems	yes	yes	yes	-
275315	Synchronous Wireless Clock Systems	-	-	yes	-
281310	Access Control	yes	yes	yes	4
281600	Intrusion Detection	yes	yes	yes	-

282300	Video Surveillance (DVR)	yes	yes	yes	-
282311	IP Video Surveillance	yes	yes	yes	-
282600	Area Of Refuge Intercom. System	yes	yes	yes	-

2.4 TRAINING

A. Provide training clock hours as stated above.

B. Trainer must be certified by the manufacturer.

C. Provide a copy of a sign off sheet (signed by District staff) for the completed training with the close out documents.

2.5 CERTIFICATION

A. Provide a certification stating that the Communications and Security Work has been performed by qualified/trained installers and that the installation meets all codes, rules, regulations, and laws of the city and the state where the project is located etc.

PART 3 - EXECUTION

3.1 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a combined training manual.

B. Set up instructional equipment at predetermined instruction location.

3.2 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
   1. Architect/Engineer will furnish the designer to describe basis of system design, operational requirements, criteria, and regulatory requirements.
   2. Owner will furnish an instructor to describe Owner's operational philosophy.
   3. Owner will furnish Contractor with names and positions of participants.

C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
   1. Schedule training with Owner through Architect and/or Construction Manager with at least seven (7) days' advance notice.

D. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

3.3 DEMONSTRATION AND TRAINING VIDEOS

A. General: Record demonstration and training on video. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.
   1. At beginning of each training module, record each chart containing learning objective and lesson outline.

B. Format: Provide USB Thumb drive or high-quality DVD as preferred by the Owner.

C. Recording: Camera shall be mounted on a tripod during recording unless otherwise necessary to show area of demonstration and training. Display continuous running time.

D. Narration: Describe scenes on video by audio narration by microphone while recording or as necessary dubbing audio narration off-site after video is recorded. Include description of items being viewed. Describe vantage point, indicating location, direction (by compass point), and elevation or story of construction.

E. Transcript: Provide a typewritten transcript of the narration. Display images and running time captured from videotape opposite the corresponding narration segment.

F. Instruction and Training:
1. The instruction process must include real or simulated situations for hands on training.
2. Training program must be coordinated with Owner to establish goals, specific concerns, review program issues and analyze staff strengths and training logistics.
3. The training instructor must make recommendations concerning the optimum training program to address each level of needs from basic to advanced, to system administrator.
4. All training must be supported not only by the manufacturer's documentations, but by clear and concise training guides and customized for each customer for each system specified.
5. A complete user’s guide must be provided for each staff member attending training and one complete electronic file of this guide.
6. Training is based on 3 levels:
    a. Level 1: Teachers/staff.
    b. Level 2: Administrators/media personnel.
    c. Level 3: Technical staff.
7. Training procedure must be done for all levels for voice, video, data and must be submitted with shop drawing submittal for Owner's approval.

G. System Setup and Programming
1. Provide part of your shop drawing submittal a complete system setup as directed by Owner. Any changes that are needed for the first 2 years must be included in your bid. (Maximum reprogramming setup is 4 separate times).

END OF SECTION 27 01 11

SECTION 27 05 00 - COMMON WORK RESULTS FOR COMMUNICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. When equipment furnished for or by the Owner as indicated on the Drawings or specified, this Contractor shall make all connections to Owner furnished equipment. The Contractor shall verify exact requirements and locations before installation.

B. Support from bar joists shall be allowed only at panel points in top or bottom chords.
   1. Loading shall not exceed 5 lbs./S.F. or 100 lbs. per panel point applied at the panel point.
   2. If support must occur between panel points, then threaded rods shall be dropped from both panel points, an adequate angle attached to both, and then the support attached to the angle as required.
   3. Supports shall not be attached to or through steel roof decks.
   4. Supports shall not be attached to the ceiling grid.

C. Related Work Specified Elsewhere: Division 07 Penetration Fire Stopping and Fire-Resistive Joint Sealants.

D. The contractor shall seal and label ALL conduit sleeves pertaining to Divisions 27 and 28 above the ceiling after all the cabling is installed and tested with an approved sealant as required to match the rating of the assembly.

E. The Contractor shall take field measurements necessary for his Work, and shall be responsible for the accurate location and size of openings, recesses, slots, ferrules, and the like.

F. The Contractor shall be required to cooperate with "Other Trades" at the site and other Contractors in the coordination of his Work to avoid interferences with installations by other trades and Contractors.

G. Deviations from the Drawings, to avoid interferences, shall be considered a "Job Condition" and no additional compensation will be considered applicable. In the event that such interferences occur in course of the Work, due to an error, omission, or oversight by the Contractor, no additional compensation shall be allowed. Interferences which may occur during the course of construction shall be brought to the immediate attention of the Architect/Engineer, and the Architect/Engineer decision, confirmed in writing, shall be final.

H. Related work specified elsewhere: Communications sleeves

I. Related sections includes the following:
   1. Division 01 General Requirements.
   2. Division 26 Electrical
   3. Division 27 Communications
   4. Division 28 Electronic Safety and Security

1.3 REFERENCES

A. Work shall be in accordance with codes, rules, ordinances, regulations of authorities, bodies, associations, and governments, having proper and legal jurisdiction. Specifically, the following requirements shall be met in their entirety.
   1. State and Local Rules, Regulations, Codes, Statutes and Ordinances
   2. National Fire Protection Association - applicable requirements

3. National Board of Fire Protection
4. National Electric Code - applicable requirements
5. Other Codes and Standards as specifically noted in each Section of the Specifications

B. Electrical equipment shall be Underwriter's approved; also, shall meet requirements established by N.F.P.A., N.E.M.A., and A.N.S.I. and as specified hereinafter.

C. Abbreviation used in these Specifications:

N.E.C.	-	National Electric Code - Latest Edition adopted by the National Fire Protection Association
N.E.M.A.	-	National Electrical Manufacturers Association
I.P.C.E.A.	-	Insulated Power Cable Engineers Association
A.N.S.I.	-	American National Standards Institute, Inc.
F.C.C.	-	Federal Communications Commission
N.A.B.	-	National Association of Broadcasters
N.A.E.B.	-	National Association of Educational Broadcasters
I.T.L.	-	Independent Testing Laboratories
E.T.L.	-	Electrical Testing Laboratories
U.L.	-	Underwriters Laboratories
B.I.C.S.I.	-	Building Industry Consulting Service International
I.E.E.E.	-	The Institute of Electrical and Electronics Engineers, Inc.
T.I.A.	-	Telecommunications Industry Association
E.I.A.	-	Electronic Industries Association
R.C.D.D.	-	Registered Communication Distribution Designer
N.I.C.E.T	-	National Institute of Certification in Engineering Technologies

1.4 SUBMITTALS

A. Provide shop drawing submittals and illustrations in accordance with requirements of Division 01 Submittal Procedures unless otherwise noted.

B. Provide shop drawings for each section separately as follows:
1. Provide one electronic file submittal for each section.(do not mix sections together)
2. Provide an index with a complete material list in the Specification sequence.
3. Each Specification Section shall have its own material list.
4. Provide product cut sheet for each specified item in sequence.
5. Each manufacturer's product cut sheet shall be identified/marked or highlighted.

C. Provide a PDF of wiring diagrams and system layout drawings showing all devices, equipment, home runs, labeling, dB loss, etc. for each of the following systems:
1. Sound (weight room) systems

D. Partial shop drawings from one section WILL NOT BE ACCEPTABLE.

E. Submittals will be returned unchecked if they do not follow the outlines above.

1.5 CLOSEOUT DOCUMENTATION

A. Provide the following as part of the closeout documentation:

1. Provide certificate of warranty required in the Division 27 Specification sections.
2. Provide Operation and Maintenance manuals for the active electronic communications systems equipment. The Operation and Maintenance manuals shall consist of the following:
   a. Equipment spreadsheet indicating the equipment manufacturer's name, model number, serial number, and serial number.
   b. Operational procedures for all equipment installed.
   c. Wiring diagrams.
   d. License requirements including renewal dates.
3. Provide test results documentation.
   a. Printouts generated for all cabling indicating the final test results.
      1) When repairs and re-tests are performed, the problem(s) found, and the corrective action(s) taken shall be noted. Both failed and passed test results shall be documented.
4. Where indicated on the drawings and specifications, provide the spare items to the owner. As part of the closeout documentation the Contractor shall provide a spreadsheet indicating the quantity of these items and that these items that have been turned over to the Owner.
5. Provide the following training documentation:
   a. Sign-in sheet with the name of attendees and the completion date.
   b. Video recordings of the trainings in digital format if applicable.
6. Provide project record drawings to be included in the closeout documentation:
   a. Project record drawings shall be provided in .pdf format. Marked up drawings or scanned field working drawings are not acceptable.
   b. DWG files will be made available to the Contractor for use in completing the project record drawings for a nominal fee.
   c. Each drawing sheet of the record set is to be stamped "Project Record Drawing".
   d. The Contractor's RCDD overseeing the project must stamp and sign each technology record drawing sheet to confirm compliance with the documents.
   e. Notations and labels on the record drawings shall be typed. Handwritten notes are not acceptable.
   f. All deviations from the bid documents are to be noted. Indicate changes made by Addenda, Architect Supplemental Instructions (ASI), Change Orders, and Field Directives.
   g. All devices are to be shown in their approximate installed location and labeled with

the correct field designation.

h. The project record drawings shall indicate at a minimum the telecommunications rooms, telecommunications outlet labels, backbone cabling type and routing, backbone connector labeling, and communications systems wiring details.

B. Closeout documentation shall be submitted in electronic format (PDF).

1.6 QUALITY ASSURANCE

A. The cabling system components and equipment shall be listed by Underwriters Laboratories, Inc., and the components shall bear the UL label. The system shall be installed in accordance with requirements set by National Electric Code.

B. Installing Contractor shall have five years experience in cable installations.

C. Contractor shall submit a list of Jobs performed (minimum of five) in the past five years, equal to one specified herein. Also the contractor shall arrange a site visit of any job(s) selected by Architect/Engineer. The list shall include the following:
1. Job location, and date when it was completed.
2. Contact person at each job location.
3. Brief description of each job.

D. Contractor shall employ on their staff or have a contract with a Registered Communications Distribution Designer (RCDD) registered with the Building Industries Consulting Services International (BICSI).

E. Contractor shall submit the name, registration number, and seal of the RCDD on the contractors' staff as part of their shop drawing submittals.

F. The RCDD shall certify the final installation in writing and provide written verification that they have inspected the completed installation and that the installation meets the terms and conditions of this bid, design requirements of the BICSI TDMM (Latest edition), and all TIA/EIA, NFPA, NEC, and all local codes and specifications related to this work this letter shall be provided with the closeout paperwork.

G. All design documents, submittals, Project Record Drawings, test results, third party testing and other documentation provided by the Communications Contractor shall bear the name, registration number, and seal of the RCDD responsible for this Project.

H. Cabling systems installation shall be provided by the Contractor's own work forces. Any subcontractor agreements for any portion of the work specified herein must meet with approval of the A/E, Construction Manager and Owner. It is the intent of the contract to have one Contractor provides sole responsibility for material, labor and service for the systems.

I. The Audio Video Cabling Contractor shall have on staff a certified video technician/Engineer. The Video Cabling System shall be tested and certified under the direct supervision of the video engineer to meet all FCC requirements for leakage including, but not limited to, amplifiers, taps, couplers, splitters, connectors, and cabling.

J. The Data Contractor certification in the manufacturer's equipment he/she is installing and shall be an authorized reseller with factory trained staff on the system provided, and the contractor shall be certified to service and support the type of system with the specified requirements.

K. The Sound System Contractor shall have on-staff, qualified sound system engineers. The engineer shall test and certify the sound system installation.

1.7 TECHNOLOGY TERMS AND ABBREVIATIONS

A. Cable Pathway
   1. Shafts, conduits, surface mounted raceway, boxes, sleeves, floor boxes, cable tray, and floor penetrations that provide routing space for communications cabling.

B. Equipment Rooms (ER)
   1. An Equipment Room (ER) is a special-purpose room that provides space and maintains a suitable operating environment for communications and/or computer equipment.
   2. An Equipment Room (ER) may contain terminations, interconnections, and cross-connects for telecommunications distribution cables as well as other low voltage equipment such as fire alarm panels, video-audio distribution, security, and other building signaling and communication systems.

C. Main Cross-Connect (MC)
   1. The Main Cross-Connect (MC) is typically located with the Equipment Room (ER) and is the main cross-connect and interconnection point for first level backbone.

D. Telecommunications Rooms (TR)
   1. A Telecommunications Room is a space used to make connections from the first level backbone cabling from the MC to the horizontal cabling. TR's contain telecommunications equipment, control equipment, cable terminations, and cross connect wiring.

E. Entrance Facility (EF)
   1. An Entrance Facility (EF) is a space within a building for both public and private network service cables to be terminated, protected and spliced to an indoor rated cable. This space may be in the MC or ER.

1.8 PRECEDENCE

A. Contractors shall review both Drawings and Schedules of Communications Systems for any discrepancy.

B. If there is a discrepancy in the number of rooms and quantities between the Drawings and the Schedules, the Contractor shall include the higher of the two quantities.

C. If the products specified are no longer available, Contractor shall provide replacement products that meet or exceed performance specifications of the original specified model at no cost to the Project.

D. If the Contractor bids products that do not meet or exceed the performance specifications or the original specified model, the Contractor shall provide products that meet the performance specifications as approved by the Architect/Engineer at no cost to the project.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXPLANATION AND PRECEDENCE OF DRAWINGS

A. For purposes of clarity and legibility, the Telecommunication "T" drawings are essentially diagrammatic and, although size and location of equipment are closely drawn to scale whenever possible, Contractor shall make use of the data in all of the Contract Documents and shall verify this information at the building site.

B. The Drawings indicate required size and points of termination of wiring and other related items and may suggest proper routes for such items to conform to structure, avoid obstructions and preserve clearances. It is not intended that Drawings indicate every necessary offset. It shall

be the Work of the Contractor to install each item in a manner to conform to structure, avoid obstructions, preserve headroom, and keep opening and passageways clear.

C. It is intended that apparatus be located in coordination with architectural elements, and shall be installed at exact height and location stipulated.

D. Contractor shall fully inform himself regarding peculiarities and limitations of the spaces available for the installation of work and materials provided under his Contract.

E. Contractor shall carefully examine existing conditions, existing wiring and other materials on the premises and compare the documents with the existing conditions. Variances and necessary changes shall be adjusted by appropriate modifications.

F. Contractor shall carefully examine the Division 26 drawings for scope requirements, pathway, sleeves, grounding, etc.

3.2 PERMITS, FEES, REGULATIONS, INSPECTIONS

A. Contractor shall arrange and pay for permits, fees, and inspections required in connection with his work for this project, from local, county, state and public agencies, and shall obtain permits from railroad, state highway and utility companies.

B. Work shall be inspected by approved local and state inspection bureaus, Electrical Inspection Agency, and/or authority, and local utilities.

C. Upon completion of the Work, the Contractor shall furnish to the Architect/Engineer, a certification of inspection and approval from said Bureau or Agency before final payment on contract will be allowed.

D. Contractor shall verify the right of way with all local and state agencies.

3.3 HOISTS, RIGGING, TRANSPORTATION, AND SCAFFOLDING

A. Contractor shall provide scaffolding, staging, cribbing, tackle, hoists, and rigging necessary for placing of his materials and equipment in their proper places in the Project.

B. Contractor shall pay costs for transportation of materials and equipment to the job site and shall include such costs in his proposal.

C. Scaffolding and hoisting equipment shall comply with requirements of pertinent Federal, State, and Local Laws and Codes.

3.4 PROTECTION

A. In addition to other requirements of the Contract, the Contractor shall provide various types of protection as follows:
   1. Protect finished floors and countertops during installation, etc.
   2. Protect equipment, finished surfaces from paint droppings, insulation adhesive, and sizing droppings by use of drop cloths.
   3. Protect countertops during cutting for grommets.
   4. Protect closet electronics and equipment, video projectors, televisions, DVD, television studio, switches, sound system, clocks, access control, IP cameras, etc. from dirt and dust.

B. Contractor shall be responsible for the protection of finished work from other trades from damage or defacement by his operations and shall remedy such damage at his own expense.

3.5 CUTTING AND PATCHING

A. Contractor shall do his own cutting and patching of building materials and piping, as required for the installation of his Work, but no structural members shall be cut without the approval of the Architect and such cutting shall be done in a manner directed by the Architect.

B. Patching of and repair of damage to Work in place shall be done in a neat and workmanlike manner, meeting with the approval of the Architect. Contractor whose operations require cutting of work in place, or who causes damage which entails repairs of such work, shall employ mechanics of the particular trade whose work must be cut or which is damaged, and shall pay the costs of such patching or repair.

3.6 SLEEVES

A. The contractor shall examine the technology and electrical drawings for sleeve locations, and shall verify the locations, size and quantity with the General and Electrical contractors.

B. The contractor shall be responsible for any additional sleeves and cores should they be required.

C. NO change order shall be issued to provide sleeves in addition to those provided under the electrical contract.

3.7 FINAL COMPLETION

A. Communication installation shall be cleaned prior to Substantial Completion of the Work.

B. Retouch or repaint factory painted prime and finish coats, where scratched or damaged. Whenever retouching will not be satisfactory, the Architect/Engineer may require complete repainting until the desired appearance is obtained.

C. Contractor shall clean equipment; restore damaged materials; remove grease, oil, chemical, paint spots, and stains; and generally leave the Work in A-1 condition.

D. Contractor and his subcontractors, on completion of his Work, shall remove tools, equipment, surplus materials, and rubbish pertaining to his operations, and pay costs for such removal and disposal from the site.

3.8 GUARANTEE AND WARRANTY

A. Contractor shall submit written certificates warranting that each item of equipment furnished complies with the requirements of the Drawings and Specifications.

3.9 SUPERVISION AND COOPERATION

A. Work by the Contractor under this Division shall include the services of an experienced superintendent, who shall be constantly in charge of the Work, together with the qualified journeymen, helpers, and laborers required to properly unload, install, connect, adjust, start, operate, and test the Work involved, including related equipment and materials furnished under other contracts or by the Owner.

3.10 COLOR CHART

A. All voice, video, and data cables and connectors to have the following colors unless otherwise noted on the prints:

Description Item	Jack	Cable	**Patch Cables**	I.D.	Notes

Data/Computer	Blue	Blue	Blue	C	4 Pair Cable
Wireless Access point	Green	Green	Green	WAP	4 Pair Cable
Composite Video	Yellow	Black	Black	V	Coax Cable
AV Control Cable	Gray	Gray	Gray	L	4 Pair Cable
Video Projector	-	Gray	Gray	VP	4 Pair Cable
Audio – Right	Red	-		AR	4 Pair Cable/RCA
Audio – Left	White	-		AL	4 Pair Cable/RCA
Composite Video	Yellow	-		CV	4 Pair Cable/RCA
Fiber – Multi-mode	Black	Aqua	Aqua	FO	6/12/24/36
Fiber – Single-mode	Ivory	Yellow	Yellow	FO	6/12
Sound System	-	Green		SS	Multi-conductors
Intercom	-	White		IS	Multi-Conductors
CCTV – IP	White	White	White	CCTV	4 pair cable
Coax	-	Black/White	Black	CTV	RG-59
VGA	-	Black/White	Black/Gray	VGA	14 conductor
HDMI	Black	Red	Red or Black	HDMI	4 Pair cable or HDMI cable

3.11 COMMUNICATIONS SYSTEMS DEMOLITION

A. Cabling Contractor shall remove the following:
   1. All existing wall mounted monitors and mounts
   2. All cabinets/racks, etc.
   3. All sound system equipment (PA system to remain as noted on drawings)
   4. All sound system cabling

B. Coordinate demolition and removal of communication equipment with the Owner.

3.12 MATERIAL LIST

A. Contractors shall provide with their bids <u>complete</u> materials list on THEIR LETTER HEAD showing manufacturers name, catalog numbers, description, and quantities for each item in each system, per section number as follows:
   1. Manufacturers Name.
   2. Manufacturer's catalog number.
   3. Quantities.
   4. Bonds.
   5. Training.

6. Project managements.
7. Shop drawings.
8. Close out.
9. Warranties.
10. Allowance.

B. The lowest responsible bidders shall provide unit pricing for all materials as described in Part "A" above, within 24 hours with NO exceptions.

C. If a subcontractor is utilized for any portion of the work, all contact information, references, material list, and any other information shall be provided per the specified contract bid requirements.

D. If the above requirements are NOT provided, then the contractor is considered a non-responsive bidder subject to disqualification.

END OF SECTION 27 05 00

SECTION 27 05 26 - GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General [and Supplementary Conditions] and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes methods and materials for grounding system for communications equipment:
   1. Grounding conductors
   2. Comm rooms busbar
   3. Grounding connectors

B. Related section includes the following:
   1. Division 01 General Requirements
   2. Division 26 Electrical
   3. Division 27 Communications
   4. Division 28 Electronic Safety and Security

1.3 DESCRIPTION OF WORK

A. Provide a communications grounding and bonding system throughout the building including to all comm equipment cabinets and racks.

B. Bond the following items within the telecommunications grounding system:

1. All communications system active equipment.

2. All surge protection equipment.

3. Metallic raceway systems, including metallic cable trays and ladder racks.

4. Communications equipment enclosures (cabinets) or cross-connect frames.

5. Metallic cable screens, armor or shields.

7. Wall and rack mounted grounding/bonding busbars.

C. All metal equipment cabinets/racks, cable shields (copper & armored fiber), strength members, ladder racks, cable trays, conduits, and the like entering or residing in the IDF shall be grounded to the appropriate SBB
using a minimum 6AWG stranded copper bonding conductor and two-hole compression connectors.

D. Provide primary and secondary bonding bus bars in each TR and MC/ER.

1.4 QUALITY ASSURANCE

A. The Grounding and Bonding for Communications Systems components and equipment shall be listed by Underwriters Laboratories, Inc., and the components shall bear the UL label.

B. The Grounding and Bonding for Communications Systems shall be installed in accordance with all requirements set by all applicable standards, codes, and regulations including but not limited to the standards referenced in Section 270500 – Common Work Results for Communications.

C. The grounding system installation shall comply with the latest BICSI (TDMM) standards.

D. Installer shall employ or have a contract with a Registered Communications Distribution Designer (RCDD) registered with the Building Industries Consulting Services International (BICSI).

E. Installer must have personnel certified by BICSI on staff.

1. Installation Supervision: Installation shall be under the direct supervision of ITS Technician

2. Field Inspector: Currently registered by BICSI as an RCDD to perform the on-site inspection.

F. Equipment shall be provided with a suitable ground bus in the telecommunication rooms.

1.5 DEFINITIONS (as of TIA-607-C updates)

A. PBB (Primary Bonding Busbar) formerly known as TMGB: Telecommunication main grounding bus bar.

B. SBB (Secondary Bonding Busbar) formerly known as TGB: Telecommunication grounding bus bar.

C. TBC: Telecommunication bonding Conductor.

D. RBB: Rack Bonding Busbar

E. ACEG: Alternating current equipment ground.

F. TBBIBC: Telecommunication bonding backbone interconnecting bonding conductor.

G. NRTL: Nationally recognized testing laboratory.

1.6 WARRANTY

A. All components, parts, and assemblies of the Grounding and Bonding for Communications Systems supplied by the installer shall be guaranteed against defects in materials and workmanship for a period of 2 years by the manufacturer and installer.

B. Warranties shall include all labor, material, travel expenses, test equipment, equipment rental and any other expense required to troubleshoot, remove, repair or replace equipment or components to bring the system up to the original performance criteria and operation.

C. Warranty services shall be provided by an installer certified by the equipment manufacturer during normal business hours.

D. Provide warranty certificate as part of the closeout documentation..

1.7 TRAINING

A. Refer to Section 270500 – Common Work Results for Communications for more information.

B. B. Provide two (2) training hours for the Grounding and Bonding for Communications Systems as specified in the 27 01 11 section titled "Demonstration, Training and Warranty of Communications Systems".

PART 2 - PRODUCTS

2.1 TELECOMMUNICATIONS BONDING BACKBONE (TBB)

A. The telecommunications bonding backbone shall provide a conductor that interconnects the PBB in the MDF to the SBB in each IDF.

B. The telecommunications bonding backbone shall reduce or equalize potential differences between telecommunications systems. While the telecommunications bonding backbone will carry some current under AC power ground fault conditions, it is not intended to provide the only ground fault path.

C. The telecommunications bonding backbone shall be bare or insulated copper, of minimum conductor size #6 AWG and sized at 2 kcmil per linear foot up to a maximum size of 750 kcmil.

D. TBB conductor size vs. length:

TBB Linear Length	TBB size (AWG)
Less than 13’	6
14’-20’	4
21’-26’	3
27’-33’	2
34’-41’	1
42’-52’	1/O
53’-66’	2/O
67’-84’	3/O
85’-105’	4/O
106’-125’	250kcmil
126’-150’	300kcmil
151’-175’	350kcmil
176’-250’	500kcmil
251’-300’	600kcmil
Greater than 301’	750kcmil

E. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

F. Where un-insulated, to be identified with green tape at termination location.

2.2 Telecommunications Equipment Bonding Conductor (TEBC)

A. The copper bonding conductor shall be bare or insulated copper.

B. The copper grounding conductor shall be #6 AWG minimum from each rack/cabinet grounding bar to the telecom bonding bus bar.

C. The copper grounding conductor shall be marked by distinctive green color.

D. TEBCs that are routed on a cable tray bend radius shall not be less than 200mm & 90 degrees minimum

E. TEBC conductor size vs. length:

TEBC Linear Length	TEBC size (AWG)
Less than 13’	6
14’-20’	4
21’-26’	3
27’-33’	2
34’-41’	1
42’-52’	1/O
53’-66’	2/O
67’-84’	3/O

2.3 Primary Bonding Bus Bar (PBB)

A. Provide the Primary Bonding Bus Bar in the MC/ER. The PBB is the main ground to which all TGBs in TRs, equipment, conduits, cable shields, cable trays, sleeves, etc. shall be bonded. The PBB shall be connected to the main electrical service ground of the building with a minimum conductor size 2 AWG. A larger conductor size may be required based on the distance between the PBB and the main electrical ground. The PBB shall also be bonded to building structural steel.

B. The PBB shall be .25 inch thick, 4 inches wide, and 12 inches in length.

C. The PBB shall be predrilled copper bus bar with standard NEMA bolt hole sizing and spacing for the type of connectors to be used.

D. Approved Manufacturers:
1. nVent Erico TMGBA12L15P with B548A41 mounting kit.
2. Harger TGBI14412TMGBKT
3. Panduit GB4B0612TPI-1
4. Hubbell HBBB14412

2.4 Secondary Bonding Bus Bar (SBB)

A. Provide a SBB in each of the telecommunication rooms (TR’s). Every TR shall have an SBB installed to which all equipment, conduits, cable shields, cable trays, sleeves, etc. shall be bonded. The SBB shall be connected to the PBB with a minimum conductor size 6AWG. A larger conductor size may be required based on the distance between the PBB and the SBB. This conductor shall be continuous. The SBB shall also be bonded to building structure if close and accessible.

B. The TGB shall be .25 inch thick, 2 inches wide, and 12 inches in length.

C. The TGB shall have predrilled copper bus bar with standard NEMA bolt hole sizing and spacing for the type of connectors to be used.

D. Approved Manufacturers:
1. nVent Erico TGBA12L06P
2. Harger TGBI14212TGB
3. Panduit GB2B0306TPI-1
4. Hubbell HBBB14212TP

2.5 Two-Hole Compression Lug

A. Provide two-hole lug that is UL Listed as wire connector

B. Compression Lugs shall be manufactured from electroplated tinned copper.

C. Compression Lug shall be sized to fit the installed size conductor.

D. Approved Manufacturers:
   1. Panduit LCC6-14 EDW-L series
   2. Harger GECLB62C
   3. Thomas & Betts 54852BEPH

2.6 Equipment Ground Jumper Kit

A. Kit includes one 24" L insulated ground jumper with a straight two-hole compression lug on one end and an L-shaped two-hole compression lug on the other end, two plated installation screws, an abrasive pad and a .5 once tube of antioxidant joint compound.

B. Ground conductor is an insulated green/yellow stripe #6 AWG wire.

C. Lugs are made from electroplated tinned copper and have two mounting holes spaces .5" to .625" apart that accept 1/4" screws.

D. Jumper will be made with UL Listed components

2.7 C-Type, Compression Taps

A. Compression taps shall be manufactured from copper alloy.

B. Compression taps shall be C-shaped connectors that wrap around two conductors forming an irreversible splice around the conductors; installation requires a hydraulic crimping tool.

C. Compression taps shall be sized to fit specific size conductors, sizes #2 AWG to 4/0, as stated below.

D. Compression taps shall be UL Listed.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The bonding conductor shall be a continuous wire and carried throughout the grounding system.

B. Each telecommunication bonding conductor shall be labeled, per J-STD-607A.

C. Bond metallic conduit entering communications handhole and building service rooms (Demarc).

D. Provide a grounding conductor from the main electrical ground bus at the service entrance to each telecommunication room or /and as shown on the drawings.

E. Provide continuous grounding conductor in the cable tray, see grounding detail for more information.

3.2 GROUNDING AND BONDING

A. All systems installed under these contracts shall comply fully with TIA/EIA 607-A and the BICSI TDMM Latest Edition as they relate with bonding and grounding systems.

B. All bonding conductors and connectors shall be listed for the purpose intended and approved by a Nationally Recognized Testing Laboratory (NRTL).

C. All bonding conductors shall be insulated and copper.

D. Bonding conductors should not be placed in ferrous metallic conduit. If it is necessary to place bonding conductors in ferrous metallic conduit of any length (conduit sleeves etc), provide

grounding bushing at each end of the conduit and bond the grounding conductor to the bushing at each end of the conduit with a conductor sized as a No. 6 AWG, minimum and then ground these conduit sleeves to the cable tray at each side of the wall.

E. Labels, Color-Coding, and Markings
1. Each telecommunications bonding conductor and bus bar shall be labeled.

2. Labels shall be located where they are easily visible and have the name of what busbar it is. For example, to comply with standard requirements, the SBB identifier must include a unique number or designation followed by SBB. Either sequential numbering or another unique number can be used, as follows:
• Labels in a sequential numbering method are 1-TGB (or A-TGB), 2-TGB (or B-TGB), and so on.
• Alternately, the number of the room in which the TGBs are installed can be used. For example, if the TGBs are installed in rooms 1A, 2B, and 3C, they are labeled 1A-TGB, 2B-TGB, and 3C-TGB.
3. Labels shall be located on conductors as close as practicable (i.e., ease of access to read the label) to their point of termination and describe point of origin and destination. Telecommunication equipment bonding conductors (TEBCs) are used to connect the PBB or SBB to equipment racks and cabinets. For this example, in Room 2B that contains a SBB identified as 2B-SBB and the fourth rack or cabinet in the row is identified as R201.4, the TEBC would be identified as 2B-SBB/R201.4.
4. Labels shall be nonmetallic.
5. Each telecommunications bonding conductor shall be marked appropriately by a distinctive green color.

3.3 BONDING CONDUCTOR FOR TELECOMMUNICATIONS

A. Bonding to the service equipment (power) ground:
1. The bonding conductor for telecommunications shall bond the PBB to the service equipment (power) ground.

B. Sizing the bonding conductor for telecommunications:
1. The bonding conductor for telecommunications shall be, as a minimum, the same size as the TBB.

2. As a general rule, the following process could be applied:
• Determine the size of the GEC for the main electrical service entrance.
• Increase the size of the bonding conductor one trade size (e.g., 4 AWG [5.2 mm (0.20 in)] to 3 AWG [5.8 mm (0.23in)]) for every 30 m (100 ft) of travel over 30 m (100 ft).

3.4 THE TELECOMMUNICATIONS BONDING BACKBONE (TBB)

A. The TBB is a conductor that extends throughout the building using telecom backbone pathways, and interconnects all SBB's with the PBB. The TBB's basic function is to reduce or equalize potential differences between telecommunications systems bonded to it. The TBB is not intended to serve as the only conductor providing a ground fault current return path.

B. Description of the TBB:
1. The interior water piping system of the building shall not be used as a TBB.
2. The metallic cable shield shall not be used as a TBB.

C. The TBB shall be a minimum size No. 6 AWG insulated copper conductor. The TBB shall be connected to the PBB as specified above.

D. TBB conductors shall be installed and protected from physical and mechanical damage.

E. TBB conductors should be installed without splices, where practicable. Where splices are necessary they should be minimum and shall be accessible and located in telecommunications spaces. Joined segments of a TBB shall be connected using irreversible compression-type

connectors, exothermic welding, or equivalent. All joints shall be adequately supported and protected from damage.

3.4 TESTING

A. Perform the following field quality control testing:
   1. After installing grounding system but before permanent electrical circuitry has been energized, test for compliance with the following requirements.
   2. Test completed grounding system at each telecommunications bus bar is located. Measure ground resistance not less than two full days after the last trace of precipitation, and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests, by fall-of-potential method according to IEEE 81.
   3. Provide drawings locating each grounding bus bar and ground attachment location. Describe measures taken to improve test results. Test results shall comply with the following minimum requirements.
      a. Equipment Rated 500 kVA and Less: 10 ohms.
      b. Manhole Grounds: 10 ohms.
   4. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify A/E promptly and include recommendations to reduce ground resistance.

END OF SECTION 27 05 26

SECTION 27 05 28 - PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes, but is not limited to, the pathways for communications systems:
   1. Cable supports
   2. Sleeves
   3. Cable ties
   4. Innerduct
   5. Warning tape

B. Related Sections includes the following:
   1. Division 01 General Requirements
   2. Division 26 Electrical
   3. Division 27 Communications
   4. Division 28 Electronic Safety and Security

1.3 DESCRIPTION OF WORK

A. Provide supports, cable ties, conduits, sleeves etc and all related equipment for the pathways for communications cabling as described herein and shown on the drawings.

1.4 QUALITY ASSURANCE

A. Materials shall be new, complete with manufacturer's guarantee or warranty, and shall be approved by the Underwriters' Laboratories, Inc.

B. Materials shall also comply with applicable standards of the National Electrical Manufacturers' Association, Insulated Power Cable Engineers Association, National Safety Code, and the American Institute of Electrical Engineers.

C. Work shall be executed in a workmanlike manner and shall present a neat mechanical appearance when completed. Methods and techniques of installation shall be subject to the approval of the Architect.

D. Materials of the same type or class shall be the product of the same manufacturer.

E. Installer shall employ or have a contract with a Registered Communications Distribution Designer (RCDD) registered with the Building Industries Consulting Services International (BICSI).

F. Installer must have personnel certified by BICSI on staff.

   1. Installation Supervision: Installation shall be under the direct supervision of ITS Technician

2. Field Inspector: Currently registered by BICSI as an RCDD to perform the on-site inspection.

1.5 PROJECT CONDITIONS

A. Contractor shall be responsible for the accurate location of their Work and for informing themselves of the nature and arrangement of the materials, equipment, and construction to which their Work attaches or passes through.

B. In general, work shall be concealed in walls in conduit and above ceilings in wire management system, conduit in chases, in equipment rooms so that such work will not interfere with the proper coordinated installation work of other trades or Contractors.

C. In general, wiring, and conduit shall be installed parallel (or at right angles) to the building walls, and at such heights as not to obstruct portions of windows, doorways, stairways, pipe space, tunnel, or passageway, and properly concealed to not interfere with the proper coordinated installation of other trades or Contractors. Where interferences develop in the field, the Work shall be offset or routed as required to clear such interferences. Consult Electrical Technology Drawings, Contractors, and other details before installing work.

D. Contractor shall procure definite locations and connections before rough-in or installation. The contractor shall then lay out the Work and be responsible for determining proper elevations, obliquity, acclivity, measurements, and locations required for the installation.

1.6 WARRANTY

A. Provide warranty as specified in the 27 01 11 section titled "Demonstration, Training and Warranty of Communications Systems.

1.7 TRAINING

A. Provide training as specified in the 27 01 11 section titled "Demonstration, Training and Warranty of Communications Systems.

PART 2 - PRODUCTS

2.1 **Approved Cable Support Manufacturers:** Eaton, ICC, nVent, Panduit

Approved Cable Tie Manufacturers: Hubbell, Leviton, Panduit

Approved Velcro Hook and Loop (Velcro) Manufacturers: Hubbell, Leviton, Panduit

Approved Indoor Plenum Innerduct: Carlon, Eastern, Endot, Pyramid Industries

Approved Outdoor Fabric Innerduct: MaxCell, Milliken

2.2 CABLE SUPPORTS

A. Provide adjustable cable support that meets UL, NEC and TIA/EIA requirements for structured cabling systems.

B. Provide wide base cable support that meets UL, NEC, and TIA/EIA requirements for structured cabling system.

C. The cable support system shall provide support for various types of low voltage cables such as Category 3, 5E, 6 and 6A UTP cables in addition to fiber optic cable, innerduct, multi-pair backbone cables, coaxial cables, intercom, security and sound system cables.

D. The support system shall attach to the building structural elements or be wall mounted.

E. The supports shall be made of fire retardant, low smoke emission products, which meet UL 2034 requirements for air plenum spaces.

F. The support products shall have a minimum of a 1 inch wide platform for the cable to rest.

G. Individual supports shall be installed at intervals not greater than 60 inches.

H. Cable sag between supports shall not exceed 12 inches. Sagging cables shall not touch the ceiling grid or tiles.

I. Cable supports shall be installed a minimum of 6 inches above lay-in ceiling system.

J. Minimum clearances from sources of EMI and RFI must be adhered to as specified in TIA/EIA-568B, TIA/EIA-569 and the latest version of the BICSI TDMM.

2.3 SLEEVES

A. The conduit sleeves indicated on the drawings shall be provided under Division 26. Where additional sleeves are required, this contractor shall provide conduit sleeves that meet the specified requirements.

B. Provide a minimum of two (2) four (4) inch sleeves between floors with plastic bushings at each end.

C. Provide four (4) four (4) inch sleeves from the corridor cable tray to the TR/MC/ER cable tray with plastic bushings at each end.

D. Provide a minimum of three (3) four (4) inch sleeves (unless otherwise noted) in the corridor between cable trays when the cable tray passes thru wall separations with doors with plastic bushings at each end.

E. Provide a minimum of two (2) two (2) inch sleeve with plastic bushing at each end from the corridor cable tray to each room, install sleeve above the door. One 2” sleeve is for sound, access, intrusion detection, fire and BAS cables and the other is for Horizontal Comm cables.

F. Firestop all sleeves inside and out.

2.4 CABLE TIES

A. Provide plenum rated cable ties for cables installed above ceilings.

B. Cable ties shall meet UL 94V-O.

C. Color shall be maroon.

D. Provide one bag of 100 cable ties to the owner.

2.5 CABLE HOOK AND LOOP FASTENERS

A. Provide cable hook and loop fasteners to secure cable bundle to communication equipment cabinet and racks.

B. Hook and loop fasteners may be used above ceilings if they are plenum rated.

C. UL listed.

D. Color shall be maroon.

E. Provide one bag of 100 units to the owner.

2.6 INNDERDUCT (INDOOR)

A. Provide 1.0 inch I.D. minimum plenum rated orange corrugated innerduct above ceiling for all non-armored fiber.

B. Innerduct shall be UL listed.

2.7 INNERDUCT (OUTDOOR)

A. Provide multi-cell, detectable fabric innerduct in site conduits as shown on the drawing.

B. Innerduct shall be UL listed.

C. Sewn-in 18AWG TFN solid copper wire suitable for direct wired toning equipment and above ground handheld locators

D. Features color coded, pre-installed 1250LB pull tape in each cell for 3" and 4" MaxCell. 1.25", 1.75" and 2" MaxCell have pre-installed 1250LB VisT Glide Rope in each cell.

2.8 UNDERGROUND WARNING TAPE

A. Description: Permanent, bright-colored, continuous-printed polyethylene tape.
1. Not less than 6 inches wide by 4 mils thick.
2. Compounded for permanent direct-burial service
3. Print legend shall indicate type of underground lines.

PART 3 - EXECUTION

3.1 SITE PREPARATION

A. Contractor shall do excavating of materials encountered, including backfilling necessary for the installation of underground wiring and equipment in his Contract. Provide and maintain bracing, shoring, or sheathing necessary to support the walls of excavations.

B. Trenches shall be opened in straight lines and bottomed out at least 4 inches below conduit or ducts. Exterior trenches shall have a minimum depth of 36 inches which shall be maintained between top of largest conduit or duct and finish grade.

C. Where roots of live trees are encountered in excavations, they shall be carefully protected during construction. Contractor shall cut or remove interfering trees, remove stumps, and rocks in the line of the excavation; however, approval of the Architect shall be obtained before a tree is removed or cut. Shrubbery in line of excavation shall be removed with a ball of dirt and replaced at completion of installation.

D. Where excavation is necessary in existing pavements, Contractors for whose work the excavation is required shall pay fees and costs of opening street or pavement and costs of filling and repaving in accordance with requirements of and to the satisfaction of the Municipality, Utility, or other Owners of such paving.

E. Where existing sidewalks, drives, and roadways must be cut, they shall be cut in straight lines, and shall present a neat appearance when re-laid and shall match existing work. At such locations the backfill medium shall be concrete from the bottom of the finished surface to the bottom of the trench except as may be otherwise approved by the Architect/Engineer.

F. Where excavation is necessary in an existing lawn, carefully remove and restore sod. After backfilling trench, replace sod or apply top dressing of black dirt and seed to match existing lawn. Care shall be exercised during the work to see that no unnecessary damage is done to lawns in the storing of dirt or other construction material. Should unnecessary damage occur, in

the opinion of the Architect, the Contractor shall be required to recondition lawns at his own expense.

G. In addition, the Contractor shall provide and maintain warning barricades, flags, and warning lights, and shall conduct his work so as to create a minimum amount of inconvenience to others, traffic, construction, and the like. Temporary suspension of work does not relieve the Contractor of responsibility for the above requirements.

H. Remove and legally dispose of debris, rubbish, and excavation spoils resulting from the Work.

I. This Contractor shall “after one year” return to the jobsite and fill all trenches that have settled.

3.2 INSTALLATION

A. Materials installed under this Division of Work shall be supported from the building structure, independent of other pipe, duct, equipment, ceiling grid, etc.

B. Cabling shall be supported by cable supports that meet BICSI, EIA, TIA requirements. These include J-Hooks, cable tray, basket tray or conduit. Cables shall not lie on or be supported directly on the building structural steel, tops of masonry walls, ceiling grid, ceiling supports, mechanical piping etc.

C. Cable supports shall be independently supported from wires, rods or be independently secured to structure using approved anchors. In above ceiling applications these wires or rods shall be visually distinguishable, independent of the ceiling grid supports and be affixed at both ends to minimize movement.

D. Cables in exposed ceiling areas such as auditorium, gymnasium, mechanical rooms, boiler rooms, chiller rooms, art rooms, classrooms, locker rooms, corridors, etc. shall be installed in conduit from the device to the nearest accessible lay-in ceiling or the nearest telecommunication room. Refer to the Division 26 drawings for conduit being provided. The contractor shall coordinate the conduit routing with the Division 26 contractor to minimize the cable distances.

E. Sound system cables in exposed ceiling areas, such as the auditorium, gymnasium, student dining, locker rooms etc. shall be installed in conduit from the device to the area sound system cabinet. Refer to the Division 26 drawings for conduit being provided. The contractor shall coordinate the conduit routing with the Division 26 contractor to minimize the cable distances.

F. Install underground warning tape 12 inches above the conduit in the trench.

G. Install jacks, fitting, and connectors in properly selected outlet boxes and junction boxes.

H. Cover and protect equipment, materials, enclosures, boxes, cabinets, racks, before and after to prevent the entrance of grit, dirt, and foreign matter. The contractor shall clean all equipment and racks or cabinets prior to final acceptance.

I. Outdoor minimum separations from possible EMI exceeding 5KVA shall be 24 inches for power in nonmetallic pathways and 12 inches for power in grounded metal pathways.(Per table 3.1 in BISCI TDMM)

END OF SECTION 27 05 28

SECTION 27 05 53 - IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Condition and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the identifications for communications systems:
   1. Self-laminating wrap around labels
   2. Equipment cabinet/rack labels

B. Related Sections includes the following:
   1. Division 01 General Requirements
   2. Division 27 Communications
   3. Division 28 Electronic Safety and Security

1.3 DESCRIPTION OF WORK

A. Provide identifications for communications and security systems as described herein and/or shown on the drawings.

1.4 SUBMITTALS

A. Comply with requirements of the submittal 270500 section of the Specifications.

1.5 QUALITY ASSURANCE

A. Materials shall be new, complete with manufacturer's guarantee or warranty, and shall be approved by the Underwriters' Laboratories, Inc.

B. Materials shall also comply with applicable standards of the National Electrical Manufacturers' Association, Insulated Power Cable Engineers Association, National Safety Code, and the American Institute of Electrical Engineers.

C. Work shall be executed in a workmanlike manner and shall present a neat mechanical appearance when completed. Methods and techniques of installation shall be subject to the approval of the Architect.

D. Materials of the same type or class shall be the product of one manufacturer.

E. Provide labeling per ANSI/EIA/TIA-606 requirement and in accordance with the Owner and Technology Consultant.

1.6 PROJECT CONDITIONS

A. Contractor shall be responsible for the accurate location of his work and for informing himself of the nature and arrangement of the materials, equipment, and construction to which his work attaches or passes through.

B. In general, label all communication cables, equipment, cabinets, patch cord, data jacks, video jacks, cover plate, telecommunication rooms, video equipment, telephone system, etc.

PART 2 - PRODUCTS

2.1 SELF-LAMINATING LABELS

A. Provide self-laminating labels on all communications cabling, faceplates, patch panels and equipment to meet TIA/EIA-606-A.

B. All labels shall be typed and printed. Handwritten labels will not be accepted.

C. Labeling shall be per Class 2 and/or Class 3 requirements.

D. Approved Manufacturers:
1. Panduit
2. Brady
3. Brother
4. Dymo

2.2 EQUIPMENT CABINETS/RACKS IDENTIFICATION LABELS

A. Provide engraved, laminated acrylic label showing closet name and cabinet/rack number.

B. Secure to equipment with screws.

C. Label shall be white letters on a black background.

D. Minimum letter height shall be 1/2-inch.

PART 3 - EXECUTION

3.1 IDENTIFICATION

A. Equipment Identification:
1. Provide nameplates on equipment such as Telecommunication Rooms (TR), Main Cross Connect/Equipment Room (MC/ER), patch panels, CPU, and the like.
2. Lettering shall include name of equipment, the specific unit number, and other instructions that are applicable.
3. Nameplates shall be laminated phenolic with a black surface and white core. Use 1/16-inch-thick material for plates up to 2 inches by 4 inches. For larger sizes use 1/8-inch-thick material. Lettering of names should correspond to nomenclature specified for apparatus, corresponding with the Drawings, details, schedules, charts, wiring diagrams, and operating instructions, as approved by the Architect/Engineer.
4. Lettering shall be condensed Gothic. The space between lines shall be equal to the width of the letters. Use 1/4-inch minimum height letters which occupy four to the inch. Increase letter size to 3/4 inch on largest plates.
5. Attached directly to the apparatus in a manner approved by the Architect/Engineer.

B. Labeling
1. Label each cable (voice, video and data), video outlet, telephone and data jack at each patch panel and jack outlet clearly, neatly, and completely, including "Spares." Labels shall not be subject to moisture or fading, shall be self-adhesive and must be typewritten. Type room label above patch panel port location to allow end user ease in identification of patch panel locations. Patch panels shall be labeled with a large 1/2-inch letter to designate patch panel I.D. (A-Z). This letter will correspond to the faceplate labeling at the station faceplate. (Example: TR-B1.1 A22 where the closet “TR-B1.1” and the patch panel port “A22” number are both identified)
2. Use the following format to identify plate/connectors:
    a. Individual jack designations shall begin at the main entry point of a room or space and continue in a clockwise rotation. The following labeling codes shall be used:
        1) C – communication
        2) V – video

3) L - video control
4) A - audio (left-white, right-red)
5) I – input
6) O – output
7) AI - audio input, AL – audio left, AR – audio right
8) AO - audio output
9) VI - video input
10) VO - video output
11) VP – video projector
12) IWB – Interactive white board
13) FO – fiber optic
14) F – coax cable
15) S – security
16) DC – door contact
17) PT – power transfer
18) MD – motion detectors
19) REQ – required for exit
20) SS – sound system
21) WAP – wireless access points
22) CAM - camera
23)

3. The PBB (Primary Bonding Busbar or TMGB), all SBB (Secondary Bonding Busbar or TGB) and all conductors connected to the PBB and all SBBs should be labeled.
4. These include:
   a. • Telecommunications Bonding Conductor (TBC)
   b. • Rack Bonding Busbar (RBB).
   c. • Conductors to the cable tray, incoming equipment, GEC or building steel.
   d. • Backbone Bonding Conductor (BBC)
5. When labeling the PBB, a SBB, or conductors (e.g., RBB) that begin and end within the
6. same space, the label may omit location information as personnel working in the location.
7. would already have this information. In most installations, there should be only one Grounding Electrode Conductor (GEC), which may be labeled GEC or another convenient but unambiguous identifier.
8. Labeling scheme shall be submitted with the system submittal drawings and approved prior to termination of devices. Contractor shall submit a detailed drawing or sample plate with connectors installed to depict the intended labeling scheme.
9. Label shall be applied within 6 inches from end of each end of all cables.
10. Cabling at the patch panels shall be terminated in numerical order so as to provide a logical pattern that will provide the end user the greatest ease in system administration.
11. For fiber cabling, labels shall be applied at the patch panels in the space that is provided. Label shall include the room and location where fiber is routed to and from.
12. Labels shall be clean and level.
13. Final labels should reflect the Owner's room designation scheme, which may not match the construction drawing numbers. The final room number scheme shall be confirmed with the Architect/Engineer prior to labeling the faceplate and patch panels. If the final room numbers are not available at the time of cable installation, architectural numbers shall be permitted for cable labeling only. If architectural numbers are used, a cross reference sheet shall be submitted in a spreadsheet format. This may require that the Contractor shall have to re-label the patch panels to match the final room numbers.
14. Provide blue dot with the IP address for all WAP's, Cameras, Video projectors etc, mount the label on the grid below the device. Coordinate with other trades to confirm blue dots are not being used for other systems.

C. Other Items
   1. Provide identification as required in other subsections of these Specifications and as denoted on the Drawings.

D. It shall be the responsibility of the Cabling Contractor to label all terminal blocks, cables, and equipment (with length and room number) clearly and logically.

E. Labels shall be clearly typed and shall appear at all cable ends within 6 inches of the jack or patch panel termination on the outer jacket, on the faceplate of the station jacks, and on the patch panels. All patch cables shall be numbered 1 through X within 1/2 inch of each termination. Station runs shall be labeled indicating the user room number of the station and its closet rack number, patch panel letter/number and patch panel port as well as a unique identifier. (Handwritten labeling is not permitted.)

F. Telephone device labeling: All telephones shall be labeled after the programming per the owners' requirements, verify labeling with owner.

G. Security door controller labeling: The door controller shall be labeled with the electrical circuit number and patch panel/TR location.

H. Video coax cable shall be tagged with a distance at the closet end as well as a regular user end identifier. Backbone cables will be identified with an identifier that identifies where each cable end is terminated.

I. Provide labeling for the following items with room name and room number:
   1. Video projector and video projector remote
   2. Television and television remote
   3. Set Top Boxes
   4. Document Camera
   5. Classroom sound system and microphones
   6. Wireless keyboard and mouse
   7. Interactive whiteboards
   8. Interactive tablets
   9. Mobile carts
   10. Telephones
   11. Cameras
   12. Security devices
   13. Miscellaneous AV equipment, etc.

END OF SECTION 27 05 53

SECTION 271515 - COMMUNICATIONS COPPER HORIZONTAL CABLING

(CATEGORY 6)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes, but is not limited to the following:
   1. Local area network
   2. Horizontal cabling
   3. Patch panels compatible with the structured cabling system
   4. Patch cords compatible with the structured cabling system
   5. Modular jacks
   6. Termination of all horizontal cabling
   7. Certified test results of all horizontal cabling

B. Related section includes the following:
   1. Division 01 – All Sections
   2. Division 26 - Electrical
   3. Division 27 – Communications Sections
   4. Division 28 - Electronic Safety and Security.

1.3 SYSTEM DESCRIPTION

A. The horizontal cabling is the portion of the telecommunications cabling system that extends from the mechanical termination in the outlet/connector to the horizontal cross-connect in the ER or TR.

B. The Cat6 horizontal cabling system shall be capable of 10/100/1000 Mbps full duplex transmission via 4 PR UTP Category 6 horizontal cable and shall comply with TIA/EIA 568B requirements for color coding unless otherwise noted.

C. Provide labor, material, equipment, and accessories necessary for a complete operational network system that is manufacturer channel approved. The Data/Cabling Contractor shall furnish the equipment, accessories and necessary material as described herein.

D. The cabling for the voice and data cabling system shall include but not limited to the following:
   1. Provide UTP cables (horizontal).
   2. Provide channel approved patch panels and patch cords.
   3. Provide channel approved modular jacks and cover plates.
   4. Provide, terminate, test, and label all cabling within each room and the data cabinets (MC/ER's and TR's).

E. Horizontal Cabling shall be installed in a physical star topology. Each data cable outlet/connector shall be cabled directly to its appropriate termination point within the designated data closet.

F. Contractor shall coordinate the extension of the electrical service from the electrical junction box located in the room to each communications cabinets/rack with the Site Electrical Contractor.

1.4 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Maintenance Proximity: Not more than 2 hours travel time from Installer's place of business to Project site.

   2. Cable installer company must have on staff a registered communication distribution designer (RCDD) certified by Building Industry Consulting Service International (BICSI)

   3. Installers' Site Project Manager must be a certified BICSI Installer or Technician

B. The system shall be installed in accordance with requirements set by National Electric Code.

C. Communications cabling system components and equipment shall be listed by Underwriters Laboratories, Inc. for Computer use, and the components shall bear the UL label.

D. All equipment shall comply with the latest ANSI-J-STD-607 grounding and bonding standards.

E. All equipment and installation practices shall comply with latest BICSI (TDMM) standards.

F. All equipment shall comply with the latest ANSI/TIA/EIA-568, 569, 60, 607, and 862 standards, as applicable.

G. Cables shall be installed in accordance with ANSI/EIA/TIA and BISCI standards.

H. Provide labeling per ANSI/EIA/TIA-606 requirement and in accordance with the Owner and the Technology Consultant.

I. All cabling shall be tested in accordance with the ANSI/TIA/EIA-568-B2 standards with the required testing equipment.

1.5 CERTIFICATION

A. Cabling Contractor shall provide a certified passing test report from a copper cable certifier for each channel path in PDF form. If test reports are rejected or missing the contractor will be required to retest any failed or missing channels and submit new test reports in order to receive acceptance for the entire installation. The tester will need to be within its acceptable calibration window.

B. This Contractor shall submit with his/her bid a certificate from the manufacturer indicating that the named customers' installation will be certified for a 25-year Extended Manufacturer Product Warranty on Registered System Installation and that the installing company is a certified installer with that manufacturer.

C. All certificates shall be provided with the shop drawing submittal.

D. Once the structured cabling system has been installed, registered, and validated, a System Warranty Certificate will be issued to the end user, providing them with confidence and security in their newly installed structured cabling system.

1.6 SUBMITTALS / RECORD DRAWINGS / MAINTENANCE MANUALS

A. Shop Drawings
   1. Complete and comprehensive shop drawings with labeling, etc. shall be submitted to the Architect/Engineer for approval.
   2. Drawings shall be provided in AutoCAD Release 2002 format or higher.

B. See front end submittals section for more information.

C. See Common Work Results for Communications section 270500 for more submittal requirements.

D. Provide record drawings and maintenance manual, per section – "Operation and Maintenance of Communications Systems".

1.7 WARRANTY

A. Components, parts, and assemblies supplied by the Communications Contractor/manufacturer shall be guaranteed against defects in materials and workmanship for a period as specified in section – "Demonstration, Training, and Warranty of Communications Systems", commencing upon the building substantial completion date. Warranty services shall be provided by an installer certified by the equipment manufacturer during normal working hours.

B. The manufacturer's statement of a complete channel warranty shall be included in the shop drawing submittals.

1.8 TRAINING

A. Provide training as specified in section titled "Demonstration, Training, and Warranty of Communications Systems" for more information.

PART 2 - PRODUCTS

2.1 **Approved Plenum Cat6 Manufacturers:** Belden, BerkTek, General, Hitachi, Hubbell, Mohawk, Panduit, Siemon, Superior Essex

Approved Plenum OSP Cat6 Manufacturers: Belden, BerkTek, General, Hitachi, Mohawk, Panduit, Siemon, Superior Essex

Approved OSP Cat6 Protector Manufacturers: Circa, Cyclix, Emerson, Marconni, Tii Tech

Approved Outlet/Connector Manufacturers: Belden, Hubbell, Leviton, Panduit, Siemon

Approved Faceplate Manufacturers: Belden, Hubbell, Leviton, Panduit, Siemon

Approved Patch Panel/Patch Cable Manufacturers: Belden, Hubbell, Leviton, Panduit, Siemon

2.2 HORIZONTAL CABLING & CONNECTIVITY HARDWARE PRODUCTS

A. Contractors shall provide a system where the connectivity hardware and cable manufacturer used for the infrastructure install have formed a partnership to create a complete channel solution. This solution shall be standards based; performance warranted by the connectivity manufacturer.

2.3 HORIZONTAL CABLE - CATEGORY 6 – PLENUM

A. The Category 6 cable shall be four unshielded twisted pair (UTP), 23 AWG, solid bare annealed copper, Fluoropolymer; Low-Smoke, Flame Retardant insulation for all 4 pairs and is suitable for 10 Mbps 10BASE-T through 1000BASE-T Ethernet.

B. UL listed CMP with transmission characteristics that meet or exceed those of FCC-68/EIA/TIA, 568A-5 and EIT/TIA TSB-95 performance and NEMA low loss, extended frequency; jacket shall be sequentially marked at 2 foot intervals and must be plenum rated.

C. Pair twisting shall be maintained to meet the cable performance. Maximum UTP cable untwisting for termination allows for one half (1/2) inch.

D. Category 6 cable must be properly installed and terminated to meet specifications. The cable must not be kinked or bent too tightly; the bend radius should be larger than four times the outer diameter of the cable.

E. Applications include:

- 10BASE-T through 1000BASE-T Ethernet
- Power over Ethernet (PoE) – IEEE 802.3af
- PoE+ – IEEE 802.3at Type 1 and 2

F. Cable shall meet ANSI/TIA/EIA-658-B2-1 specification.

G. Design bandwidth - 250 MHZ, cable bandwidth - 250+ MHZ, standard data rate up to 1000 Mbps.

H. Color Code = Pair #1 - White/Blue and Blue
Pair #2 - White/Orange and Orange
Pair #3 - White/Green and Green
Pair #4 - White/Brown and Brown

I. The maximum allowed length of a Cat 6 cable is 100 meters (328 ft). This consists of 90 meters (295 ft) of solid horizontal cabling between the patch panel and the wall jack, plus 5 meters (16 ft) of stranded patch cable between each jack and the attached device. **If there is any doubt or possibility of length overages bring those concerns to the Designer before beginning installation of any cabling.**

J. **BASIS OF DESIGN** – Superior Essex Series 77 - 77-2xx-xB

2.4 OUTDOOR HORIZONTAL CABLE -CATEGORY 6

A. The Outside Plant (OSP) unshielded Broadband category cable is designed to provide an extension of the LAN beyond the premises or in situations where the NEC code requires an OSP-rated cable when it is in contact with earth, whether in a conduit or not. The cable consists of a core of four (4) balanced twisted pairs surrounded by gel that does not drip or flow. The core is jacketed with a sunlight and abrasion resistant black, polyethylene outer jacket. The jacket prevents intrusion of moisture and easily wipes clean during installation.

B. UL listed CM with transmission characteristics that meet or exceed those of FCC-68/EIA/TIA, 568A-5 and EIT/TIA TSB-95 performance and NEMA low loss, extended frequency, jacket shall be sequentially marked at 2-foot intervals.

C. Transition point from Plenum Cat6 to OSP Cat6 should be enclosed in a surface mount box with a service loop on both cables. Pair twisting shall be maintained to meet the cable performance, but maximum cable untwisting allowed is one half (1/2) inch.

D. Transmission performance characterized to 500 MHz for CAT 6.

E. Certifying shall be through the whole cable from user side patch cable to equipment side patch cable including through the transition point.

F. Color Code = Pair #1 - White/Blue and Blue
Pair #2 - White/Orange and Orange
Pair #3 - White/Green and Green
Pair #4 - White/Brown and Brown

G. **BASIS OF DESIGN** - Superior Essex PN: 04-001-68

2.5 TELECOMMUNICATIONS OUTLET/CONNECTORS

A. Provide a flush mounted modular data jack RJ-45 to fit in a one or two gang 3-1/2-inch-deep box and/or to fit in the surface mounted raceway or floor boxes as shown on the Drawings and as specified herein.

B. Data jacks shall be 8-position configurations and shall meet all the transmission performance of specified cable.

C. The data jacks shall be UL listed and must meet TIA/EIA 568B.2 requirements.

D. The data jacks to be wired to TIA/EIA 568B color scheme unless otherwise noted.

E. Modular data jacks shall be mounted in modular cover plates.

F. Different systems may use different color outlets/connectors. Refer to Tech Sheets for matrix.

G. Provide one spare bag/box of each color of RJ45 jacks used.

H. **BASIS OF DESIGN** – HUBBELL IFP**XX & HUBBELL HXJ6X

2.6 MODULAR COVER PLATES

A. Telecommunications outlet/connector faceplates shall be appropriately mounted (e.g., single-gang boxes, double-gang boxes, box eliminators, surface mount boxes, floor monuments/boxes). Flush or surface mount outlets designed for mounting of wall telephones shall use the dimensions of the mounting place and outlet/connector in ANSI/TIA-570-C or local equivalent compatible with wall-mounted telephones to be attached to the faceplates.

B. Provide modular cover plates as shown on the drawing and as specified.

C. Color of the faceplate/cover plates shall be coordinated with the Architect prior to submission of submittal.

D. Provide decorative modular mounting frames for all jacks in surface raceway.

E. Provide the cover plate inside floor boxes to match receptacle cover plates (verify with site electrical contractor).

F. Jacks shall be mounted on stainless steel plate where required.

G. Cover plate shall be adjustable either in field or by factory (1/4 inch minimum).

H. Provide blanks in all unused openings for all cover plates and in floor boxes.

I. **BASIS OF DESIGN** – HUBBELL IMF*XX, NS61*XX, Q106X, SP6R

2.7 STAINLESS STEEL COVER PLATES

A. Provide stainless steel cover plates to fit the modular jacks as shown on the Drawings.

B. Stainless steel cover plate shall be single gang or double gang.

C. Provide stainless steel cover plates in the following areas:
1. Gymnasium
2. Auditorium
3. Cafeteria / Kitchen

D. **BASIS OF DESIGN** – HUBBELL IMSS*

2.8 WEATHERPROOF COVERPLATE

A. Weather resistant receptacles are designed with nylon and corrosion resistant metal components. When installed in an approved weather protective cover, weather resistant receptacles offer extra durable protection from rain, snow, ice, moisture and humidity.

B. Provide weatherproof cover plate for all outdoor devices.

C. **BASIS OF DESIGN** – HUBBELL WP26XX

2.9 WIRELESS ACCESS POINT, CAMERA AND VIDEO PROJECTOR LOCATIONS

A. Cable Connection
1. Provide two port plenum rated surface mount boxes to terminate the appropriately rated RJ45 jack for Cat6/Cat6A cable. Use a blank if there is an unused port.
2. Provide 5 foot patch cord as required.
3. Patch the wireless access point, camera and video projector to the data jack in the box above the ceiling.
4. Place a color dot sticker on the ceiling grid to locate the cable location from the floor in common areas.
5. If cable run is under 295', leave a 20' cable coil on these cables for flexibility of mounting the associated equipment. Do not leave this excess if the coil will make the overall cable be over footage.

B. **BASIS OF DESIGN** – HUBBELL ISB2XXP

2.10 COPPER PATCH PANELS

A. Provide 24 or 48 port Category 6/Class E punchdown or modular patch panels to terminate unshielded twisted 4-pair, 22 – 26 AWG, 100 ohm cable and mount to standard EIA 19 inches or 23 inches racks.

B. Patch panels shall be easy to identify with pre-printed numbers, write-on areas and optional label kits.

C. Provide a dedicated 24 or 48 port RJ45 patch panel for termination of all UTP cables for each system independently if possible with front and back cable management.

D. Patch panels shall meet or exceed all transmission performance of the specified cable as outlined in TIA/EIA-568B.2 - 1, TSB-95.

E. Each RJ45 jack shall be terminated with all 4 pair of UTP wire and shall be wired to meet TIA/EIA 568B color scheme.

F. Provide two (2) extra wire management for data switches in each closet.

G. **BASIS OF DESIGN** – HUBBELL HP6Exx OR HPJxx

2.11 PATCH CORDS

A. Provide factory made patch cords with modular RJ45 at each end. Patch cords are usually UL listed, 1 foot (.3m), 3 foot (1m), 5 foot (1.5m), 7 foot (2.1m), 10 foot (3m), and 15 foot (4.6m) long.

B. Patch cord manufacturer must match connector/patch panel manufacturer to meet the channel requirements.

C. Patch cable quantity
   1. Furnish one blue patch cord for each data jack (within patch panel) with 20% spare; provide 50% three (3) foot patch cables, 30% five (5) foot patch cables, and 20% seven (7) foot patch cables.
   2. Furnish one blue station patch cable for each data jack (within faceplate) with 20% spare; provide 90% ten (10) foot patch cables and 10% fifteen (15) foot patch cables.

D. **BASIS OF DESIGN:** HUBBELL NEXTSPEED SLIM HC6**xx

2.12 CAT 6 OSP PROTECTOR

A. Provide solid state CAT 6 OSP protector for each 4 pair data cabling entering the building.

B. Unit shall be rated for UL497/UL497B protection standards.

C. Unit shall be Certified Category 6, Frequencies up to 250 MHz, Equipped with an Internal Fuse Link and 110 terminations

D. **BASIS OF DESIGN** – Tii TECHNOLOGIES INC. PN:606-65

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide communications copper horizontal cabling, connectors, jacks, cover plates, patch panels, cords, etc., as specified and as shown on drawings.

B. Cabling at patch panels shall be terminated in numerical order, to provide a logical pattern that will provide the end user the greatest ease in the system administration.

C. The ICT infrastructure shall be clearly labeled to identify all system components, including racks, cables, panels, and telecommunications outlet/connectors. The labeling system shall be machine printed and shall uniquely identify the cable origin and destination..

3.2 UNSHIELDED TWISTED PAIR CABLE (UTP)

A. Provide the following additional UTP runs:
   1. Provide one (1) 4-pair UTP to the telephone headend equipment and to the telephone back-up power supply in same room.
   2. Provide two (2) 4-pair UTP to each file server from MC/ER.
   3. Provide two (2) 4-pair UTP to the fire alarm panel from nearest data closet.
   4. Provide two (2) 4-pair UTP to the elevator controls from nearest data closet.
   5. Provide 10 additional 4-pair UTP cables, jacks, labeling, testing etc (180 feet each) to the nearest telecommunications rooms. (Install as directed by the Architect/Engineer.)

B. Maximum pulling force shall be as recommended by the manufacturers and the maximum bending radius shall be (10) times the cable diameter.

C. Outdoor computer/data cable shall be used in all floor box locations where concrete is slab on grade.

D. Terminate the data jacks per the manufacturer's recommendations and ensure the termination bar is positioned as close as possible to the cable jacket edge.

3.3 CABLE PULLING

A. Cable pulleys must be used when pulling cable around multiple bends and corners of wireways. Pulleys shall have a minimum diameter of 6 inches.

B. Cable rollers used for pulling in cable shall be mounted close to wireway supports and shall be placed at the beginning of the run and spaced every 25 feet along the run.

C. Providing cable slack is recommended to enable the possibility of future changes in the horizontal cabling system configuration:

• In the TR:
1. – Balanced twisted-pair cabling – ≈3 m (10 ft)
2. – Optical fiber cabling – ≈3 m (10 ft)

• In the work area:
3. – Balanced twisted-pair cabling – ≈0.3 m (1 ft)
4. – Optical fiber cabling – ≈1 m (3.3 ft)

Cable slack shall be taken into consideration in the total length of the horizontal cabling system segments. Loops shall be laced above the ceiling in the cable tray or support service loop above ceiling properly.

3.4 LABELING AND MARKING

A. See Drawings for Technology Schedules for more information and notes.

B. When labeling all cables:

• Cables shall be identified at each end with a permanent label. The same alphanumeric identifiers shall be used at both ends of the cable and on the faceplate.

• The labeling will indicate the type, function, and terminating position, preferably using a scheme such as ANSI/TIA-606-B or ISO/IEC 14763-2-1.

3.5 CABLE SEPARATION FROM POWER WIRING

A. Between the cabling system and any fluorescent, neon, incandescent, or high intensity discharge lamp fixtures, the minimum distance shall be 5 inches.

B. Cable may be installed closer to lighting and convenience outlet power cable (single phase, 120V, 20A maximum), in metal cable channels for limited distances if the following guidelines are observed:
1. Coincident (parallel) runs of no more than 15 feet are permissible if a 1 inch separation between the power cable and the cabling system cable is maintained by separators or suitable retention hardware. If necessary, the separation may be less than 1 inch for a run of up to 6 inches if no contact between the cabling system cable and the power cable occur.
2. Coincident runs of no more than 30 feet are permissible if a 2 inch separation is maintained. The separation may be less than 2 inches for a run of up to 12 inches, if no contact occurs between the cabling system cable and the power cable.

3.6 TESTING

A. The Cabling Contractor shall be responsible for testing each horizontal cable run, patch panel, and patch cables to verify the performance of the channel warranty for the horizontal cabling system as defined in TIA/EIA TSB-67.

B. The contractor shall configure the tester for the cable and connectors used in the installation.

C. The contractor shall calibrate the tester to the newest software.

D. The contractor shall use the same tester(s) from the same manufacturer for the entire project(s).

E. All test reports shall have the same appearance and layout.

F. The contractor shall turn in all passing copper/fiber test results. Partial, failed, or quick tests shall NOT be accepted, all test results shall be PDF format when submitted with the close out documents.

G. System and Wiring Testing, Checking, and Reports:
   1. Cabling Contractor shall provide necessary technical personnel and testing instruments as required to perform complete testing of all systems installed by Contractor and coordinate this testing activity with the Architect/Engineer and Owner's representative.
   2. All wiring, terminations, equipment, etc. shall be checked and tested by qualified field representative or equipment vendor. A report shall be submitted to Architect/Engineer and Commissioning Agent by vendor representative and/or Contractor indicating results of such final check-out and testing processes. Final payment will not be approved until such report is submitted and any "failure" results are corrected.
   3. Cabling Contractor shall conduct such other tests and make necessary adjustments of equipment and installation infrastructure required by Architect/Engineer and/or Commissioning Agent, as requested or necessary to verify performance requirements. Submit all data gathering information taken during such tests to Architect/Engineer and Commissioning Agent.
   4. Cabling Contractor must input the specified cable parameters, manufacturers' name and number in the tester. (Test results will not be accepted with generic or not applicable cable types.)
   5. Reporting to be done in compliance with standards and schedules published by authority and agencies defined in the Specifications.

END OF SECTION 271515

SECTION 27 41 12 - COMMUNICATIONS AUDIO-VIDEO MOUNTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes, but is not limited to the following:
   1. Audio - Video mounts
   2. Miscellaneous items

B. Related section includes the following:
   1. Division 01 – General Requirements
   2. Division 08 – Ceilings
   3. Division 11 - Equipment
   4. Division 26 – Electrical
   5. Division 27 – Communications Sections
   6. Division 28 – Electronic Safety and Security

1.3 DESCRIBTION OF WORK

A. Provide audio - video mounts for all AV equipment, monitors and all accessories to attach to the building structural steel and or walls.

B. Provide labor, material, equipment, and accessories necessary for a complete installation of video display mounts.

C. It shall be the responsibility of the audio - video mounts contractor to verify the video locations and provide the proper mounts as specified here.

1.4 QUALITY ASSURANCE

A. The audio - video mounts and accessories shall bear the UL label and must be CSA certified.

B. All equipment installation practices shall comply with the latest BICSI (TDMM) standards.

C. All equipment shall comply with the latest ANSI/TIA/EIA-568, 569, 606, 607, and 862 standards, as applicable.

D. Provide labeling per ANSI/EIA/TIA-606 requirement and in accordance with the Owner and Technology Consultant.

E. See section – "Common Work Results for Communication" for more information.

1.5 SUBMITTALS / RECORD DRAWINGS / MAINTENANCE MANUALS

A. Shop Drawings
   1. Complete and comprehensive shop drawings including all mounting components shall be submitted to the Architect/Engineer for approval.
   2. A complete technical data sheet shall be included.
   3. Provide complete detail drawings for each type of bracket support.
   4. Certification letter.

B. See Common Work Results for Communications section 270500 for more submittal requirements.

C. Provide record drawings and maintenance manual, per section – "Operation and Maintenance of Communications Systems".

1.6 WARRANTY

A. Components, parts, and assemblies supplied by the manufacturer shall be warranted against defects in materials and workmanship for a period as specified in section – "Demonstration and Training of Communications Systems" from date of completion. Warranty services shall be provided during normal working hours.

1.7 Provide training as specified in section titled "Demonstration and Training of Communications Systems" for more information.

PART 2 - PRODUCTS

2.1 AUDIO - VIDEO MOUNTS

A. Provide audio - video amount as shown on the Drawings.

B. Mounts shall comply with the following:
1. Constructed of 14 gauge cold rolled steel and finished in black fused epoxy.
2. Provide proper model for the size and weight of the television set specified.
3. Mount shall be capable of adjustable tilt (0 to 30 degrees).

C. Ceiling Support
1. Provide accessories, rigid pipe, unistrut or structural steel above the ceiling to allow proper support of the television mounting devices. Ensure that the structure can support the TV as well as the mounting hardware.
2. Accessories:
   a. Provide adaptors for attachment of brackets to round, rectangular, I-beams, or I-beam trusses.

D. Wall Support
1. Provide blocking or suitable reinforcement to allow a safe, secure wall bracket installation.
2. Secure wall bracket with anchors suitable for the installation as recommended by the manufacturer.
   a. Provide information on the proposed anchors to the A/E for approval prior to installation.

2.2 WALL MOUNTED VIDEO MONITOR MOUNT

A. Provide wall mounted monitor mount for concrete or metal stud. (Provide any additional hardware per manufacturer's installation instructions.).

B. Mount shall be low profile.

C. Approved Manufacturer:
1. Echo Gear – EGLT2
2. Peerless
3. Monoprice
4. Approved Equal

PART 3 - EXECUTION

3.1 PREMISES DISTRIBUTION SYSTEM

A. Contractor shall be responsible for all the miscellaneous support, steel, hardware, brackets, metal stud wall plates, concrete wall plates, ceiling attachments, adapters and decouplers, safety belts, bumper guards, etc. to provide a safe and secure installation and shall comply with the manufacturer’s instructions.

B. Coordinate the location of the monitor, monitor heights, locations, etc. with the Architect/Engineer, Owner, electronic whiteboard and other.

C. The Architect/Engineer will pre-approve the installation methods and verify all mounting heights of all audio/video display devices in the field. A pre-installation conference must be scheduled by the Contractor prior to the installation of the audio/video display mounts.

D. The contractor shall provide a mock room for Owner and Architect to review and approve.

3.2 MAINTENANCE

A. Response times for major system failure during the coverage period which materially affects the operation of the system or equipment must not exceed 4 hours.

B. Response times for minor failures must not exceed 24 clock hours, Monday through Friday, 8:00 a.m. - 5:00 p.m., excluding holidays.

3.3 TESTING

A. A certified trained technician shall test the video display mounts and must report his test as part of the operation and maintenance manual.

3.4 CERTIFICATION

A. As a condition of final acceptance by the Owner, the Contractor shall issue to the Owner a letter of certification stating that the audio/video mounts were installed per the manufacturer's recommendations.

END OF SECTION 27 41 12

SECTION 27 41 17 - INTEGRATED A/V CONTROL SYSTEMS AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this section.

1.2 SUMMARY

A. This section includes but is not limited to the minimum requirements for the installation, configuration, and training of the audio-visual components in the LGI, Steam shown on sheet T1.05 and Gym/Cafe as depicted on sheet T1.06 of the Drawings and required by these specifications. The Gym/Café A/V system shall be capable of being used independently as well as together as one system.

B. These Specifications, together with the Drawings accompanying them, are intended to depict the installation requirements necessary to support this Project. Contractor shall furnish materials shown and/or called for on the Drawings but not mentioned in the Specifications, or vice versa, that are necessary for the installation and support of communications cabling, whether specifically called for in both. In addition, Contractor shall provide incidental equipment and materials required for the completion of systems included in this contract whether specified or shown on the drawings.

C. All required back boxes and conduit to support the AV systems are provided and installed by others. Contractor is required to provide, install, test, and configure all cabling, equipment, and AV systems as described within this specification and as shown on the Tech drawings.

D. This section includes minimum requirements for the following:

1. Media Player
2. Mixer/Amplifier
3. Weight Room Ceiling Loudspeakers
4. Loudspeaker Rigging Components
5. Sound System Cabinet – AV Equipment Rack
6. AV Equipment Rack Blanks
7. AV Equipment Rack Vents
8. Microphone/Line Level Cabling
9. 12 AWG Loudspeaker Cabling
10. 16 AWG Loudspeaker Cabling
11. UTP Cabling
12. STP Cabling
13. HDMI Cabling
14. RS-232 Cabling
15. Relay Cabling
16. RF Cabling
17. Custom Faceplates
18. Grommeted Faceplates
19. XLR Panel Mount Connectors
20. RCA Panel Mount Connectors
21. BNC Panel Mount Connectors
22. Ethernet Panel Mount Connectors
23. HDMI Panel Mount Connectors
24. RS-232 Panel Mount Connectors
25. XLR Cable Connectors
26. RCA Male Cable Connectors

27. BNC Cable Connectors

1.3 QUALITY ASSURANCE

A. The following industry Standards are the basis for the audio-visual system described herein. The list is incorporated by this reference to them.

1. ANSI - American National Safety Institute
2. ASTM - American Society of Testing and Materials
3. EIA - Electronics Industries Association
4. FCC - Federal Communications Commission
5. NEMA - National Electrical Manufacturer's Association
6. OSHA - Occupational Safety and Health Administration
7. NEC - National Electric Code.
8. NFPA - National Fire Protection Association.
9. IEEE - Institute of Electrical and Electronics Engineers.
10. ISO - International Standards Organization.
11. UL - Underwriters Laboratories
12. Davis and Davis, Sound System Engineering (2nd Edition), Howard W. Sams, 1987
13. Giddings, Audio System Design and Installation (ASDI), Howard W. Sams, 1990

B. All cable and equipment shall be installed in a neat and skillful manner. Equipment and materials shall be of the quality and manufacturer indicated. The equipment specified is based upon the acceptable manufacturers listed. Where "Or equal" is stated, equipment shall be equivalent in every way to that of the equipment specified and subject to approval.

C. Materials and work specified herein shall comply with the requirements of the local Authority Having Jurisdiction.

D. Contractor should have the following qualifications:

1. Experienced in the installation of systems similar in complexity and scale to those included within the scope of work. If requested, the Contractor shall provide the names, locations, and points of contact for at least three installations of the type and complexity specified herein.
2. Within the last two (2) years, installed an audio-visual system with similar equipment and functionality.
3. Have at least one (1) person on staff with CTS-I certification.

1.4 SUBMITTALS

A. See front end submittals section for more information.

B. See Common Work Results For Communications section 270500 for more submittal requirements.

1.5 RECORD DRAWINGS / OPERATION AND MAINTENANCE MANUALS

A. Provide record drawings and operation and maintenance manuals, as described in Sections – "Operation and Maintenance of Communications Systems" and Common Work Results for Communications Systems".

1.6 DELIVERY, STORAGE, AND HANDLING

A. Equipment and components shall arrive onsite properly protected and undamaged with

containers, packaging, and labels intact.

B. Store, handle and protect materials and equipment in accordance with Manufacturer's recommendations.

C. Store materials and equipment in dry, environmentally controlled space. Do not install equipment and materials until spaces are enclosed, watertight, and dry. Protect equipment from dust and other airborne materials.

D. Provide additional protection during handling as necessary to prevent breaking, scraping, marring, or otherwise damaging products or surrounding areas.

E. Protect all equipment and components that are to be installed within this project from theft, vandalism, and exposure to rain, freezing temperatures and direct sunlight.

F. Protect installed equipment and components from damage and prevent use by unauthorized persons.

1.7 WARRANTY

A. The integrated audio video system and equipment for classrooms shall carry a warranty as specified in Section – "Demonstration and Training of Communications Systems". The warranty shall include all labor and material to replace all components that fail and or do not comply with the performance specifications.

B. Contractor shall repair, adjust, and/or replace, whichever the Owner determines to be in its best interests, any defective equipment, materials, or workmanship, as well as such parts of the work damaged or destroyed by such defect, during the warranty period, at the Contractor’s sole cost and expense. If parts or components need to be repaired, then a loaner will be supplied and installed until the part or component can be repaired and reinstalled.

C. Manufacturer certified technicians shall perform all service work.

D. At the end of the warranty period, the Contractor shall complete one (1) site visit to evaluatethe status of the audio-visual systems. All equipment within this scope of work found to be defective shall be replaced at no cost to the Owner.

E. Guarantees of material, equipment, and workmanship running in favor of the Contractor shall be transferred and assigned to the Owner on completion of the work and acceptance of said work by the Owner.

PART 2 - PRODUCTS

2.1 MEDIA PLAYER

A. Shall meet or exceed the following specifications:

1. CD/SD/USB Player with Bluetooth® Receiver and FM/AM Tuner.
2. Shall include two (2) channels of stereo audio.
3. Shall include two analog output systems: XLR balanced connectors and RCA unbalanced connectors.
4. Shall have a frequency response of 20 – 20,000 Hz.
5. Shall support Bluetooth 4.2, WAV, MP3, AAC.
6. Shall include an AUX IN connector to enable playback from external music players.
7. Shall be rack mountable.
8. Shall include all accessories for full functionality.

9. Acceptable Manufacturers:
    a. Tascam CD-400u
    b. Or Equal

2.2 MIXER/AMPLIFIER

A. Shall meet or exceed the following specifications:

1. Shall have 8 inputs with 2 outputs of 120-watts of power.
2. Shall support 70V and 100V distributed audio systems without the need for a separate transformer.
3. Shall provide four channels of amplification.
4. Shall provide protection of circuit components in the event of over-drive, output overload, or short circuits.
5. Shall be 1RU rack mountable.
6. Acceptable Manufacturers:
    a. JBL Pro CSMA 2120
    b. Or equal

2.3 WEIGHT ROOM CEILING LOUDSPEAKERS

A. Shall meet or exceed the following specifications:

1. Shall be a 200mm (8 in) speaker with high 96dB sensitivity and a 5-Watt multi-tap transformer.
2. Shall have a coverage pattern of 120º, conical.
3. Shall have a frequency response of 100 Hz – 16 kHz.
4. Provide all necessary hardware and brackets required for installation. Including backcan and tile rails.
5. Verify color with Architect - black.
6. Acceptable Manufacturers:
    a. JBL CSS8008
    b. Or equal

2.4 LOUDSPEAKER RIGGING COMPONENTS

A. Contractor shall provide and install speaker rigging components as necessary to mount main loudspeakers as shown on the drawings.

B. Structural support members to have a safety factor of at least 5. Mounting hardware and wire rope to have a safety factor of 8. All fasteners to be graded and certified for use in the intended applications. Overhead suspension hardware shall comply with ASME B30.20 standards and all applicable local building and safety codes.

C. Overhead suspension hardware must be of a type that includes product traceability controls.

D. Once the systems are installed, the engineer shall physically inspect the methods and means used to verify compliance with the original design.

E. Loudspeaker Rigging Components shall meet or exceed the following specifications:

1. Loudspeaker Rigging Components shall be made of quenched or tempered forged steel.
2. Loudspeaker Rigging Components shall meet or exceed all the requirements of ASME B30.26 including identification, ductility, design factor, proof load and temperature requirements.

3. Loudspeaker Rigging Components shall be hot dip galvanized or self-colored.
4. Shackles shall meet the performance requirements of Federal Specification RR-C-271D Type IVA, Grade A, Class1.
5. Turnbuckles shall meet the performance requirements of Federal Specifications FF-T-791b, Type 1 Form 1 - CLASS 4, and ASTM F-1145.
6. Wire rope thimble shall meet the performance requirements of Federal Specification FF-T-276b Type II.
7. Wire rope shall be sized as 7x19 utility cable.
8. Provide all screw pin type shackles with mouse wire.
9. All end fittings shall be moused to the body with mousing cable.
10. Select size of product based working load limits required.
11. Acceptable product:
    a. Chicago Hardware Company
    b. Crosby Group
    c. Wire Rope Corporation of America (WRCA)

2.5 SOUND SYSTEM CABINET - AV EQUIPMENT RACK

A. Shall meet or exceed the following specifications:

1. Shall have 18 units of available rack space.
2. Shall have 16-gauge steel construction with black textured powder coat finish.
3. Shall have side panels and a lockable door.
4. Shall have an overall depth of 25” and useable depth of 23.47”.
5. Shall include rack shelves and 3 RU drawer.
6. Acceptable Manufacturers:
    a. Middle Atlantic ERK-1825
    b. Or Equal

2.6 EQUIPMENT RACK BLANKS

A. Contractor to provide equipment rack blanks where required.

B. Shall meet or exceed the following specifications:

1. Shall have a flanged construction.
2. Shall be made of 1/16” thick aluminum.
3. Shall have a black brushed and anodized finish.
4. Provide rack blank sizes as required.
5. Acceptable Manufacturers:
    a. Middle Atlantic BL Series
    b. Or Equal

2.7 EQUIPMENT RACK VENTS

A. Contractor to provide equipment rack vents where required.

B. Equipment rack vents shall meet or exceed the following specifications:

1. Shall have a flanged construction.
2. Shall be made of 1/16” thick aluminum.
3. Shall have a black brushed and anodized finish.
4. Provide rack vent sizes as required.
5. Acceptable Manufacturers:
    a. Middle Atlantic VTP Series
    b. Or Equal

2.8 MICROPHONE/LINE LEVEL CABLING

A. Contractor shall provide and install microphone/line level cabling as required.

1. Provide cabling meeting the following specifications:

a. Minimum shielded 22 AWG, 7x30 stranded cabling
b. Nominal conductor to conductor capacitance: 114 pF/m
c. Tinned copper drain wire
d. Cable to be PVC jacketed.

2. Acceptable Manufacturers
a. Belden 9451
b. Or Equal

2.9 12AWG LOUDSPEAKER CABLING

A. Contractor shall provide and install 12AWG loudspeaker cabling as required.

1. Provide speaker cabling meeting the following specifications:

a. Minimum unshielded 12 AWG, 65x30 stranded cabling
b. Nominal conductor to conductor capacitance: 32 pF/ft
c. Cable to be PVC jacketed.

2. Acceptable Manufacturers
a. Belden 5000UP
b. Or Equal

2.10 16AWG LOUDSPEAKER CABLING

A. Contractor shall provide and install 16AWG loudspeaker cabling as required.

1. Provide speaker cabling meeting the following specifications:

a. Minimum unshielded 16 AWG, 65x34 stranded cabling
b. Nominal conductor to conductor capacitance: 98 pF/ft
c. Cable to be PVC jacketed.

2. Acceptable Manufacturers

a. Belden 5200UP
b. Or Equal

2.11 UTP CABLING

A. Contractor shall provide and install UTP cabling as required per manufacturer's recommendations.

1. Provide UTP cabling meeting the following specifications.

a. Minimum 24 AWG, eight (8) conductor cable
b. Nominal conductor to conductor capacitance: 15 pF/ft

2. Acceptable Manufacturers

a. Belden
b. Commscope
c. General Cable
d. Superior Essex
e. Or Equal

2.12 STP CABLING

A. Contractor shall provide and install STP cabling as required per manufacturer's recommendations.

1. Acceptable Manufacturers
   a. Crestron
   b. Or Equal

2.13 HDMI CABLING

A. Contractor shall provide and install HDMI cabling as required.

1. Provide pre-molded cables in lengths as required.
2. Shall support HDMI signal transmission up to 328 ft. via optical cabling.
3. Shall support up to 4k 60Hz 4:4:4 HDR video.
4. Shall meet HDMI 2.0/HDCP 2.2 testing standards.
5. Shall be plenum rated.
6. Shall not require external power.
7. Acceptable Manufacturers

   a. FSR HDMI 2.0 Digital Ribbon Cables
   b. Or Equal

2.14 RS-232 CABLING

A. Contractor shall provide and install RS-232 cabling as required.

1. Provide pre-molded cables in lengths as required.
2. Acceptable Manufacturers
   a. Crestron
   b. Or Equal

2.15 RELAY CABLING

A. Contractor shall provide and install audio video control cabling as required.

1. Provide control cabling meeting the following specifications:

   a. Minimum unshielded 22 AWG, 26x34 stranded cabling
   b. Nominal conductor to conductor capacitance: 98 pF/m
   c. Provide number of conductors as required.

2. Acceptable Manufacturers
   a. Belden
   b. Or Equal

2.16 RF CABLING

A. Contractor shall provide and install RF cabling as required.

1. Provide RF cabling meeting the following specifications:

   a. Provide RG-8X type cable.
   b. Center conductor 16 AWG solid.
   c. Gas-injected FPE insulation
   d. Cable to be PVC jacketed.

2. Acceptable Product:
   a. Belden 9258
   b. Or Equal

2.17 CUSTOM FACEPLATE

A. Contractor shall provide plates as required by the T-series drawings. Engrave as shown on the drawings.

B. Contractor shall coordinate plate finish and color with the Owner. Plastic plates are not acceptable.

C. On dark plates, letters shall be white; on stainless steel or brushed natural aluminum plates, letters shall be black.

D. Custom and/or engraved plates/panels:
1. Custom panels constructed of 1/8-inch brushed aluminum
2. Finish: Black Anodized.
3. Acceptable Manufacturer:
   a. ProCo
   b. Or Equal

2.18 GROMMETED FACEPLATES

A. Contractor shall provide grommet faceplates as needed by audio and video locations as shown on the T-series drawings.

B. Grommet faceplates shall provide a minimum of 1.5” Diameter opening for cable pass-through unless otherwise noted.

C. Contractor shall coordinate plate finish and color with the Owner. Plastic plates are not acceptable.

D. Grommeted plates/panels:

1. Custom panels constructed of 1/8-inch brushed aluminum
2. Finish: Black Anodized.
3. Acceptable Manufacturer:
   a. ProCo
   b. Or Equal

2.19 XLR PANEL MOUNT CONNECTORS

A. Contractor shall provide the quantity of XLR jacks as needed.

B. Provide XLR jack meeting the following specifications:

1. XLR jack shall be panel mounted with metal shell.
2. XLR jack shall utilize gold contact solder terminations.
3. Shell color shall match plate finish.
4. Acceptable Manufacturers:
    a. Neutrik
    b. Switchcraft
    c. Or Equal

2.20 RCA PANEL MOUNT CONNECTORS

A. Contractor shall provide the quantity of RCA jacks as needed.

B. Provide RCA jack meeting the following specifications:

1. RCA jack shall be panel mounted with metal shell.
2. RCA jack shall utilize gold contact solder terminations.
3. Shell color shall match plate finish.
4. Each RCA jack shall have correct color code depending on input (i.e. left or right).
5. Acceptable Manufacturers:
    a. Neutrik
    b. Switchcraft
    c. Or Equal

2.21 BNC PANEL MOUNT CONNECTORS

A. Contractor shall provide the quantity of BNC jacks as needed.

B. Provide BNC jack meeting the following specifications:

1. BNC jack shall be panel mounted with metal shell.
2. BNC jack shall utilize an RF protector.
3. BNC jack shall utilize a feed-through connector.
4. Acceptable Manufacturers:
    a. Neutrik
    b. Switchcraft
    c. Or Equal

2.22 ETHERNET PANEL MOUNT CONNECTORS

A. Contractor shall provide the quantity of Ethernet jacks as needed.

B. Provide Ethernet jack meeting the following specifications:

1. Ethernet jack shall be panel mounted with metal shell.
2. Ethernet jack shall utilize bronze contact terminations.
3. Acceptable Manufacturers:
    a. Neutrik
    b. Switchcraft
    c. Or Equal

2.23 HDMI PANEL MOUNT CONNECTORS

A. Contractor shall provide the quantity of HDMI jacks as needed.

B. Provide HDMI jack meeting the following specifications:

1. Shall be compatible with telecom faceplate.
2. Shall meet HDMI 1.4 standards.
3. Shall utilize a Type A female port.
4. Color shall match telecom faceplate.
5. Acceptable Manufacturers:
    a. Panduit CMHDMIXX
    b. Or Equal

2.24 RS-232 PANEL MOUNT CONNECTORS

A. Contractor shall provide the quantity of RS-232 jacks as needed.

B. Provide RS-232 jack meeting the following specifications:

1. Shall be compatible with telecom faceplate.
2. Shall provide RS-232 female port.
3. Color shall match telecom faceplate.
4. Acceptable Manufacturers:
    a. Panduit CMD15HDXXX
    b. Or Equal

2.25 XLR CABLE CONNECTORS

A. Contractor shall provide the quantity of XLR cable connectors as needed.

B. Provide XLR cable connector meeting the following specifications:

1. XLR cable connector shall have black die-cast shell.
2. XLR cable connector shall utilize gold contact solder terminations.
3. XLR cable connector shall include strain relief.
4. Acceptable Manufacturers:
    a. Neutrik
    b. Switchcraft
    c. Or Equal

2.26 RCA MALE CABLE CONNECTORS

A. Contractor shall provide the quantity of RCA male cable connectors as needed.

B. Provide RCA cable connector meeting the following specifications:

1. RCA cable connector shall have a silver die-cast shell.
2. XLR jack shall utilize silver contact solder terminations.
3. Acceptable Manufacturers:
    a. Neutrik
    b. Switchcraft
    c. Or Equal

2.27 BNC CABLE CONNECTORS

A. Contractor shall provide the quantity of BNC cable connectors as shown on the T-series drawings.

B. Provide BNC cable connector meeting the following specifications:

1. BNC cable connector shall have brass or copper contacts.
2. BNC cable connector shall utilize a crimp termination.
3. BNC cable connector shall provide the proper impedance.
4. Acceptable Manufacturers:
    a. Kings
    b. Amphenol
    c. Canare

PART 3 - EXECUTION

3.1 GENERAL

A. Coordinate incorporation of the Work specified herein with other project work to facilitate a cohesive final product.

B. The installation recommendations contained within ASDI and Telecommunications Distribution Methods Manual are mandatory minimum standards and requirements.

C. Mount equipment and enclosures plumb and level.

D. Permanently installed equipment to be firmly and safely held in place. Design equipment supports to support loads imposed with a safety factor of at least five.

E. Seismic bracing shall be installed on appropriate equipment where local codes require such installation.

F. Verify all locations of equipment in all rooms with Owner's Representative, Owner, and Consultant.

G. Follow all manufacturer requirements and recommendations for the installation of all AV equipment.

3.2 CEILING MOUNTED SPEAKERS

A. Shall be wired in parallel according to Manufacturer specifications.

B. All speaker cabling shall be supported above the ceiling and may not rest on ceiling tiles or other structural devices.

C. A minimum five (5) foot service loop shall be provided and secured above each speaker.

3.3 RACK MOUNT POWER SEQUENCER

A. Contractor to ensure all equipment is powered in the correct order to avoid audible pops or click from the audio-video system in response to the power sequencing.

3.4 AUDIO VIDEO CONTROL SYSTEM

A. Control system shall be programmed to at a minimum switch between available AV sources, power on/off control audio source and system volume.

3.5 CABLING

A. All cable routing shall meet Owner's standards.

B. Run wire with conduit, exposed above accessible ceilings, below accessible floors, cable trays and in riser rooms.

C. Provide plenum cabling where required.

D. J-hooks shall be used so cables are supported at a maximum of 4 feet intervals. Cables shall not rest on light fixtures, ceiling tiles, conduits, sprinkler pipes, HVAC ducting, or any other building structure. Provide appropriate support for all horizontal to vertical transitions to keep weight of cable from damaging the point of transition.

E. Horizontal cabling shall be in groups of no more than 60 cables when supported by J-hooks.

F. Cable runs shall be continuous from device location to the point of termination. Properly installed transition points are acceptable.

G. Provide plastic cable ties or Velcro straps to bundle cabling. Electrical tape or adhesive backed cable ties are not acceptable.

H. Isolate cabling of different signals to minimize crosstalk. Separate wiring between microphone/line level circuits, loudspeaker circuits, and power circuits.

I. Dress, lace, and/or harness all wiring and cabling to prevent mechanical stress on electrical connections. Neatly tie cabling in bundles with cable lengths cut to minimize excess slack.

J. Provide adequate service loops to allow equipment racks to be pulled out for servicing.

K. To prevent against electrostatic hum, on unused shields, fold back shield over cable jacket and cover with heat-shrink tubing. Do not cut off unused shield.

L. Provide grommets and strain relief material where necessary to avoid abrasion of wire and excess tension on wire and cable.

3.6 COMPONENT CONNECTIONS

A. Prepare wire ends for attachment to components in accordance with manufacturer recommendations.

B. Wire nuts shall not be an acceptable means of connecting wire or cable.

3.7 LABELING

A. Cables, jacks, system components, etc. shall be labeled according to ANSI/EIA/TIA-606 specifications and in coordination with the District/Technology Consultant.

B. All Audio-Video cables shall be equipped with a self-laminating, wrap-around machine printed label at both ends of the cable and wiring label permanently affixed for easy identification.

C. Cover labels with clear heat-shrink tubing.

D. Hand-written labels are not acceptable.

E. Locate the cable designator at the origination and destination of each circuit within 3 inches of the termination.

3.8 AUDIO VIDEO PLATE INSTALLATION

A. Install plate mounted connectors rigidly attached to plates, plumb and level.

B. Install XLR type connectors in accordance with IED-268 standard.

3.9 TESTING

A. Prior to turning on the system, verify all electronic devices are properly grounded and each audio video AC receptacle has the proper hot, neutral, and ground connections.

B. Audio Testing:

1. Verify each amplifier channel is correctly wired by providing a test signal to each channel and verify the correct speakers are operating.
2. Adjust the input and output gain of each device to properly set the system gain.
3. Adjust the output level of each amplifier channel and/or speaker tap settings to achieve 85 dB ± 2 dB in the area covered by the respective speaker zone when the output of the sound reinforcement system is set to 0 dBu.
4. Equalize all loudspeakers to provide an acceptable frequency response based on the specifications of the provided loudspeakers.
5. Verify no hum or buzz is present in the system at all operating levels. If present, propose a resolution and correct the issue at no cost to the Owner.

3.10 TRAINING

A. After final completion, provide instruction to Owner designated personnel.

B. Provide a minimum of four (4) hours of training to the Owner. Plan for multiple training trips to the site. Training session(s) shall cover the following topics at a minimum:
1. System Equipment Connectivity
2. Device Configurations
3. Operation, maintenance, and upgrade procedures.

C. Training to be arranged with Owner personnel and be coordinated with Owner personnel and their needs.

D. Training plan, timeline, and agenda shall be provided to and signed off by Owner.

E. Warranty certificate and agreement shall be provided to Owner at initial training session.

F. Provide a digital video copy of the training sessions.

G. Contractor to be present at first two (2) uses of the facility.

3.11 SYSTEM ACCEPTANCE

A. Contractor shall demonstrate to the Owner that all systems have been installed per the plans and specifications and that all programming functions, display functions, control functions and all interfaced equipment operate as expected.

B. Contractor shall demonstrate to the Owner that all the end user staff has a working knowledge of how to operate the installed equipment and that the facilities staff also has a working knowledge of the troubleshooting methods for non-critical service problems.

C. Contractor shall collaborate with the General Contractor to complete all punch lists and work required to allow the General Contractor to close out his project in a timely manner. This will include but not limited to any work that would impact any final inspection for turnover of the building.

END OF SECTION

SECTION 27 41 43 - INTEGRATED A/V EQUIPMENT (MONITORS)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes, but is not limited to the following:
   1. This section includes the following:
      a. 75-inch LED screens.
      b. Articulated wall bracket

B. Related section includes the following:
   1. Division 01 – All Sections
   2. Division 27 – Communications Sections
   3. Division 28 – Electronic Safety and Security

1.3 SCOPE OF WORK

A. The work described includes all labor, material, testing and service necessary for the installation of the monitors as indicated on the drawings and/or described herein.

1.4 SUBMITTALS

A. Furnish to the Architect/Engineer complete shop drawings for approval, per the submittal Section.

B. See front end submittals section for more information.

C. See Common Work Results for Communications section 270500 for more submittal requirements.

1.5 CONTRACTOR QUALIFICATIONS

A. The Contractor or his subcontractor shall meet the minimum requirements as outlined in section – "Common Work Results for Communications".

1.6 QUALITY ASSURANCE

A. All equipment shall be UL listed.

B. All equipment and Installation Practices shall comply with the latest ANSI/NFPA-70 National Electric Code.

C. All equipment Installation Practices shall comply with the Local Electric Code.

D. All equipment shall comply with the latest ANSI-J-STD-607 Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications Standards.

E. All equipment and Installation Practices shall comply with the latest BICSI Telecommunications Distribution Methods Manuals Manual (TDMM).

F. All equipment shall comply with the latest ANSI TIA/EIA-568, 569, 606, 607, 862 standards.

G. Provide labeling per ANSI/EIA/TIA-606 requirement and in accordance with the Owner and Technology Consultant.

H. All equipment and installation shall comply with the latest InfoComm International Installation Handbook.

1.7 PRECEDENCE

A. The Contractor shall review the of the monitors specifications very carefully and shall provide the best quality equipment that meets and exceeds the bid specifications.

B. If the product specified is NO longer available, the contractor shall provide the replacement products and equipment that exceeds the absolute products with NO exceptions.

C. If the Contractor provides the replacement products on his own that does not meet the specification, then he shall be responsible to provide the new products/equipment at NO cost to the Owner.

1.8 WARRANTY

A. The audio video distribution system shall have a warranty as specified in section – "Demonstration and Training of Communications Systems". The warranty shall include all labor and material to replace all components that fail and or do not comply with the performance specifications.

1.9 RECORD DRAWINGS / OPERATION AND MAINTENANCE MANUALS

A. Provide record drawings and operation and maintenance manuals, as described in Sections – "Operation and Maintenance of Communications Systems" and "Common Work Results for Communications Systems".

PART 2 - PRODUCTS

2.1 AUDIO - VIDEO MOUNTS

A. Mounts shall comply with the following:
   1. Constructed of 14 gauge cold rolled steel and finished in black fused epoxy.
   2. TV Size Range: 40" - 86" screens weighing up to 125 lbs.
   3. Depth From Wall: 2.4" - Extension: 5.8"
   4. Tilt: 12º - Swivel: 10º

B. Wall Support
   1. Provide blocking or suitable reinforcement to allow a safe, secure wall bracket installation.
   2. Secure wall bracket with anchors suitable for the installation as recommended by the manufacturer.
      a. Provide information on the proposed anchors to the A/E for approval prior to installation.

C. Provide 65”-75” LED articulated universal wall brackets as follows:
   1. 40"-86" screens weighing up to 125 lbs.
   2. Integrated cable management.
   3. Adjustable tilt +15/-5 degrees.
   4. Scratch resistant black epoxy finish.
   5. Wall plate covers fasteners.
   6. Provide all mounting hardware, stud fasteners and concrete anchors.
   7. Approved Manufacturers:
      a. ECHO GEAR – EGLT2

2.2 LED SCREENS

A. Provide a 75-inch diagonal LED monitor with the following:
   1. Viewable Display Size - 74.50" (1892.3mm)
   2. Resolution - 3840 x 2160
   3. Aspect Ratio - 16:9
   4. High Dynamic Range - Dolby Vision, HDR10+, HDR10, HLG
   5. Backlight Type - Full Array LED
   6. Active Pixel Tuning - Yes
   7. UHD Upscale Engine - Spatial Scaling Engine
   8. Variable Refresh Rate Support - FreeSync Premium
   9. Dynamic Motion Rate - 60
   10. Clear Action - 180
   11. Input Lag - < 10ms @60Hz, measuring middle of screen
   12. HDMI INPUT Ports - 3 (sidex3) – Type - Side(x3)(v2.1)
   13. Protocol Wi-Fi - Wi-Fi 6 Dual Band
   14. Bluetooth - 5.2 with BLE
   15. Ethernet - 2 (rear1, back1)
   16. USB Ports - 1 (side1)
   17. TV Tuner – Yes
   18. Dimensions without Stand - 65.70" x 37.60" x 2.90" (1668.8mm x 955.0mm x73.7mm)
   19. Weight without Stand - 58.64lbs (26.6kg)
   20. Approved monitor manufacturers:
       a. VIZIO – M75Q6-L4

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install monitors as shown on the drawings. Coordinate locations with other trades.

B. The contractor shall provide a mock-up to review the installation of the monitors for the Owner, CM and architect/engineers review and approval.

C. Provide universal articulated wall LCD monitor brackets, mount, plates, supports, and blocking as needed for the specified monitors in all educational spaces unless otherwise noted

3.2 TESTING

A. Upon completion of the installation, all monitors shall be tested by the manufacturer's representative and all necessary adjustments must be made to assure compliance with this specification.

B. All testing shall be logged on a spreadsheet. See Section – "Operation and Maintenance of Communications Systems" for more information.

3.3 WARRANTY

A. The Contractor shall warrant all components as specified. The warranty shall include labor and material to replace all components that fails or do not comply with the performance specifications.

B. Response time shall be (2) hours for major failures and 24 hours for minor failures. A major failure shall be defined as a malfunction resulting in the loss of two or more video outlets.

C. The Contractor shall employ factory trained technical service personnel for service and maintenance of the system. The Contractor shall also instruct the owner's technical personnel in the operation, care and maintenance of the system.

END OF SECTION 27 41 43

DIVISION 28

ELECTRONIC SAFETY AND SECURITY

SECTION 28 05 10 - COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. When equipment furnished for or by the Owner is indicated on the Drawings or specified, this Contractor shall provide the proper electronic safety and security systems required; and make connections to Owner furnished equipment. The Security Contractor shall verify exact requirements and locations before installation.

B. Support from bar joists shall be allowed only at panel points in top or bottom chords.
   1. Loading shall not exceed 5 lbs./S.F. or 100 lbs. per panel point applied at the panel point.
   2. If support must occur between panel points, then threaded rods shall be dropped from both panel points, an adequate angle attached to both, and then the support attached to the angle as required.
   3. Supports shall not be attached to or through steel roof decks.
   4. Supports shall not be attached to the ceiling grid.

C. Related Work Specified Elsewhere: Division 07 Penetration Fire Stopping and Fire-Resistive Joint Sealants.

D. The Electronic Safety and Security Contractor shall take field measurements necessary for his Work, and shall be responsible for the accurate location and size of openings, recesses, slots, ferrules, and the like.

E. The Electronic Safety and Security Contractor shall be required to cooperate with "Other Trades" at the site and other Contractors in the coordination of his Work to avoid interferences with installations by other trades and Contractors.

F. Deviations from the Drawings, to avoid interferences, shall be considered a "Job Condition" and no additional compensation will be considered applicable. In the event that such interferences occur in course of the Work, due to an error, omission, or oversight by the Contractor, no additional compensation shall be allowed. Interferences which may occur during the course of construction shall be brought to the immediate attention of the Architect/Engineer, and the Architect/Engineer decision, confirmed in writing, shall be final.

G. Related work specified elsewhere: Communications sleeves

H. Related sections includes the following:
   1. Division 1 General Requirements.
   2. Division 26 Electrical
   3. Division 27 Communications
   4. Division 28 Electronic Safety and Security
   5. Division 270100 Operation and Maintenance of Communications System
   6. Division 270111 Demonstration, Training, and Warranty of Communications Systems

1.3 REFERENCES

A. Work shall be in accordance with codes, rules, ordinances, regulations of authorities, bodies, associations, and governments, having proper and legal jurisdiction. Specifically, the following requirements shall be met in their entirety.
   1. State and Local Rules, Regulations, Codes, Statutes and Ordinances

2. National Fire Protection Association - applicable requirements
3. National Board of Fire Protection
4. National Electric Code - applicable requirements
5. Other Codes and Standards as specifically noted in each Section of the Specifications

B. Electrical equipment shall be Underwriter's approved; also, shall meet requirements established by N.F.P.A., N.E.M.A., and A.N.S.I. and as specified hereinafter.

C. Abbreviation used in these Specifications:

N.E.C.	-	National Electric Code - Latest Edition adopted by the National Fire Protection Association
N.E.M.A.	-	National Electrical Manufacturers Association
I.P.C.E.A.	-	Insulated Power Cable Engineers Association
A.N.S.I.	-	American National Standards Institute, Inc.
F.C.C.	-	Federal Communications Commission
N.A.B.	-	National Association of Broadcasters
N.A.E.B.	-	National Association of Educational Broadcasters
I.T.L.	-	Independent Testing Laboratories
E.T.L.	-	Electrical Testing Laboratories
U.L.	-	Underwriters Laboratories
B.I.C.S.I.	-	Building Industry Consulting Service International
I.E.E.E.	-	The Institute of Electrical and Electronics Engineers, Inc.
T.I.A.	-	Telecommunications Industry Association
E.I.A.	-	Electronic Industries Association
R.C.D.D.	-	Registered Communication Distribution Designer
N.I.C.E.T.	-	National Institute of Certification in Engineering Technologies

1.4 SUBMITTALS

A. Provide shop drawing submittals and illustrations in accordance with requirements of Division 01 Submittal Procedures unless otherwise noted.

B. Provide shop drawings for each section separately as follows:
1. Provide one electronic file submittal for each section.(do not mix sections together)
2. Provide an index with a complete material list in the Specification sequence.
3. Each Specification Section shall have its own material list.
4. Provide product cut sheet for each specified item in sequence.
5. Each manufacturer's product cut sheet shall be identified/marked or highlighted.

C. Wiring diagrams and system layout drawings shall show all devices, equipment, home runs, labeling, etc. for the following systems:
1. Access control
2. Intrusion detection
3. Video surveillance system
4. Area of Refuge system.

D. Partial shop drawings WILL NOT BE ACCEPTABLE.

E. Each piece of shop drawing must be in the sequence of the specifications and must be clearly marked.

F. Submittals will be returned unchecked if they do not follow the outlines above.

G. Any Shop drawing submittals that are not required, and will be returned unchecked.

1.5 QUALITY ASSURANCE

A. The security cabling system components and equipment shall be listed by Underwriters Laboratories, Inc., and the components shall bear the UL label. The system shall be installed in accordance with requirements set by National Electric Code.

B. Installing Security System Contractor shall have five years experience in cable installations.

C. Security System Contractor shall submit a list of Jobs performed (minimum of five) in the past five years, equal to one specified herein. Also the contractor shall arrange a site visit of any job(s) selected by Architect/Engineer. The list shall include the following:
   1. Job location, and date when it was completed.
   2. Contact person at each job location.
   3. Brief description of each job.

D. Security cabling systems installation shall be provided by the Contractor's own work forces. Any subcontractor agreements for any portion of the work specified herein must meet with approval of the A/E and Owner. It is the intent of the contract to have one Contractor provide sole responsibility for material, labor and service for the systems.

E. Security Contractor shall have a staffed office (secretary, project manager, technicians, etc.) within (100) miles of the project and provide a service response time of a maximum of (2) hours from time of notification of major system failure.

F. The Security System Contractor must have on-staff, qualified security system engineers. The engineer shall test and certify the security systems installation.

1.6 TECHNOLOGY ABBREVIATIONS

A. Cable Pathway
   1. Shafts, conduits, surface mounted raceway, boxes, sleeves, floor boxes, cable tray, and floor penetrations that provide routing space for security cabling.

B. Equipment Rooms (ER)
   1. An Equipment Room (ER) is a special-purpose, security room that provides space and maintains a suitable operating environment for communications and/or computer equipment.
   2. An Equipment Room (ER) may contain terminations, interconnections, and cross-connects for telecommunications distribution cables as well as other low voltage equipment such as fire alarm panels, video-audio distribution, security, and other building signaling and communication systems.

C. Main Cross-Connect (MC)
   1. The Main Cross-Connect (MC) is typically located with the Equipment Room (ER) and is the main cross-connect and interconnection point for first level backbone.

D. Telecommunications Rooms (TR)
   1. A Telecommunications Room is a space used to make connections from the first level backbone cabling from the MC to the horizontal cabling. TRs contain telecommunications equipment, control equipment, cable terminations, and cross connect wiring.

E. Entrance Facility (EF)
   1. An Entrance Facility (EF) is a space within a building for both public and private network service cables to be terminated, protected and spliced to an indoor rated cable. This space may be in the MC or ER.

1.7 PRECEDENCE

A. Security System Contractors shall review both Drawings and Schedules of Security Systems.

B. If there is a discrepancy in the number of rooms and quantities between the Drawings and the Schedules, the Security Contractor shall include the higher of the two quantities.

C. If the products specified are no longer available, Security System Contractor shall provide replacement products that meet or exceed performance specifications of the original specified model at no cost to the Project.

D. If the Security System Contractor bids products that do not meet or exceed the performance specifications or the original specified model, the Security System Contractor shall provide products that meet the performance specifications as approved by the Architect/Engineer at no cost to the project.

1.8 COORDINATION

A. Coordinate arrangement, mounting, and support of electronic safety and security equipment:
   1. To allow maximum possible headroom, unless specific mounting heights that reduce headroom are indicated.
   2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
   3. To allow right of way for piping and conduit installed at required slope.
   4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components, as they are constructed.

C. Coordinate location of access panels and doors for electronic safety and security items that are behind finished surfaces, or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames".

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "penetration Firestopping".

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXPLANATION AND PRECEDENCE OF DRAWINGS

A. For purposes of clarity and legibility, the Telecommunication "T" drawings are essentially diagrammatic and, although size and location of equipment are closely drawn to scale whenever possible, Contractor shall make use of the data in all of the Contract Documents and shall verify this information at the building site.

B. The Drawings indicate required size and points of termination of wiring and other related items and may suggest proper routes for such items to conform to structure, avoid obstructions and preserve clearances. It is not intended that Drawings indicate every necessary offset. It shall be the Work of the Security System Contractor to install each item in a manner to conform to structure, avoid obstructions, preserve headroom, and keep opening and passageways clear.

C. It is intended that apparatus be located in coordination with architectural elements, and shall be installed at exact height and location stipulated.

D. Communications Contractor shall fully inform himself regarding peculiarities and limitations of the spaces available for the installation of work and materials provided under his Contract.

E. Security System Contractor shall carefully examine existing conditions, existing wiring and other materials on the premises and compare the documents with the existing conditions. Variances and necessary changes shall be adjusted by appropriate modifications.

F. Security System Contractor shall carefully examine the Division 26 drawings for pathway, sleeves, conduits, power requirements, etc.

3.2 PERMITS, FEES, REGULATIONS, INSPECTIONS

A. Security System Contractor shall arrange and pay for permits, fees, and inspections required in connection with his work for this project, from local, county, state and public agencies, and shall obtain permits from railroad, state highway and utility companies.

B. Work shall be inspected by approved local and state inspection bureaus, Electrical Inspection Agency, and/or authority, and local utilities.

C. Upon completion of the Work, the Security System Contractor shall furnish to the Architect/Engineer, a certification of inspection and approval from said Bureau or Agency before final payment on contract will be allowed.

3.3 HOISTS, RIGGING, TRANSPORTATION, AND SCAFFOLDING

A. Security System Contractor shall provide scaffolding, staging, cribbing, tackle, hoists, and rigging necessary for placing of his materials and equipment in their proper places in the Project.

B. Security System Contractor shall pay costs for transportation of materials and equipment to the job site and shall include such costs in his proposal.

C. Scaffolding and hoisting equipment shall comply with requirements of pertinent Federal, State, and Local Laws and Codes.

3.4 PROTECTION

A. In addition to other requirements of the Contract, the Security System Contractor shall provide various types of protection as follows:
   1. Protect finished floors during installation, etc.
   2. Protect equipment, finished surfaces from paint droppings, insulation adhesive, and sizing droppings by use of drop cloths.
   3. Protect countertops during cutting for grommets.
   4. Protect cameras, door controllers, motion detectors, etc. from dirt.

B. Communications Contractor shall be responsible for the protection of finished work from other trades from damage or defacement by his operations and shall remedy such damage at his own expense.

3.5 CUTTING AND PATCHING

A. Contractor shall do his own cutting and patching of building materials and piping, as required for the installation of his Work, but no structural members shall be cut without the approval of the Architect and such cutting shall be done in a manner directed by the Architect.

B. Patching of and repair of damage to Work in place shall be done in a neat and workmanlike manner, meeting with the approval of the Architect. Contractor whose operations require cutting of work in place, or who causes damage which entails repairs of such work, shall employ

mechanics of the particular trade whose work must be cut or which is damaged, and shall pay the costs of such patching or repair.

C. Contractor shall be responsible for any additional sleeves and cores should they be required. NO change order shall be issued to provide sleeves in addition to those provided under the electrical contract.

3.6 FINAL COMPLETION

A. Security system installation shall be cleaned prior to Substantial Completion of the Work.

B. Retouch or repaint factory painted prime and finish coats, where scratched or damaged. Whenever retouching will not be satisfactory, the Architect/Engineer may require complete repainting until the desired appearance is obtained.

C. Security System Contractor shall clean equipment; restore damaged materials; remove grease, oil, chemical, paint spots, and stains; and generally leave the Work in A-1 condition.

D. Security System Contractor and his subcontractors, on completion of his Work, shall remove tools, equipment, surplus materials, and rubbish pertaining to his operations, and pay costs for such removal and disposal from the site.

3.7 GUARANTEE AND WARRANTY

A. Security System Contractor shall submit written certificates, warranting that each item of equipment furnished complies with the requirements of the Drawings and Specifications.

3.8 SUPERVISION AND COOPERATION

A. Work by the Security System Contractor under this Division shall include the services of an experienced superintendent, who shall be constantly in charge of the Work, together with the qualified journeymen, helpers, and laborers required to properly unload, install, connect, adjust, start, operate, and test the Work involved, including related equipment and materials furnished under other contracts or by the Owner.

3.9 COLOR CHART

A. All security cables and connectors to have the following colors:

Description Item	Jack	Cable	I.D.	Notes
Security Cable	-	White	S	Multi-conductors
Door Contact	-	White	DC	22/2
Power Transfer	-	Gray	PT	12/6 and 18/6
Request for Exit	-	Blue	REQ	18/4 or 22/4
Card Reader	-	Orange	CR	22/6
Motion Detector	-	White	MD	22/4
CCTV – IP	-	White	CCTV	4 pair UTP cable
Key Pad	-	White	K	22/6

Knox Box	-	Orange	KB	18/4
Lock Down	-	Red	LD	18/4
Door Release	-	Red	DR	18/4

3.10 SECURITY SYSTEMS DEMOLITION

A. Security System Cabling Contractor shall remove the following:
   1. All 4 pair UTP cabling
   2. All multi-pair UTP cabling.
   3. All coax cabling
   4. All fiber optic cabling
   5. All connectors patch panels, etc.
   6. All cover plates, jacks, etc.
   7. All cabinets/racks, etc.
   8. All security system equipment
   9. All security system cabling

B. Coordinate demolition and removal of security equipment with the Owner.

3.11 MATERIAL LIST

A. Contractors shall provide with their bids [or 24 hours after bid] complete materials list on THEIR LETTER HEAD showing manufacturers name, catalog numbers, description, and quantities for each item in each system, per section number as follows:
   1. Manufacturers Name.
   2. Manufacturer's catalog number.
   3. Quantities.
   4. Bonds.
   5. Training.
   6. Project managements.
   7. Shop drawings.
   8. Close out.
   9. Warranties.
   10. Allowance.

B. The lowest responsible bidders shall provide unit pricing for all materials as described in Part "A" above, within 24 hours with NO exceptions.

C. If a subcontractor is utilized for any portion of the work, all contact information, references, material list, and any other information shall be provided per the specified contract bid requirements.

D. If the above requirements is NOT provided, then the contractor is considered a none responsive bidder subject to disqualification.

3.12 RECORD DRAWINGS

A. Record Drawings shall be provided to the Owner/Architect/Engineer in the latest Auto CAD releases. Mark-up drawings or scanned drawings are not acceptable.

B. CAD files will be available for all Contractors:
   1. PDF — Drawing sheet from construction Document set. — $50 first drawing, $15 each additional drawing

2.	Printed Sheet or set	Complete set of documents	Contact Printing Company
3.	AutoCAD .dwg file	Plan base sheet - .dwg drawing file of each floor. Includes base plans and equipment, etc.	$100 each – First 3 plans $75 each additional plan
4.	Specifications	1 volume	$200

END OF SECTION 28 05 10

SECTION 28 05 23 - CONDUCTORS AND CABLES FOR SECURITY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes, but is not limited to the following:
   1. RS-232 cabling.
   2. Door Contact
   3. Card Reader.
   4. Keypad.
   5. Electric lock.
   6. Door Release.
   7. Lock Down.
   8. RS485.
   9. REX.
   10. Knox Box.
   11. Mics. cabling

B. Related Sections:
   1. Division 26, Electrical
   2. Division 27, Communications
   3. Division 28, Safety and Security

1.3 DEFINITIONS

A. BICSI: Building Industry Consulting Service International.

B. EMI: Electromagnetic interference.

C. IDC: Insulation displacement connector.

D. RCDD: Registered Communications Distribution Designer.

E. UTP: Unshielded twisted pair.

F. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.

G. Open Cabling: Passing telecommunications cabling through open space (e.g., between the studs of a wall cavity).

1.4 SUBMITTALS

A. Quality Assurance/Control Submittals:
   1. Product Data: For each type of product indicated.
      a. For coaxial cable, include the following installation data for each type used:
         1) Nominal OD.
         2) Minimum bending radius.
         3) Maximum pulling tension.
   2. Qualification Data: For qualified layout technician, installation supervisor, and field inspector.
   3. Source quality-control reports.
   4. Field quality-control reports.

B. Closeout Submittals:
   1. Maintenance Data: For wire and cable to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Flame-Spread Index: 25 or less.
   2. Smoke-Developed Index: 50 or less.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with UL 50.

D. TIA/EIA-607 Telecommunications grounding.

E. Latest edition of BISCI – TDMM – manual

F. Americans with Disabilities Act (ADA)

G. Federal Communications Commission, Part 15

H. Sound System Engineering (Davis and Patronics) 3rd Edition 2006.

I. Audio System Design and Installation (Giddings) 1990.

1.6 WARRANTY

A. The security system shall carry a warranty as specified in Section "Demonstration and Training of Communications Systems".

1.7 TRAINING

A. Provide training per Section "Demonstration and Training of Communications Systems".

1.8 RECORD DRAWINGS/OPERATION AND MAINTENANCE MANUALS

A. Provide record drawings and operation and maintenance manuals as described in Sections "Operation and Maintenance of Communications" and "Common Works Results for Communication Systems".

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS

A. Manufacturers:
   1. Belden CDT Inc.; Electronics Division.
   2. Carol Brand; a division of General Cable Technologies Corporation.
   3. Coleman Cable Inc.
   4. Genesis Cable Products; Honeywell International, Inc.
   5. West Penn Wire; a division of Belden CDT Inc.

2.2 PATHWAYS

A. Support of Open Cabling: NRTL labeled for support of 4 pair UTP, designed to prevent degradation of cable performance and pinch points that could damage cable.
   1. Support brackets with cable tie slots for fastening cable ties to brackets.

2. Lacing bars, spools, J-hooks, and D-rings.
3. Straps and other devices.
4. Cable Ties: Comply with Division 27 Section "Identification of Communications Systems."

B. Cable Trays: Comply with requirements in Division 26 Section "Cable Trays for Electrical Systems."

C. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems."
1. Card reader.
2. Door contact.
3. Request for exit motion detector
4. Keypad
5. 1/2-inch conduit in door frames for all security devices, as shown on Drawings.

2.3 RS-232 CABLES

A. Standard Cable: NFPA 70, Type CM.
1. Paired 1,2,3,4 pair(s), No. 22 AWG, stranded (7x30) copper conductors.
2. Polypropylene insulation.
3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
4. PVC jacket.
5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) copper drain wire.
6. Flame Resistance: Comply with UL 1581.

B. Plenum-Rated Cable: NFPA 70, Type CMP.
1. Paired 1,2,3,4 pair(s), No. 22 AWG, stranded (7x30) copper conductors.
2. Plastic insulation.
3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
4. Plastic jacket.
5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) copper drain wire.
6. Flame Resistance: Comply with NFPA 262.

2.4 DOOR CONTACT AND WINDOW SWITCHES

A. Manufacturers:
1. Honeywell.
2. Amseco; Division of Kobishi America, Inc.
3. FBII; Pittway Corporation.
4. GE Interlogix; General Electric Company.
5. GRI
6. DSC

B. Description: Balanced-magnetic switch, complying with UL 634, installed on frame with integral overcurrent device to limit current to 80 percent of switch capacity. Bias magnet and minimum of two encapsulated reed switches shall resist compromise from introduction of foreign magnetic fields.

C. Flush-Mounted Switches: Unobtrusive and flush with surface of door and window frame.

D. Overhead Door Switch: Balanced-magnetic type, listed for outdoor locations, and having door-mounting magnet and floor-mounting switch unit.

2.5 DOOR CONTACT CABLE

A. Standard Cable: NFPA 70, Type CM
1. Paired, 1 pair, No. 22 AWG, stranded (7 x 30) copper conductors.

2. Polyolefin insulation.
3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
4. PVC jacket.
5. Pairs are cabled on common axis with No. 22 AWG, stranded (7 x 30) copper drain wire.
6. Flame Resistance: Comply with UL 1581.

B. Plenum-rated Cable: NFPA 70, Type CMP
1. Paired, 1 pair, No. 22 AWG, stranded (7 x 30) copper conductors.
2. Fluoropolymer installation.
3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
4. Plastic jacket.
5. Pairs are cabled on common axis with No. 22 AWG, stranded (7 x 30) copper drain wire.
6. Flame Resistance: Comply with NFPA 262

2.6 MOTION DETECTOR CABLE

A. Standard Cable: NFPA 70, Type CM
1. Paired, 2 pair, No. 22 AWG, stranded (7 x 30) copper conductors.
2. Polyolefin insulation.
3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
4. PVC jacket.
5. Pairs are cabled on common axis with No. 22 AWG, stranded (7 x 30) copper drain wire.
6. Flame Resistance: Comply with UL 1581.

B. Plenum-rated Cable: NFPA 70, Type CMP
1. Paired, 2 pair, No. 22 AWG, stranded (7 x 30) copper conductors.
2. Fluor polymer installation.
3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
4. Plastic jacket.
5. Pairs are cabled on common axis with No. 22 AWG, stranded (7 x 30) copper drain wire.
6. Flame Resistance: Comply with NFPA 262

2.7 CARD READER CABLES

A. Standard Cable: NFPA 70, Type CM.
1. Paired 3 pair(s), No. 22 AWG, stranded (7x30) copper conductors.
2. Polypropylene insulation.
3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
4. PVC jacket.
5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) copper drain wire.
6. Flame Resistance: Comply with UL 1581.

B. Plenum-Rated Cable: NFPA 70, Type CMP.
1. Paired 3 pair(s), No. 22 AWG, stranded (7x30) copper conductors.
2. Plastic insulation.
3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
4. Plastic jacket.
5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) copper drain wire.
6. Flame Resistance: Comply with NFPA 262.

2.8 KEYPAD CABLES

A. Standard Cable: NFPA 70, Type CM.
1. Paired 3 pair(s), No. 22 AWG, stranded (7x30) copper conductors.

2. Polypropylene insulation.
3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
4. PVC jacket.
5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) copper drain wire.
6. Flame Resistance: Comply with UL 1581.

B. Plenum-Rated Cable: NFPA 70, Type CMP.
1. Paired 3 pair(s), No. 22 AWG, stranded (7x30) copper conductors.
2. Plastic insulation.
3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
4. Plastic jacket.
5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) copper drain wire.
6. Flame Resistance: Comply with NFPA 262.

2.9 RS-485 CABLE

A. Standard Cable: NFPA 70, Type CM.
1. 18 AWG, 2 pair stranded (7 x 26) bare copper conductors.
2. PVC insulation.
3. Individually shielded.
4. PVC overall jacket.
5. Flame Resistance: Comply with UL 1581.

B. Plenum-Rated Cable: NFPA 70, Type CMP.
1. 18 AWG, 2 pair stranded (7 x 26) bare copper conductors.
2. Fluorinated ethylene propylene insulation.
3. Individually shielded.
4. Fluorinated ethylene propylene jacket.
5. Flame Resistance: NFPA 262, Flame Test.
6. Jacket color: Gray
7. Operating voltage: 300 V RMS

2.10 REQUEST FOR EXIT MOTION DETECTOR CABLE

A. 18 AWG, 4 conductors, stranded bare copper conductors, unshielded with an overall jacket.
1. 4 conductor, 18 AWG
2. Stranded 7 x 26
3. Polymer alloy insulation
4. Flexible plenum jacket material
5. Operating voltage: 300 V RMS
6. Unshielded with overall jacket
7. Flame resistance: NFPA262
8. UL listed
9. CMP rated for plenum

2.11 ELECTRIC LATCH/LOCK CABLE

A. 18 AWG, 6 conductors, stranded bare copper conductors, unshielded with an overall jacket.
1. 6 conductor, 18 AWG
2. Stranded 7 x 26
3. Polymer alloy insulation
4. Flexible plenum jacket material
5. Operating voltage: 300 V RMS
6. Unshielded with overall jacket
7. Flame resistance: NFPA262
8. UL listed
9. CMP rated for plenum

2.12 KNOX BOX CABLE

A. 18 AWG, 4 conductors, stranded bare copper conductors, unshielded with an overall jacket.
   1. 4 conductor, 18 AWG
   2. Stranded 7 x 26
   3. Polymer alloy insulation
   4. Flexible plenum jacket material
   5. Operating voltage: 300 V RMS
   6. Unshielded with overall jacket
   7. Flame resistance: NFPA262
   8. UL listed
   9. CMP rated for plenum

2.13 DOOR RELEASE CABLE

A. 18 AWG, 4 conductors, stranded bare copper conductors, unshielded with an overall jacket.
   1. 4 conductor, 18 AWG
   2. Stranded 7 x 26
   3. Polymer alloy insulation
   4. Flexible plenum jacket material
   5. Operating voltage: 300 V RMS
   6. Unshielded with overall jacket
   7. Flame resistance: NFPA262
   8. UL listed
   9. CMP rated for plenum

2.14 LOCK DOWN CABLE

A. 18 AWG, 4 conductors, stranded bare copper conductors, unshielded with an overall jacket.
   1. 4 conductor, 18 AWG
   2. Stranded 7 x 26
   3. Polymer alloy insulation
   4. Flexible plenum jacket material
   5. Operating voltage: 300 V RMS
   6. Unshielded with overall jacket
   7. Flame resistance: NFPA262
   8. UL listed
   9. CMP rated for plenum

2.15 LOW-VOLTAGE CONTROL CABLE

A. Paired Lock Cable: NFPA 70, Type CMG.
   1. 1 pair, twisted, No. 16 AWG, stranded (19x29) copper conductors.
   2. PVC insulation.
   3. Unshielded.
   4. PVC jacket.
   5. Flame Resistance: Comply with UL 1581.

B. Plenum-Rated, Paired Lock Cable: NFPA 70, Type CMP.
   1. 1 pair, twisted, No. 16 AWG, stranded (19x29) copper conductors.
   2. PVC insulation.
   3. Unshielded.
   4. PVC jacket.
   5. Flame Resistance: Comply with NFPA 262.

2.16 ACCESS CONTROLLER INPUT CABLE

A. Paired Input Cable: 1 pair, twisted, No. 22 AWG, stranded (7x30) copper conductors, polypropylene insulation, overall aluminum foil-polyester tape shield with No. 22 AWG, stranded (7x30) copper drain wire, 100 percent shield coverage, and PVC jacket.
   1. NFPA 70, Type CMR.
   2. Flame Resistance: UL 1666 Riser Flame Test.

B. Plenum-Type, Paired Input Cable: 1 pair, twisted, No. 22 AWG, stranded (7x30) copper conductors, fluorinated-ethylene-propylene insulation, aluminum foil-polyester tape shield (foil side out), with No. 22 AWG drain wire, 100 percent shield coverage, and plastic jacket.
   1. NFPA 70, Type CMP.
   2. Flame Resistance: NFPA 262 Flame Test.

2.17 AC TRANSFORMER CABLE

A. Paired AC Transformer Cable: 1, 2 , 3 or 4 pair, twisted, No. 18 AWG, stranded (7x26) copper conductors, PVC insulation, unshielded, and PVC jacket.
   1. NFPA 70, Type CMG.

B. Plenum-Type, Paired AC Transformer Cable: 1,2,3 or 4 pair, twisted, No. 18 AWG, stranded (19x30) copper conductors, fluorinated-ethylene-propylene insulation, unshielded, and plastic jacket.
   1. NFPA 70, Type CMP.
   2. Flame Resistance: NFPA 262 Flame Test.

2.18 ELEVATOR TRAVEL CABLE

A. Elevator Travel Cable: Steel center core, with shielded, twisted pairs, No. 20 AWG conductor size.
   1. Steel Center Core Support: Preformed, flexible, low-torsion, zinc-coated, steel wire rope; insulated with 60 deg C flame-resistant PVC and covered with a nylon or cotton braid.
   2. Shielded Pairs: Insulated copper conductors; color-coded, insulated with 60 deg C flame-resistant PVC; each pair shielded with bare copper braid for 85 percent coverage.
   3. Jute Filler: Electrical grade, dry.
   4. Binder: Helically wound synthetic fiber.
   5. Braid: Rayon or cotton braid applied with 95 percent coverage.

B. Jacket: 60 deg C PVC specifically compounded for flexibility and abrasion resistance. UL VW-1 and CSA FT1 flame rated.

2.19 CONTROL-CIRCUIT CONDUCTORS

A. Class 1 Control Circuits: Stranded copper, Type THHN-THWN, in raceway complying with UL 83.

B. Class 2 Control Circuits: Stranded copper, Type THHN-THWN, in raceway; power-limited cable, concealed in building finishes; or power-limited tray cable, in cable tray complying with UL 83; unless indicated otherwise.

C. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type TW or TF, complying with UL 83.

PART 3 - EXECUTION

3.1 INSTALLATION OF PATHWAYS

A. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.

B. Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems." for installation of conduits and wireways.

C. Install manufactured conduit sweeps and long-radius elbows whenever possible.

D. Pathway Installation in Equipment Rooms:
1. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.
2. Install cable trays to route cables if conduits cannot be located in these positions.
3. Secure conduits to backboard when entering room from overhead.
4. Extend conduits 3 inches above finished floor.
5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

E. Backboards: Install backboards with 96-inch dimension vertical. Butt adjacent sheets tightly, and form smooth gap-free corners and joints.

3.2 INSTALLATION OF CONDUCTORS AND CABLES

A. Provide all cabling for the access control system.

B. Provide all cabling for the Intrusion alarm system.

C. Provide all cabling for the CCTV camera system.

D. Comply with NECA 1.

E. General Requirements for Cabling:
1. Comply with TIA/EIA-568-B.1.
2. Comply with BICSI ITSIM, Chapter. 6, "Cable Termination Practices."
3. Install 110-style IDC termination hardware unless otherwise indicated.
4. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
5. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
6. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
7. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
8. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
9. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

F. UTP Cable Installation: Comply with Division 27 Section "Communications Copper Horizontal Cabling."

G. Optical Fiber Cable Installation: Comply with Division 27 Section "Communications Fiber Optical Backbone Cabling."

H. Coaxial Cable Installation: Comply with Division 27 Section "Communications Coaxial Horizontal Cabling."

I. Open-Cable Installation:
   1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
   2. Suspend copper cable not in a wireway or pathway a minimum of 8 inches above ceilings by cable supports not more than 60 inches apart.
   3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

J. Installation of Cable Routed Exposed under Raised Floors:
   1. Install plenum-rated cable only.
   2. Install cabling after the flooring system has been installed in raised floor areas.
   3. Coil cable 72 inches long shall be neatly coiled not less than 12 inches in diameter below each feed point.

K. Separation from EMI Sources:
   1. Comply with BICSI TDMM and TIA/EIA-569-A recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
   2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
      a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.
      b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.
      c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.
   3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
      a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
      b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.
      c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.
   4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
      a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
      b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.
      c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.
   5. Separation between Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.
   6. Separation between Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.3 CABLE APPLICATION

A. Comply with EIA/TIA-569, "Commercial Building Standard for Telecommunications Pathways and Spaces."

B. Cable application requirements are minimum requirements and shall be exceeded if recommended or required by manufacturer of system hardware.

C. RS-232 Cabling: Install at a maximum distance of 50 feet.

D. RS-485 Cabling: Install at a maximum distance of 4000 feet.

E. Card Readers:
   1. Install number of conductor pairs recommended by manufacturer for the functions specified.
   2. Unless manufacturer recommends larger conductors, install No. 20 AWG wire if maximum distance is 500 feet.

3. For greater distances, install "extender" or "repeater" modules recommended by manufacturer of the Controller.
4. Install minimum No. 18 AWG shielded cable to readers that draw 50 mA or more.

F. Install minimum No. 16 AWG cable from Controller to electrically powered locks. Do not exceed 500 feet.

G. Install minimum No. 18 AWG ac power wire from transformer to Controller, with a maximum distance of 25 feet.

3.4 CONNECTIONS

A. Comply with requirements in Division 28 Section "Intrusion Detection" for connecting, terminating, and identifying wires and cables.

B. Comply with requirements in Division 28 Section "Access Control" for connecting, terminating, and identifying wires and cables.

C. Comply with requirements in Division 28 Section "Video Surveillance" for connecting, terminating, and identifying wires and cables.

3.5 FIRESTOPPING

A. Comply with requirements in Division 07 Section "Firestopping."

B. Comply with TIA/EIA-569-A, "Firestopping" Annex A.

C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.6 GROUNDING

A. For communications wiring, comply with ANSI-J-STD-607-A and with BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. For low-voltage wiring and cabling, comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems."

3.7 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Division 27 Section "Identification for Communications Systems."

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:
1. Test and inspect optical fiber cabling according to Division 27 Section "Communications Fiber Optical Backbone Cabling."
2. Test and inspect UTP cabling according to Division 27 Section "Communications Copper Horizontal Cabling."
3. Test and inspect coaxial cabling according to Division 27 Section "Communications Coaxial Horizontal Cabling."
4. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.

C. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a guide, or transfer the data from the instrument to the computer, save as text files, print, and submit.

D. End-to-end cabling will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

END OF SECTION 28 05 23

SECTION 28 13 10 – ACCESS CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes, but is not limited the following:
   1. Application software – AVIGILON ACCESS CONTROL SERVER EXISTING (additional licenses for any new doors will be needed)
   2. Controller – LP1502 INTELLIGENT CONTROLLER
   3. HID Card Reader – SIGNO READER 40 (ac-hid-reader-signo-40nks)
   4. Cards
   5. Fobs
   6. Power supplies
   7. Enrollment center
   8. Photo ID Card software.
   9. Request for exit motion detector.
   10. Push-button switch
   11. Door magnetic contacts
   12. Motion Detectors
   13. Interfaces
   14. Alarm panel
   15. Cabling
   16. Miscellaneous items

B. This Section includes but is not limited to adding to an existing Avigilon security access system consisting of field-installed Non-proprietary Controllers connected by a high-speed electronic data transmission network. The security access system shall have the following:

   1. Access Control:
      a. Regulating access through doors and gates.
      b. Visitor assignment access supported or optional application.
      c. Surge and tamper protection.
      d. Credential cards and readers
      e. Credential creation and credential holder database and management.
      f. Monitoring of field-installed devices.
      g. Both Central and Remote Reporting.

   2. Security:
      a. Video and camera control.
      b. Interface with paging, HVAC, elevator control, Burglar Alarm Systems.

C. Related Sections:

   1. Division 8 Sections, Door Hardware

   2. Division 14 Sections, Conveying Equipment

   3. Division 23 Sections, Heating, Ventilation, and Air Conditioning

   4. Division 26 Sections, Electrical

   5. Division 27 Sections, Communications

   6. Division 28 Sections Electronic Safety and Security

1.3 DEFINITIONS

A. ABA Track: Magnetic stripe that is encoded on track 2, at 75-bpi density in binary-coded decimal format; for example, 5-bit, 16-character set.

B. CCTV: Closed-circuit television.

C. Central Station: A PC with software designated as the main controlling PC of the security access system. Where this term is presented with initial capital letters, this definition applies.

D. Controller: An intelligent peripheral control unit that uses a computer for configuring its operational data and stores the data to manage and control device controllers in a fully distributed manner. Where this term is presented with an initial capital letter, this definition applies.

E. Sub-Controller: A remotely managed field-installed device controller connected to a user specified main Controller to manage site control and monitoring devices for access control, alarm access, alarm monitoring and site control outputs. Where this term is presented with initial capital letters, this definition applies.

F. Non-Proprietary: Control hardware that has a commercially available operational protocol allowing multiple developing manufacturers to write code to support the hardware. Where this term is presented with an initial capital letter, this definition applies.

G. CPU: Central processing unit.

H. Credential: Data assigned to an entity and used to identify that entity.

I. Dpi: Dots per inch.

J. File Server: A PC in a network that stores the programs and data files shared by users.

K. Identifier: A credential card, keypad personal identification number or code, biometric characteristic, or other unique identification entered as data into the entry-control database for the purpose of identifying an individual. Where this term is presented with an initial capital letter, this definition applies.

L. I/O: Input/Output.

M. LAN: Local area network.

N. LED: Light-emitting diode.

O. Location or Site: A Location on the network having a PC-to-Controller communications link, with additional Controllers at the Location connected to the PC-to-Controller link with RS-485 communications loop. Where this term is presented with an initial capital letter, this definition applies.

P. PC: Personal computer. This acronym applies to the Central Station, workstations, and file servers.

Q. PCI Bus: Peripheral component interconnect; a peripheral bus providing a high-speed data path between the CPU and peripheral devices (such as monitor, disk drive, or network).

R. PDF: (Portable Document Format.) The file format used by the Acrobat document exchange system software from Adobe.

S. RF: Radio frequency.

T. ROM: Read-only memory. ROM data are maintained through losses of power.

U. RS-232: A TIA/EIA standard for asynchronous serial data communications between terminal devices. This standard defines a 25-pin connector and certain signal characteristics for interfacing computer equipment.

V. RS-485: A TIA/EIA standard for multipoint communications.

W. TCP/IP: Transport control protocol/Internet protocol incorporated into Microsoft Windows.

X. TWAIN: (Technology without an Interesting Name.) A programming interface that lets a graphics application, such as an image editing program or desktop publishing program, activate a scanner, frame grabber, or other image-capturing device.

Y. UPS: Uninterruptible power supply.

Z. WAN: Wide area network.

AA. WAV: The digital audio format used in Microsoft Windows.

BB. Wiegand: Patented magnetic principle that uses specially treated wires embedded in the credential card.

CC. Windows: Operating system by Microsoft Corporation.

DD. Workstation: A PC with software that is configured for specific limited security system functions.

EE. WYSIWYG: (What You See Is What You Get.) Text and graphics appear on the screen the same as they will print.

1.4 SYSTEM DESCRIPTION

A. Existing System consists of a PC-based Central Station, one or more networked PC-based workstations,] and field-installed LP1502 Intelligent Controllers and Sub-controllers, connected by a high-speed electronic data transmission network.
   1. System Software: Based on 32-bit, Microsoft Windows central-station, workstation operating system, server operating system, and application software. Software shall have the following capabilities:
      a. Multiuser multitasking to allow for independent activities and monitoring to occur simultaneously at different workstations.
      b. Graphical user interface to show pull-down menus and a menu tree format that complies with interface guidelines of Microsoft Windows operating system.
      c. Password-protected operator login and access.

B. Network(s) connecting PCs and Controllers shall consist of the following:
   1. Local area, IEEE 802.3 Fast Ethernet 10/1000 BASE-TX, star topology network based on TCP/IP.

1.5 PERFORMANCE REQUIREMENTS

A. Security access system shall use a single database for access-control and credential-creation functions.

B. Distributed Processing: System shall be a fully distributed processing system so that information, including time, date, valid codes, access levels, and similar data, is downloaded to Controllers so that each Controller shall make local access-control and any pre-configured user operational decisions for that Location. Do not use intermediate Controllers for access control. If communications to Central Station are lost, all Controllers shall automatically buffer event transactions until communications are restored, at which time buffered events shall be uploaded to the Central Station.

C. Number of Locations: The Central Station Software shall have the expansion capability to Support an unlimited number of separate Locations and Sites and support combinations of direct-connect or TCP/IP LAN connections to each Location.

1. Each Location shall have its own database and history in the Central Station. Locations may be combined to share a common database.

1.6 SUBMITTALS

A. Shop Drawings:

1. Wiring Diagrams. Show typical wiring schematics including the following:
   a. Door controller.
   b. Local controller.
   c. Card readers
   d. Power supplies.
   e. Door contact
   f. Interfaces
   g. Misc. items
2. Battery and charger calculations for Central Station, workstations, and Controllers.

B. Quality Assurance/Control Submittals:

1. Product Data: For each type of product indicated. Include operating characteristics, furnished specialties, and accessories. Reference each product to a location on Drawings. Test and evaluation data presented in Product Data shall comply with SIA BIO-01.
2. Project planning documents as specified in Part 3.
3. Samples: For workstation outlets, jacks, jack assemblies, and faceplates for color selection and evaluation of technical features.
4. Field quality-control test reports.

C. Closeout Submittals:

1. Operation and Maintenance Data: For security system to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data" include the following:
   a. Microsoft Windows software documentation.
   b. PC installation and operating documentation, manuals, and software for the PC and all installed peripherals. Software shall include system restore, emergency boot diskettes, and drivers for all installed hardware. Provide separately for each PC.
   c. Hard copies of manufacturer's specification sheets, operating specifications, design guides, user's guides for software and hardware, and PDF files on CD-ROM of the hard-copy submittal.
   d. System installation and setup guides, with data forms to plan and record options and setup decisions.
2. Extra Materials: Receipt for extra materials.

D. See front end submittals section for more information.

E. See Common Work Results For Communications section 270500 for more submittal requirements.

F. See Common Work Results For Electronic Safety and Security 280510 for more submittal requirements.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: The contractor shall be a certified dealer for the product they propose and shall have a fully trained and approved by manufacturer.
   1. Cable installer must have on staff a registered communication distribution designer certified by Building Industry Consulting Service International.

B. Source Limitations: Obtain Central Station, workstations, Controllers, Identifier readers, and all software through one source from a single manufacturer.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with NFPA 70, "National Electrical Code."

E. Comply with NFPA 730- Guide for Premises Security.

F. Comply with NFPA 731- Standard for the Installation of Electronic Premises Security.

G. Comply with SIA DC-03 and SIA DC-07.

H. TIA/EIA-607 Telecommunications grounding.

I. Latest edition of BISCI – TDMM – manual

J. Americans with Disabilities Act (ADA)

K. Federal Communications Commission, Part 15

L. Sound System Engineering (Davis and Patronics) 3rd Edition 2006.

M. Provide labeling per ANSI/EIA/TIA-606 requirement and in accordance with the Owner and Technology Consultant.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Central Station, Workstations, and Controllers:
   1. Store in temperature- and humidity-controlled environment in original manufacturer's sealed containers. Maintain ambient temperature between 50 and 85 deg F, and not more than 80 percent relative humidity, non-condensing.
   2. Open each container; verify contents against packing list, and file copy of packing list, complete with container identification for inclusion in operation and maintenance data.
   3. Mark packing list with designations that have been assigned to materials and equipment for recording in the system labeling schedules that are generated by cable and asset management system specified in Part 2.
   4. Save original manufacturer's containers and packing materials and deliver as directed under provisions covering extra materials.

1.9 PROJECT CONDITIONS

A. Environmental Conditions: System shall be capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:

1. Control Station: Rated for continuous operation in ambient conditions of 60 to 85 deg F and a relative humidity of 20 to 80 percent, non-condensing.

2. Interior, Controlled Environment: System components, except central-station control unit, installed in air-conditioned interior environments shall be rated for continuous operation in ambient conditions of 36 to 122 deg F dry bulb and 20 to 90 percent relative humidity, non-condensing. NEMA 250, Type 1 enclosure.

3. Interior, Uncontrolled Environment: System components installed in non-temperature-controlled interior environments shall be rated for continuous operation in ambient conditions of 0 to 122 deg F dry bulbs and 20 to 90 percent relative humidity, non-condensing. NEMA 250, Type 4 enclosures.

4. Exterior Environment: System components installed in locations exposed to weather shall be rated for continuous operation in ambient conditions of minus 30 to plus 122 deg F dry bulb and 20 to 90 percent relative humidity, condensing. Rate for continuous operation where exposed to rain as specified in NEMA 250, winds up to 85 mph. NEMA 250, Type 3R enclosures.

5. Hazardous Environment: System components located in areas where fire or explosion hazards may exist because of flammable gases or vapors, flammable liquids, combustible dust, or ignitable fibers shall be rated, listed, and installed according to NFPA 70.

6. Corrosive Environment: For system components subjected to corrosive fumes, vapors, and wind-driven salt spray in coastal zones, provide NEMA 250, Type 4X enclosures.

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. Card readers: Quantity of two.

2. Credential card blanks, ready for printing: Provide fifty (50) spare.

3. Fuses of all kinds, power and electronic, equal to 10 percent of amount installed for each size used, but no fewer than three units.

1.11 WARRANTY

A. The access control system shall carry a warranty as specified in Section "Demonstration and Training of Communications Systems".

1.12 TRAINING

A. Provide training per Section "Demonstration and Training of Communications Systems".

1.13 PROGRAMMING

A. The contractor shall schedule a programming meeting with the owner through the CM/Architect/Engineers after award of bids, to review the requirement of the Access Control programming for zones, sequence of operations etc.

1.14 RECORD DRAWINGS/OPERATION AND MAINTENANCE MANUALS

A. Provide record drawings and operation and maintenance manuals as described in Sections "Operation and Maintenance of Communications" and "Common Works Results for Communication Systems".

1.15 ACCESS CONTROL/INTRUSION DETECTION SEQUENCE OF OPERATIONS.

A. All interior and exterior doors with security devices shall be on a timed lock and unlock.

B. The front entrance interior doors at the student arrival times shall automatically programmed to relock once the time frame has elapsed.

C. The lock time shall be adjustable per owner request.

D. The timed open shall be by programming cards/fobs as directed by owner(Principal, custodian, so when one of these card/fobs are swiped the system will disarm)

E. After hours, enter by using a card/fob which opens the doors and also disarm the intrusion detection system at doors with keypad arming/disarming station.

F. At doors with card readers ONLY (without a keypad arming/disarming station), access will only be granted during times that the system is disarmed. (This will allow teachers/students to exit and enter through these doors during recess).

G. Staff shall enter and exit the building from a designated door with a keypad arming/disarming station as directed by owner.

H. The system shall be armed at a set up time like 11:00pm in case someone left the building and forget to arm it, or as directed by owner.

I. When exiting **the building**, a code number **XX** shall be entered at the keypad to arm the system.

J. Fob or card shall be programmed to arm or disarm the system as directed by owner.

K. Provide a relay closure to trigger the school paging system to make an interior call announcing that the system is ready to be armed and that everyone should exit the building.

L. Coordinate the above sequence of operations with owner.

M. The security system shall have the capability to tie to freezer/cooler.

PART 2 - PRODUCTS

2.1 SECURITY ACCESS SYSTEM

A. Approved manufacturers:

1. Universal RS-2 Technologies (Non-Proprietary Hardware Provider) Access It! Universal – Standard or Enterprise
2. Continental Access
3. AMAG Technology
4. S2 Security
5. Keyscan Security
6. Linear I.E.I Emerge.
7. Honeywell
8. Vicon SMS access control
9. Kantech
10. DSX Access Systems, Inc.

2.2 APPLICATION SOFTWARE

A. System Software: Based on 64-bit, Microsoft Windows central-station and workstation operating system and application software. Software shall have the following features:

1. Multiuser multitasking to allow independent activities and monitoring to occur simultaneously at different workstations.
2. Graphical user interface to show pull-down menus and a menu tree format.
3. Capability for future additions within the indicated system size limits.
4. Open architecture that allows importing and exporting of data and interfacing with other systems that are compatible with operating system.
5. Password-protected operator login and access.
6. Shall be web based, so any owners personal with proper credentials can access it from anywhere.

B. Application Software: Interface between the alarm annunciation and entry-control Controllers, to monitor sensors, operate displays, report alarms, generate reports, and help train system operators. Software shall have the following functions:

1. Resides at the Central Station, workstations, and Controllers as required to perform specified functions.
2. Operate and manage peripheral devices.
3. Manage files for disk I/O, including creating, deleting, and copying files; and automatically maintain a directory of all files, including size and location of each sequential and random-ordered record.
4. Import custom icons into graphics views to represent alarms and I/O devices.
5. Locally link I/O so that any I/O can link to any other I/O within the same Controller, without requiring interaction with the host PC. This operation shall be at the Controller.
6. Locally code I/O links so that any access-granted event can link to any I/O within the same Controller without requiring interaction with the host PC. This operation shall be at the Controller.
7. A Local Controller shall support up to 64 card readers and 128 inputs and 128 outputs for Location or Site linkage.
8. Globally link any event with any Controller system wide with automated Macro functionality and/or user manual operations.
9. Messages from PC to Controllers and Controllers to Sub-Controllers shall be on an interrogation response network that utilizes check summing and acknowledgment of each message. Communication shall be automatically verified, buffered, and retransmitted if message is not acknowledged.
10. Selectable poll frequency and message time-out settings shall handle bandwidth and latency issues for TCP/IP, RF, and other PC-to-Controller communications methods by changing the polling frequency and the amount of time the system waits for a response.
11. Automatic backups for database and history backups shall be automatically stored at the central control PC. Only an authorized USER shall have the capability to restore or read data contained in backup.
12. Operator audit trail for recording and reporting all changes made to database and system software.

C. Workstation Software:

1. Password levels shall be individually customized in the system to allow or disallow operator access to system functions for all workstations throughout the system.

2. Workstation event filtering shall allow user to define events and alarms that will be displayed at each workstation. If an alarm is unacknowledged (not handled by another workstation) for a preset amount of time, the alarm will automatically appear on the filtered workstation.

D. Controller Software:

1. Controllers shall operate as an autonomous intelligent processing unit. Controllers shall be fully distributed allowing each Controller to make local decisions regarding access control, alarm monitoring, linking functions, and door locking schedules for all connected device Sub-controllers, and independent of other system components. Controllers shall be part of a fully distributed processing control network. The portion of the database associated with a Controller and consisting of parameters, constraints, and the latest value or status of points connected to that Controller, shall be maintained in the Controller and in the HOST system.

2. Functions: The following functions shall be fully implemented and operational within each Controller:
   a. Monitoring inputs.
   b. Controlling outputs.
   c. Automatically reporting alarms to the Central Station.
   d. Reporting of sensor and output status to Central Station on request.
   e. Maintaining real time, automatically updated by the Central Station. If dial line connected at least once a day if no event changes required reporting to the HOST during the update period.
   f. Communicating with the Central Station.
   g. Executing Controller resident programs.
   h. Diagnosing.
   i. Downloading and uploading data to and from the Central Station.
   j. Maintaining all Task conditioning and fully supporting automated controls locally.

3. Controller Operations at a Location or Site:
   a. Up to 32 Sub-Controllers connected to one or multiple RS-485 communications ports. Globally operating I/O linking functions between Sub-Controllers within the same Controller without central-station or workstation intervention. Linking shall remain fully functional within the same Controller even when the Central Station or workstations are off line.
   b. Locations or Sites shall support multiple Controller and Sub-controller hardware systems. A single Controller shall support up to 64 access points and/or a combination of access points and up to 512 inputs or 512 outputs.
   c. In the event of communications failure between the Central Station and a Location, there shall be no degradation in operations at the Controller systems at that Location. Each Controller at each Location shall have a memory buffer with a capacity to store up to 10,000 events; there shall be no loss of transactions in system history files until the buffer overflows.
   d. Buffered events shall be handled in a first-in-first-out FIFO mode of operation.

4. Individual Sub-Controller Operation:
   a. Sub-Controllers shall transmit alarms, status changes, and other data to their assigned Controller and then to the Central Station when communications circuits are operable. If communications are not available, Controllers shall function in a stand-alone mode and operational data, including the status and alarm data normally transmitted to the Central Station, shall be stored for later transmission to the Central Station.
   b. Card-reader ports of a Controller or Sub-controller shall be custom configurable for any industry standard card-reader or keypad formats. Multiple reader or keypad formats may be used simultaneously at different Sub-controllers or within the same Controller.
   c. Controllers shall provide a response to card-readers or keypad entries in less than 0.5 seconds, regardless of system size.

d. Controllers that are reset, or powered up from a non-powered state, shall automatically start up using stored programming and system configuration stored locally in Flash Memory, and user configurations stored in battery backed up RAM memory. At start up the Controller shall request a download to verify any potential changes made during the Controller power down. This start up process shall occur without operator intervention.

e. Initial Startup: When Controllers are brought on-line, database parameters shall be automatically downloaded to them. After the initial download is completed, any database changes shall be automatically downloaded to each specifically affected Controller.

f. Failure Mode: On failure for any reason, if possible Controllers shall perform an orderly shutdown and all Sub-Controllers shall manage outputs to a predetermined failure mode state, consistent with pre-determined operations user configured for the associated control devices.

g. Startup after Power Failure: After power is restored, startup software shall initiate self-test diagnostic routines, after which Controllers shall resume normal operation.

h. Startup after Controller Failure: On failure, if the database and application software are no longer resident, Controllers shall not restart, but shall remain in the failure mode until repaired. If database and application programs are resident, Controllers shall immediately resume operation. If not, software shall be restored automatically from the Central Station.

5. Communications Monitoring:

a. System shall monitor and report the status of RS-485 communications loop of each Location or Site. This is processed through each Controller communication circuit.

b. A system status screen shall display which Controllers are currently communicating. The status screen shall display the following status information:

1) System Statistics
   a) Total Cards
   b) Active Cards
   c) Active Controllers
   d) Active Sub-Controllers
   e) Active Readers
   f) Active Inputs
   g) Active Outputs
   h) Unlocked Doors
2) System Warnings
   a) Pending Alarms
   b) Unsecured Doors
   c) Unsecured Inputs
   d) Offline Controllers
   e) Offline Sub-Controllers
3) Today's Scheduled Events
   a) Card Activations
   b) Card Deactivations
4) Workstations/Users/Options
   a) Log-on
5) Software License
   a) Applications Active
   b) Application Statists
   c) Options Active

6. The system status screen shall be operator selected by User assignment.

7. A system diagnostic screen shall indicate all system level communications allowing the user to view current and past activity. The diagnostic shall allow the user to set and clear the display to accurately view specific communication periods. This display shall be electronically available to send to the integrator or manufacture for in depth review when necessary.

8. Operating systems shall include a real-time clock function that includes international time zone settings by Controller. The system clock shall maintain seconds, minutes, hours, day, date, and month internally and international time zones settings for all Controllers. The real-time clock shall be automatically synchronized with the Central Station at least once a day to plus or minus 10 seconds. The time synchronization shall be automatic, without operator action and without requiring system shutdown.

E. PC-to-Controller Communications:

1. Central-station or workstation communications shall use the following:
   a. Direct connection using RS232 serial port(s) at the PC HOST.
   b. Direct connection using RS485 serial port(s) at the PC HOST
   c. Dial-up connection using industry standard dial modems at the PC HOST and associated Controller
   d. Ethernet connection using TCP/IP with direct on board or secondary network interface cards. Ethernet addressing shall be provided (Static) or obtained (DHCP) as required by the user.
2. Serial Port Configuration: Each serial port used for communications shall be individually configurable for "direct communications," "modem communications incoming and outgoing," or as an ASCII output port.
3. Multiport Communications Board: Use if more than two serial ports are needed.
   a. Expandable RS232 design. The computer provided shall support Multi-port (Digi) Board RS232 configuration. This shall be based on specific site requirements.
   b. Expandable RS485 design. Use an 8-serial port configuration MUX module that is expandable in blocks of 8 ports. This shall be based on specific site requirements.
   c. Connect the first board to an internal PCI bus adapter card within the PC.
4. Direct serial, TCP/IP, and dial-up communications shall provide the same monitoring and control capabilities system wide.
5. TCP/IP network interface card shall automatically set the poll frequency and message response time-out settings to optimum. It shall not be required of the user to set poll frequency or message response time-out settings for typical operation.
6. PC-to-Controller and Controller-to Sub-Controller communications (direct or TCP/IP) shall use a polled-communication interrogation and response protocol that checks sum and acknowledges each message. All communications shall be verified and buffered and retransmitted automatically within the Controller programming.

F. Direct Serial or TCP/IP PC-to-Controller Communications:

1. Communication software on the PC shall continuously supervise the PC-to-Controller communications link.
2. Loss of communications to any Controller shall result in an alarm at the PC HOST and all associated workstation(s) for operator assigned response.
3. During a loss of communications with any Controller, the associated Controller(s) shall store all activity locally in battery backed up RAM memory. Typical transaction memory storage shall be set to a minimum of 10,000 events.
4. When communications are restored, all buffered (stored) events shall automatically upload to the PC HOST, and any database changes made at the PC HOST during the communication loss shall be automatically sent to the effected Controller(s).

G. Controller-to Sub-Controller Communications:

1. Controller-to Sub-Controller Communications shall be accomplished using an IEEE industry standard 2-wire, RS-485 multi-drop parallel network using an interrogation response protocol that checks sum and acknowledges each message.
2. If a MUX RS-485 module is used for RS485 port expansion the communications signals shall be regenerated at the MUX to each down-line Sub-Controller.

H. Database Downloads:

1. All data transmissions from PC HOST to a Location or Site, and to the Controllers at each Location or site, shall include a complete database checksum to check the integrity of the transmission. If the data checksum does not match, a full data download shall be automatically retransmitted to any effected Controller(s) at any Location or Site.
2. If a Controller is reset for any reason, it shall automatically request and receive a database download from the PC HOST. The download shall restore data stored at the Controller to their normal working state and shall take place with no operator intervention.

I. Operator Interface:

1. The system shall support multiple display screens that can be docked within a single computer monitor or undocked and displayed across a multi-monitor PC. The selection of docked and undocked windows shall be user selectable.
2. The system shall support three separate display screens within the system as follows:
   a. An Events screen for activity of inputs that the user assigns for display and logging only or are general status conditions
   b. An Alarm screen for all assigned alarm points user assigned for operator view, acknowledgement and response. This also shall support video verification if required by the User.
   c. A Map screen for visual display of event/alarm points within a specific area or multi-location area display. Map screen shall support full command and control including alarm acknowledgement, alarm clear and alarm video verification if required by the user.
3. General inputs in system when assigned as alarms shall have two alarm map graphic icon representations (states), normal and abnormal for the following general input events:
   a. Input Secure (normal)
   b. Input Alarm (abnormal)
   c. Input Supervisory Fault (abnormal)
   d. Entry Delay in Progress (abnormal)
4. The user shall have the ability to define each input event type with the following management settings:
   a. Annunciation Type – Disregard, Log-Only, Log and Display and Alarm
   b. Input event priority – 1 to 99
   c. Macro Assignment – Any user defined HOST generated response or command
   d. Alarm Message – User defined Operator Response Message
   e. Sound File Assignment – Allows the user to define a system Wave file for audible annunciation of the event type.
   f. Commentary Required – User assigned operator selected or typed event response detail. This shall allow for pre-defined responses and/or typed entry.
   g. Message Field – Allows the user to define additional specific event details describing the event type or location detail.
5. Inputs assigned as an alarm type shall be available for alarm graphics display and command functions. The input shall have a selection for default graphic map display and to allow an automatic map display upon alarm.

6. Inputs assigned as an alarm type shall allow the user to select an automatic clear after operator acknowledgement of the alarm or to maintain the alarm in an alarm window until the input has returned to its normal (secure) state.

7. The Map graphic display shall support real-time status update processing of all assigned alarm points. Icons displayed shall automatically change to the proper state or input condition in real time. Icons shall also display the input's state, whether armed or bypassed due to a pre-configured condition (Task or Macro), time zone or an operator manual command.

8. Alarm input, General Output and Reader shall be available for display with and interactive command and control capability for an authorized operator in the event system screen, system alarm screen and system map display screen. Operator selection of these display and control function shall be supported using standard Microsoft mouse right and left key operations or drop down selections within each of these noted system window selections as follows:
    a. Event Screen: A mouse click on event selection shall establish the control function(s) for the specific event. A left mouse click in the menu bar shall provide a drop down command display window for operator selection, a left mouse click on the selected event shall display a drop down window of command and control selection for the operator
    b. Alarm Screen: A mouse click on event selection shall establish the control function(s) for the specific event. A left mouse click in the menu bar shall provide a drop down command display window for operator selection, a left mouse click on the selected event shall display a drop down window of command and control selection for the operator
    c. Map Graphic Screen: When the cursor is placed over a map graphic icon a display window shall show the real time status of the point alarm, output or reader specifically, a right mouse click shall select the icon and automatically display a user defined default command for one click operation of the pre defined command, a left mouse click shall display a drop down of all command and control selection, for the selected point, for the operator

9. General outputs assigned in system shall have two map graphic display icon representations, activated and deactivated (locked or unlocked).

10. Icons displaying status of the I/O points shall be constantly updated to show their current real-time condition without prompting by the operator.

11. Graphic maps or drawings containing inputs, outputs, readers and alarm zones shall support the following:
    a. Database to import and store full-color maps or drawings and allow for input, output, reader and alarm zone icons to be placed on maps.
    b. Maps to provide real-time display of assigned inputs, outputs, readers to be placed on different maps.
    c. Software to allow the user to assign an alarm priority to each device that automates the display of a map while a point is being review by and operator.

12. Task, Macro and Alarm Zones Containing I/Os:
    a. The Central System shall incorporate pre-defined override functionality that provides an authorized operator with the status, command and control and automation over user-defined Alarm Zones of I/Os, which can be linked to a user defined icon for easy operator selection or system activation.
    b. Alarm Zone icons shall change automatically to show status of an alarm zone.
    c. Alarm Zone shall provide a method to manually control the points defined and to set an Alarm Zone to time zone control.
    d. The Alarm Zone icon shall highlight the group of inputs, outputs and readers associated in the zone. The Alarm Zone icon shall have the ability to be placed in the back ground behind point icons to allow individual activations to show within the Alarm Zone icon.

13. Schedule Overrides of I/Os and Alarm Zones:

a. To accommodate temporary schedule changes that do not fall within a general time zone or a pre-defined the holiday parameter, the operator shall have the ability to override schedules individually for each input, output, reader or Alarm Zone.

b. Each schedule shall be composed of a minimum of a start date and start time and a duration selection as follows:

1) Once – Specific start date and time

2) By minute – Specific start date and time with the total number of minutes

3) By Hour – Specific start date and time with the total number of hours

4) By Day – Specific start date and time with the number of days selected

5) By Week – Specific start date and time with the day(s) in the week selected

6) By Month – Specific start date and time with the day in the Month selected.

14. Copy command in database shall allow for like data to be copied and then edited for specific requirements, to reduce redundant data entry.

J. Operator System Access Management:

1. The Central System software shall provide for operator access authorization by User Group and User and password.

2. Users groups shall define system access privileges to groups of system operators, administrators, managers, supervisors, operators and/or guards as Users with various operator settings and security levels. Access permissions shall be set up to control the level of access that members of a user group will have to all of the data files, configuration files and utilities with No Access, View Only, New, Delete or Edit records or fields as follows:

a. Cardholder Fields

b. Card Fields

c. Reports

d. Badge Types

e. Servers

f. Workstations

g. Sites

h. Main or Branch Sites

i. Alarm and Event Filters

j. Alarm Delay

k. Alarm Color Display

l. Event Color Display

3. Users shall be define system operators within a User Group selection that allows the User to access pre-defined database fields and operate command and control functions. User shall have the ability to select their password without assistance from a system administrator. Operator security access levels shall determine by their user group assignments that the User assigns a name to the actual operator assigned within the User Group.

4. User passwords shall not be displayed or printed.

K. Operator Commands:

1. Command Input: Plain-language text shall allow operators to use the system without extensive training or data-processing backgrounds. System prompts shall be in plain language text typically user entered.

2. Command inputs shall allow user configured for acknowledgement and shall be processed by the system in typically less than 1 second after operator selection.

3. System functions that are executed by an operator shall include the following:

a. Acknowledgement of Alarms: Used to acknowledge that an alarm has been observed by an operator and is in process.

b. Clearing of Alarms: Used to remove an alarm from the system display screen after an operator has responded to the event as defined in any Alarm Messages presented to them at the time the alarm is being cleared.

c. Clearing alarms shall offer user defined operational processes:

1) Removing the alarm from the alarm screen

2) Responding to pre-defined alarm messages or process

3) Adding mandatory commentary regarding the alarm and/or the response process.

d. Alarm Access, overriding system points to allow physical use, shall be a standard feature within the Central System and managed in the remote Controllers using readers (card, fob or biometrics), display terminal keypads, time zones, schedules, manual commands, tasks and macros as follows:

1) Alarm Zone Disarmed - When active shall represent a zone is disarmed and no devices were in alarm condition.

2) Alarm Zone Disarmed Already Disarmed – When active shall represent a zone has been disarmed again while already in a disarmed state.

3) Alarm Zone Override Armed – When active shall represent a zone has been override armed with one or more devices in alarm condition and the disarm count has been set to zero.

4) Alarm Zone Override Disarm Count Set – When active shall represent a zone has been override disarmed and the disarm count has been set to a non-zero value.

5) Alarm Zone Force Arm Zone Armed – When active shall represent a zone has been force armed with one or more devices in alarm condition.

6) Alarm Zone Force Arm Disarm Count – When active shall represent a zone arming attempt with one or more devices in alarm condition and the disarm count has been decremented.

7) Alarm Zone Armed – When active shall represent a zone is armed and no devices were in alarm condition.

8) Alarm Zone Not Armed Zone Active – When active shall represent a zone arming attempt with one or more devices in alarm condition and the zone is not armed.

9) Alarm Zone Arm Still Disarmed – When active shall represent a zone disarm count has been decremented; however, is still greater than zero and the alarm zone is still disarmed.

10) Alarm Zone Override Arm – When active shall represent a zone is override armed with one or more devices in alarm condition and the disarm count has been set to zero.

11) Alarm Zone Override Arm Still Disarmed – When active shall represent a zone disarm count has been decremented but is still greater than zero and the alarm zone is still disarmed.

e. Display Graphics: This application module shall display any graphic standard design file incorporated by the user. As a standard, graphic displays shall be completed and shown on an operator terminal within 20 seconds from time of operator selection.

f. The Central Station shall support a system status display screen showing system status and structure upon system start-up, operator log-in or upon operator selection.

g. Generate and format reports.

h. Request help with the system operation.

1) Include in main menus.

2) Provide unique, descriptive, context-sensitive help for selections and functions with the press of one function key.

3) Provide navigation to specific topic from within the first help window.

4) Help shall be accessible outside the applications program.

i. Entry-Control Commands:

1) Lock (secure) or unlock (open) each controlled entry and exit up to twelve times a day through time-zone interval configuration.
2) Arm or disarm each monitored input up to twelve times a day through time-zone intervals configuration.
3) Enable or disable readers or keypads up to twelve times a day through time-zone interval configuration.
4) Activate or Deactivate general relay outputs up to twelve times a day through time-zone interval configuration.

L. Alarms:

1. System Setup:
   a. Assign manual and automatic responses to incoming point status change or alarms.
   b. Automatically respond to input changes with a link to other inputs, outputs, operator-response plans, unique sound with use of WAV files, and maps or images that graphically represent the point location.
   c. 256 character Alarm Message field for each alarm to define operator responses.
   d. 50 character Message field for each event to define point details.
   e. Messages shall be assignable by the operator for printing to provide further information and shall be editable by the operator.
2. Operator System Access Errors :
   a. The Central Station shall support a User Group and User assignment application that eliminates access by specific system users within segments of the systems database. If a system user has partial Edit authorizations to a menu selection and attempts to modify an unauthorized section an alert will be provided to the operator and the attempt logged into a user audit file.
   b. The Central Station shall not allow write access to system transcript files by any person, regardless of their authorization level.
3. System user access to system transcript files shall be user configurable in the User Group and User access structure. Typically this selection will be reserved for Administration level operators; however, may be assigned as required.
4. Fully Interactive Graphics Displays: Highlight alarms with flashing icons on graphic maps; display and constantly update the current status of alarm inputs and outputs in real time through animated icons.
   a. An authorized system operator shall be able to move the system cursor over an icon on any graphic map display and view current detail status in a drop down display. A left click on the system mouse shall active the icon display and the default command assigned a right click on the mouse shall open the command drop down selection display.
   b. Multimedia Alarm Annunciation: WAV files shall be associated with any user defined events for audio annunciation or instructions. Events shall be user definable for Macro actions, automatic graphic display and automatic camera views for any event or alarm in the system.
5. Alarm Handling: The Central System shall provide specific operator monitoring and response processing of site alarms and events as follows:
   a. The Central System shall activate an audible sound from the PC for any alarm defined in the system. WAV files assigned to any event or alarm shall be activated as well.
   b. The Central System shall provide a separate ‘Silence’ selection button allowing an operator to silence an alarm or event audible without acknowledging the alarm or clearing it from the system.
   c. Each input user assigned as an alarm shall require operator acknowledgement and clearing from the system.
   d. Each input shall be user configured so that an alarm cannot be cleared unless it has returned to normal.

e. Each input shall be user configured to require an operator to provide response commentary, typed entry, or pre-defined disposition commentary from a drop down list, for an input before it can be cleared from the system. Allow operator to silence alarm sound when alarm is acknowledged.

6. Contractor shall provide the integration as defined in the next three paragraphs at any site where intrusion detection or video surveillance is a requirement of the Location or Site:

a. Access Alarm Integration: The Central System shall provide a totally engineered Access Control System (ACS) with fully integrated local and remote Intrusion Detection System (IDS) functionality. Remote alarm integration shall incorporate a separate serial enabled auto-dial processor for user specified Controllers to provide remote central station connectivity for alarm monitoring and response 24/7 during unattended hours. Alarm reports shall be fully supported and displayed in the Central Station system as well as at the remote central station site. The integrated processor shall be a non-proprietary solution and commercially off-the-shelf.

b. Third Party IDS Panel Integration: The Central Station shall provide a high-level integration module that will allow down-line communication from a third party IDS panel using a serial or Ethernet connection (TCP/IP) to Central Station systems. The integration module shall allow input activation to be passed to the PC HOST for standard operator response and reporting as well as to a user selected central station. The integration module shall allow the user to define specific command that can be sent from the Central Station PC HOST to the IDS panel to automate Arm and Disarm functionality. The pre-approved third party IDS panels are:

1) Bosch 7412 and 9412

2) DMP Xr100 and Xr500

3) Honeywell V128B and V250B

c. CCTV Alarm Interface: The video integration module shall allow the user to select CCTV Switchers or Matrix products as well as DVR or NVR video system products for video surveillance at a Location or site. This integration module shall automate video alarm verification with the Central Station and on any workstation selected by the user. The video integration module shall allow the user to retrieve stored video based on alarm or event transactions or time-of-day for review. Video review shall be automated to allow a user reviewing an activity report on the Central Station or workstation to request any associate video clips directly from the on-line report. Selection of video views shall be real-time and automated with the system Map Graphics display as well as the Alarm and Event screens.

M. Alarm Monitoring: Monitor sensors and Controllers shall notify operators of any user defined alarm condition.

1. Alarms shall be displayed by user defined priority, oldest unacknowledged and highest priority first. Operator acknowledgment of one alarm shall not acknowledge of other alarms nor shall it inhibit reporting of subsequent alarms.

2. The Central Station software shall support filtering of alarms and events by user group to display pre-selected alarm to pre-selected operator logins.

3. Alarms that have been received and not acknowledged by an operator are “pending” alarms. Pending alarms shall activate an icon change where displayed as well as activating an audible, PC or pre-defined sound WAV file and shall automatically display the alarm for each input assigned to a pre-defined graphic map display.

4. Pending alarms shall require two processing steps to be cleared by an operator:

a. First Operator Step: "Acknowledged." This action shall silence sounds associated with the alarm. The alarm remains in the system "Acknowledged" but "Un-Cleared."

b. Second Operator Step: If defined by the user the operator clearing an alarm shall be required to enter a resolution or operator comment, giving the disposition of the alarm event before the alarm can be cleared from the system. Resolution response shall be available to the operator as an entry form for typing a resolution message or for selecting a pre-determined resolution message from a drop-down window.

5. Each workstation shall have the ability to display the total pending alarms and total unresolved alarms.

6. Each alarm point shall be configurable to allow simple resolution of the alarm point without operator comment to clear an alarm.

7. Each alarm point shall be configurable to disallow the resolution of alarms until the alarm point has returned to its normal state. If this configuration is elected by the user the alarm message shall stay displayed within the alarm screen until the physical condition is back to normal or user default.

8. Alarms shall transmit to the Central Station in real time.

9. Alarms shall be displayed and managed from a minimum of two different windows; Alarm Log Transaction Window and the Graphic Map Display Window.

    a. The alarm log transaction window shall have the following display information tables: Date/Time, Site Name, Card #, Facility Code, Card Holder, Description, Location, Priority, Acknowledged By and Unsecured fields. Selecting the text line shall select the point and allow acknowledgement and/or command selections for the alarm by an authorized system operator. Text display lines shall be color coded based on a user pre-defined display configuration.

    b. The graphic map display shall show a steady colored icon representing for each alarm input location on the map; change the icon to flashing red when an alarm occurs and change the icon from flashing red to steady red when the alarm is acknowledged. The alarm graphics Map display shall also provide a point status drop down when the system cursor is placed over any icon on the map.

10. System events shall be displayed and managed from an Event Log Transaction Window. The event display shall have the following display information tables: Date/Time, Site Name, Card #, Facility Code, Card Holder, Description and a cardholder photo image display field. The cardholder image display is operator selected for display. Selecting the text line shall select the event command/selection drop down to allow an authorized operator to do adhoc journal entries.

11. The time and name of the operator who acknowledged and resolved the alarm shall be recorded in the database.

12. Consecutive alarm occurrences from same alarm point shall be acknowledged at same time the operator acknowledges the first alarm. Identical alarms shall be resolved when the first alarm is resolved.

13. Alarm functions shall have priority over downloading, retrieving, and updating database from workstations and Controllers.

14. When a reader-controlled output (relay) is opened, the corresponding alarm point shall be automatically bypassed in the form of a general request to exit.

15. Printed alarm data shall include type of alarm, location of alarm, date and time of occurrence.

N. Monitor Display: Display text and graphic maps that include zone status integrated into the display shall support user defined color codes. Colors are used for the various components and current data. Colors shall be uniform throughout the system as defined by the user.

1. Color Codes:

    a. Alarm colors control shall manage how alarms are displayed in the alarms window. Four priority ranges shall be available for user selection from a low and high limit for both pending and acknowledged alarms allowing higher priority alarms to visually differentiate from lower priority alarms.

    b. Event colors control shall manage how events are displayed in the events window. Five different categories of events shall be available for user selection. Both the background (highlight) color and the font or text color shall be user selected to drawn the attention of an operator to a certain category of events.

2. Graphics:

a. The map designer in the Central Station software shall be used to create new or modify existing graphical map designs. The map designer shall allow the user to design site and or area maps in with many different styles and functions. The map designer shall be similar in function to a paintbrush style application allowing objects and hardware devices to be added to one or multiple maps. Device selection shall determine the functionality of the objects placed on a map.

b. The user shall have the ability to select a map image or background picture by either entering the full path to an image or background pictures file or by browsing for the file from any standard storage device connected to the Central Station. At a minimum the following file type shall be supported for map image or background pictures: Windows Bitmap (.BMP), JPEG (.JPG), Windows Metafile (.WMF), Enhanced Windows Metafile (.EMF) and AutoCAD Drawings (.dxf or .dwg).

c. The Maps module shall support an unlimited number of points and graphic display images. Applying a device or image to a map shall incorporate a drag and drop method. Pre-defined icon images for devices shall be fully scalable once attached to a map.

d. The Maps module shall display all maps in the database in a hierarchical listing or tree format. The map tree shall be displayed in the left window pane of the maps window. The maps window shall either be docked within the main application window or displayed in a separate window using the view option on the system menu, docking or undocking selection. Displaying the maps in a separate shall be required to utilize a multiple monitor system design. System software that does not support docking and undocking of the alarm, events and maps window screens shall be considered non-compliant.

e. Operators shall be able to view the inputs, outputs, the point's name and the status of the device and/or associated device points by moving the mouse cursor over the point icon on graphic map.

f. Inputs or outputs may be placed on multiple graphic maps. The operator shall be able to toggle to view graphic maps or apply specific map selection icons to a map to move from and to different maps.

g. Each graphic map shall have a display-order sequence associated with it to provide a predetermined order when toggled to different views from the map tree.

h. Camera icons, when selected by an operator, shall open a video window, display the camera associated with that icon, and provide camera system controls if available.

i. All device commands shall be available for operator action by selecting and associate icon and opening a drop down menu selection.

3. Tool Bar:

a. Alarm notification shall also be displayed by flashing the workstation taskbar icon if the security application is minimized or another application is being used on the local workstation' indicating to an operator that an alarm has been received by the Central Station.

O. System reports shall allow an operator to select the status of the entire system or of a particular portion of the system.

1. Status Report: The results of a status report shall be stored for future display or printout. The report shall document the operational status of system components on the date or period selected by the operator.

2. System Status Display: The system shall support a system wide display showing system status and system details. This display shall be displayed after a system login or by operator request.

P. Report Generator Software: Include commands to generate reports for displaying, printing, and storing on disk and tape. Reports shall be stored by type, date, and time. Report printing shall be the lowest priority activity. Report generation mode shall be operator selectable but set up

initially as periodic, automatic, or on request. Include time and date printed and the name of operator generating the report. Report formats may be configured by operators.

1. Automatic Printing: Setup shall specify, modify, or inhibit the report to be generated; the time the initial report is to be generated; the time interval between reports; the end of period; and the default printer.
2. Printing on Requests: An operator may request a printout of any report base on User Group authorization.
3. At a minimum the Central Station software shall include the following standard reports:
   a. Access By Access Level - This report provides a list of all cardholders and cards that have been assigned the selected access levels.
   b. Access By Reader - This report provides a list of cardholders and cards that have access to the selected readers. This report includes the time zone/floor code that corresponds to the selected readers.
   c. Access Level History - This report provides a list of all database updates for the selected access levels.
   d. Access Level Listing - This report provides a list of the selected access levels and their various properties.
   e. Access Levels By Reader - This report provides a list of all access levels that contain the selected readers. This report includes the time zone/floor code that corresponds to the selected reader.
   f. Active Card Listing - This report provides a list of all active cards, along with the access levels and precision access assigned to the cards.
   g. Alarm Acknowledgements And Clears - This report provides a list of all alarm acknowledgements and clears for the selected users.
   h. Card Access Denied Events - This report provides a list of all access denied card usage events for the selected cards.
   i. Card Access Events - This report provides a list of all access card usage events for the selected cards.
   j. Card Access Granted Events - This report provides a list of all access granted card usage events for the selected cards.
   k. Card Antipassback Events - This report provides a list of all antipassback events for the selected cards. The report includes both access grants and access denies.
   l. Card Audit History - This report provides a list of all card database update events for the selected cards.
   m. Card Group History - This report provides a list of all database update events for the selected card groups.
   n. Card Group Listing - This report provides a list of the selected card groups and their various properties.
   o. Card History - This report provides a list of all history for the selected cards. This report includes all database updates as well as all card usage.
   p. Card Listing - This report provides a list of the selected cards, along with the access levels and precision access assigned to the cards.
   q. Card Status Listing - This report provides a list of status information for the selected cards. The report includes cardholder, card number, facility code, card status, classification and last modified information.
   r. Cardholder Access Denied Events - This report provides a list of all access denied card usage events for the selected cardholders.
   s. Cardholder Access Events - This report provides a list of all access card usage events for the selected cardholders.
   t. Cardholder Access Granted Events - This report provides a list of all access granted card usage events for the selected cardholders.
   u. Cardholder Antipassback Events - This report provides a list of all antipassback events for the selected cardholders. The report includes both access grants and access denies.

v. Cardholder Audit History - This report provides a list of all cardholder and card database update events for the selected cardholders.

w. Cardholder History - This report provides a list of all history for the selected cardholders. This report includes all database updates as well as all card usage for the cardholders.

x. Cardholder Listing - This report provides a list of the selected cardholders, along with all cards issued to the cardholders. This report also includes access levels and precision access assigned to cards.

y. Cardholder Photo Gallery - This report provides a list of cardholder names and photos.

z. Cardholder Reader Access - This report provides a list of all readers that the selected cardholders have access to. This report includes the time zone/floor code that corresponds to the selected reader.

aa. Cardholder Time and Attendance - This report provides a list of in and out times at readers designated as time and attendance readers, as well as the time elapsed between in and out events. The report includes total elapsed time for the selected cardholders.

bb. Cardholders Last Location - This report provides a list of the selected cardholders along with the location and time of the last card usage.

cc. Cardholders Without Cards - This report provides a list of cardholders that do not have any associated cards.

dd. Cards Expiring In Less Than One Week - This report provides a list of all cards that will expire in one week or less. The report includes the cardholder name, card number, facility code and expire date.

ee. Cards Without Access - This report provides a list of cards that have no valid access. The report includes the cardholder name, card number and

ff. Channel History - This report provides a list of all database updates for the selected channels.

gg. Channel Listing - This report provides a list of the selected channels and their various properties.

hh. Custom Report – This is a report modified by an operator and stored for future use and/or scheduling.

ii. Detail Card Listing - This report provides a list of the selected cards. This report includes all cardholder information, photo, signature, as well as all access levels and precision access assigned to the cards.

jj. Detail Cardholder Listing - This report provides a list of the selected cardholders. This report includes all cardholder information, photo and signature.

kk. Detailed Card Audit History - This report provides a list of all cardholder and card database update events for the selected cards. The report includes current card status, classification and access information.

ll. Dossier - This report provides a full page photo and name of the selected cardholders.

mm. Evacuation Report - This report provides a list of cardholders that are currently IN the selected areas.

nn. Event Listing - This report provides a list of all user selectable events.

oo. Floor Code History - This report provides a list of all database updates for the selected floor codes.

pp. Floor Code Listing - This report provides a list of the selected floor codes and their various properties.

qq. General Building Access Report - This report provides a list of all history for the selected cardholders. This report includes all database updates as well as all card usage for the cardholders.

rr. Hardware Map - This report provides a hierarchical listing of all hardware attached to the selected SCPs. This report includes SCPs, SIOs, readers, inputs and outputs.

ss. Holiday History - This report provides a list of all database updates for the selected holidays.

tt. Holiday Listing - This report provides a list of the selected holidays and their various properties.

uu. Input Activity - This report provides a list of all input activity for the selected inputs.

vv. Input Audit History - This report provides a list of all database updates and user issued commands for the selected inputs.

ww. Input History - This report provides a list of all database updates, user issued commands and input activity for the selected inputs.

xx. Input Listing - This report provides a list of the selected inputs and their various properties.

yy. Macro History - This report provides a list of all database updates to the selected macros as well as macro execution history.

zz. Macro Listing - This report provides a list of the selected macros and their various properties.

aaa. Output Activity - This report provides a list of all output activity for the selected outputs.

bbb. Output Audit History - This report provides a list of all database updates and user issued commands for the selected outputs.

ccc. Output History - This report provides a list of all database updates, user issued commands and output activity for the selected outputs.

ddd. Output Listing - This report provides a list of the selected outputs and their various properties.

eee. Reader Access Denied Events - This report provides a list of all access denied card usage events for the selected readers.

fff. Reader Access Events - This report provides a list of all access card usage events for the selected readers.

ggg. Reader Access Granted Events - This report provides a list of all access granted card usage events for the selected readers.

hhh. Reader Activity - This report provides a list of all reader activity for the selected readers.

iii. Reader Antipassback Events - This report provides a list of all antipassback events for the selected readers. The report includes both access grants and access denies.

jjj. Reader Audit History - This report provides a list of all database updates and user issued commands for the selected readers.

kkk. Reader History - This report provides a list of all database updates, user issued commands and reader activity for the selected readers.

lll. Reader Listing - This report provides a list of the selected readers and their various properties.

mmm. Recipient History - This report provides a list of all database updates for the selected recipients.

nnn. Recipient Listing - This report provides a list of the selected recipients and their various properties.

ooo. Report Listing - This report provides a list of all reports available, as well as report category and a description.

ppp. SCP History - This report provides a list of all history for the selected SCPs. This report includes all database updates as well as all hardware activity.

qqq. SCP Listing - This report provides a list of the selected SCPs and their various properties.

rrr. Server Listing - This report provides a list of the selected servers and their various properties.

sss. SIO History - HistoryThis report provides a list of all history for the selected SIOs. This report includes all database updates as well as all hardware activity.

ttt. SIO Listing - This report provides a list of the selected SIOs and their various properties.

uuu. Site Listing - This report provides a list of the selected sites and their various properties.

vvv. Task Listing - This report provides a list of all tasks for the selected SCPs. This report includes execute conditions as well as task steps.

www. Time zone History - This report provides a list of all database updates for the selected time zones.

xxx. Time zone Listing - This report provides a list of the selected time zones and their various properties.

yyy. Unused Cards - This report provides a list of all cards that have not been used for a user inputted number of days or have never been used.

zzz. User Group History - This report provides a list of all database updates for the selected user groups.

aaaa. User Group Listing - This report provides a list of the selected user groups and their various properties.

bbbb. User Listing - This report provides a list of the selected users and their various properties.

cccc. User Transaction History - This report provides a list of all transactions for the selected users including database updates, commands to devices and alarm processing.

dddd. Workstation Listing - This report provides a list of the selected Workstations and their various properties.

4. Custom Reports: Reports tailored to exact requirements of who, what, when, and where based on the system report selected by the operator. As an option, custom report formats may be stored for future printing.
5. Automatic Reports: Named, saved, and scheduled for automatic generation.
6. Reports shall have the following four options:
   a. View on screen.
   b. Print to system printer. Include automatic print spooling and "Print To" options if more than one printer is connected to system in a user selected document format.
   c. "Save to File" with full path statement and in a user selected document format.
   d. System shall have the ability to produce a report indicating status of system inputs and outputs or of inputs and outputs that are abnormal, out of time zone, manually overridden, not reporting, or in alarm.
7. The reports of system database shall allow options so that every data field may be printed.
8. The reports of system database shall be constructed so that the actual position of the printed data shall closely match the position of the data on the report designer.
9. User shall have the ability to modify the report design to move positioning of data fields.

Q. Visitor Assignment:

1. The Central Station software shall support a visitor badging function allowing an operator to assign credentials and enroll cardholders as visitors. Allow only access levels that have been designated as approved for visitors in a user defined card group.
2. Provide a specific User Group restricting the access level for operators managing visitors.
3. Provide an automated log of visitor name, time and doors accessed, and whom visitor contacted.
4. Allow operator to recall visitors' credential holder file, once a visitor is enrolled in the system.
5. The operator shall have the ability to designate a reader as one that deactivates a visitor credential after use at the designated reader. The history log shall show the use of the reader and as such the return of a visitor credential.
6. System shall have the ability to use the visitor designation in searches and reports. Reports shall be able to print all or any visitor activity.

R. Operator Training: The Central Station software shall allow the configuration of a training operation to allow operators to practice system operational functions with alarm acknowledgment, alarm assessment, response force deployment, and response force communications. The Central Station shall continue normal operation during training exercises allowing the operator to terminate any exercises in an adhoc manner.

S. Entry-Control Enrollment Software: The following Database management functions are required to allow an operator to add, delete, and modify access data as needed.

1. The enrollment station shall not have alarm response or acknowledgment functions.

2. Provide multiple, password-protected operator access levels. Database management and modification functions shall require a higher operator access level than personnel enrollment functions or alarm response operators.

3. The program shall provide a single screen method for entering personnel identifying information into the entry-control database from user defined enrollment stations and shall provide options to include biometric data. All data entry processing shall uses menu selections and data fields. The program shall allow for a minimum of twenty data field names to be customizable during setup to suit user and site needs. Personnel identity verification subsystems selected for use with the system shall fully support the enrollment function and shall be compatible with the entry-control database files.

4. Cardholder Data: The Cardholder data file shall allow an operator to change the display order for cardholder user fields.

5. Display Names: Display names for each of the user definable data entry field shall use simple text entry allowing friendly names for the displays to be entered by a system operator.

6. Display Name: The display name field shall support a minimum 50 characters for each display name.

   a. The system operator shall have a selection of edit tool and types for the cardholder user fields. Edit control shall determine the look and functionality of the cardholder user field displayed on the cardholder form.

   b. The following types of edit controls shall be available:

      1) *Text Box* - A text box edit control tool shall be provided to allow an operator to enter free form alpha-numeric characters. A minimum of up to 50 characters shall be allowed for entry into these text fields. An input mask shall also be definable to control the way that data is entered into a text user field. Mask conditioning shall be support to define specific data entry processing.

      2) *Drop Down List* - A drop down list edit control tool shall be provided to allow an operator present a list of pre-defined items to choose from during data entry. An unlimited number of list items can be entered into each drop down list incorporated.

      3) *Date Combo* - A date combo edit control tool shall be provided to allow an operator to entry of dates into a user field. A calendar pop-up shall be provided for easy date entries.

7. Personnel Search Engine: A report generator with capabilities such as search by last name, first name, group, or any predetermined user-defined data field; by codes not used in definable number of days; by skills; or by seven other methods.

8. Multiple Deactivate Dates for Cards: User-defined fields to be configured as additional stop dates to deactivate any cards assigned to the cardholder.

9. Copy and paste functionality shall be supported to allow card data to be pasted into a cardholder record to speed data entry for sites where most card data may be similar.

10. An optional Import/Export utility shall be supported to allow the importing of cardholder data and images from multiple electronic data formats.

11. A card expire function shall be supported to automatically deactivate a card based on non-use and/or data and time.

2.3 SYSTEM DATABASE

A. Database and database management software shall define and modify each point in database using operator commands. Definition shall include parameters and constraints associated with each system device.

B. Database Operations:

1. System data management shall be in a hierarchical menu tree format, with navigation through expandable menu branches and manipulated with use of menus and icons in a main menu and system toolbar.

2. Navigational Aids:

a. Toolbar icons for add, delete, copy, print, capture image, activate, deactivate, and muster report.

b. Point and click feature to facilitate data manipulation.

c. Next and previous command buttons visible when editing database fields to facilitate navigation from one record to the next.

d. Copy command and copy tool in the toolbar to copy data from one record to create a new similar record.

3. All data entry shall be automatically checked for duplicate and illegal data and shall verify that data are in a valid format.

4. Provide a memo or note field for each item that is stored in database, allowing the storing of information about any defining characteristics of the item. Memo field is used for noting the purpose the item was entered for, reasons for changes that were made, and the like.

C. File Management:

1. Provide database backup and restoration system functionality, allowing selection of storage media to industry standard memory devices (DVD, Fixed Memory, Thumb Drives, etc.)

2. Provide manual and automatic mode for database backup operations. The operator shall have a selection tool that will automatically sequence backups before the oldest backup becomes overwritten; FIFO mode shall be operator selectable.

3. Backup program shall provide manual operation from any PC on the LAN and shall operate while system is in normal operation.

D. Operator Passwords:

1. Software shall support an unlimited number of individual system operators, each with a unique password.

2. Operator Password: One to eight alphanumeric characters.

3. Allow passwords to be case sensitive.

4. Passwords shall not be displayed when entered.

5. Provide each password with a unique and customizable password profile, and allow several operators to share a User Group profile; however, shall maintain the password file specific to each operator. Include the following features in the password profile:

a. Allow for an unlimited number of User Group and User profiles.

b. User Group and User profiles shall be specific and shall not use password levels.

c. Allow or disallow operator access to any program operation, including the functions of View, Add, Edit, and Delete and to specific file records with in the database.

d. Restrict which doors an operator can assign access to.

6. Operators shall use a user name and password to log on to system.

a. The operator user name and password shall allow the operator to access database areas and programs as determined by the associated User Group profile.

7. The system shall be designed to operate specific services that will allow an operator to exit and close the workstation application without closing the system program allow the software

to continue full system operation. The system shall support a view that will allow an operator to log-out without fully exiting the program and shall display a new log-in window for the next operator to log into the system.

E. Access Card/Code Operation and Management: Access authorization shall be accomplished using user definable reader mode selections such as; however, not limited to access by card credential-only, by a manually entered biometrics code Personal Identification Number PIN-only, a combination of both (card plus PIN) or by presenting a card or entering a PIN.

1. Access authorization shall verify the facility code first, the card or card-and-PIN validation second, and the access level (time of day, day of week, date), and number of credential uses last.
2. Use data-entry windows to view, edit, and issue access levels. Access authorization entry management system shall maintain and coordinate all access levels field.
3. Allow assignment of an unlimited number of cards/codes to any cardholder.
4. Allow assignment of up to 32 access levels per cardholder in each Controller. Each access level may contain any combination of doors.
5. Each door may be assigned to any access level and any time zone to any access level.
6. Software shall allow the grouping of locations or sites so cardholder data can be shared by all locations or sites in the group.
7. Visitor Access shall not allow a visitor badge to be issued, without assigning a cardholder name.
8. Cardholder Tracing: The system shall allow for cardholder tracing. Make a special audible and visual annunciation at the control station when a selected card or code is used at a reader. Annunciation shall include an automatic display of the cardholder image. The system shall support alarm annunciation base of up to 25 separate access events in any card file/cardholder record.
9. Allow each cardholder to be given either an unlimited number of uses or a number from 1 to 9998 that regulates the number of times the card can be used before it is automatically deactivated.
10. Provide for cards and codes to be activated and deactivated manually or automatically by date. Provide for multiple deactivate dates to be preprogrammed.

F. Security Access Integration:

1. Photo ID badging and photo verification shall use the same database as the security access system and may query data from cardholder, group, and other personal information to build a custom ID badge.
2. Automatic or manual image recall shall be supported. Photo recall shall support visual alarm verification to process cardholders into and out of controlled areas.
3. The system shall allow sorting of cardholders by group or other characteristic for a fast and efficient method of reporting on, and enabling or disabling, cards or codes.

G. Facility Codes: System shall accommodate up to 2048 facility codes per Location or Site, with the option of allowing facility codes to work at all doors or only particular doors.

H. Operator Comments:

1. With the press of one appropriate button on toolbar, the user shall be permitted to make operator comments into history at anytime.
2. Automatic prompting of operator comment shall occur before the resolution of each alarm. This feature shall be user definable per point.
3. Operator comments shall be recorded by time, date, and operator number.
4. Comments shall be sorted and viewed through reports and history.

5. The operator may enter comments in two ways; either or both may be used:
    a. Manually entered through keyboard data entry (typed) message per alarm.
    b. Predefined and stored response messages for retrieval selected by the operator.
6. System shall have a minimum of 999 predefined operator comments.

I. Group:

1. Group names may be used to sort cardholders into groups that allow the operator to determine the tenant, vendor, contractor, department, division, or any other designation of a group to which the person belongs.
2. System software shall have the capacity to assign multiple group names to an access authorization.
3. Make provision in software to deactivate and reactivate all access authorizations assigned to a particular group.
4. Allow sorting of history reports and code list printouts by group name.

J. Time Zones:

1. Each zone consists of a start and stop time for 7 days of the week and up to 8 holiday groups. A time zone is assigned to inputs, outputs, or access levels to determine when an input shall automatically arm or disarm, when an output automatically opens or secures, or when access authorization assigned to an access level will be denied or granted.
2. Up to 12 time zone intervals may be assigned to inputs and outputs allowing up to 12 arm or disarm periods per day or 12 lock or unlock periods per day; up to 8 holiday override schedules may be assigned to a time zone.
3. Data-entry window shall display a dynamically linked bar graph showing active and inactive times for each day and holiday, as start and stop times are entered or edited.
4. System shall have the capacity for 32,000 time zones for each Location or site.

K. Holidays:

1. Eight different holiday groups may be assigned to a time zone. Holiday groups consist of dates in a MM/DD/YYYY format and a description. When the holiday dates match the current date of the time zone, the holiday schedule replaces the time zone schedule for that period.
2. System shall have the capacity for 32,000 holidays.
3. Holidays have an option to be designated as occurring on the designated date each year. These holidays remain in system and will not be purged.
4. Holidays not designated to occur each year shall be automatically purged from database after the date expires.

L. Access Levels:

1. System shall allow for the creation up to 32,000 access levels.
2. One level shall be predefined as the Master Access Level. The Master Access Level shall work at all doors at all times and override any antipassback.
3. System shall allow for access to be restricted to any area by reader and by time. Access levels shall determine when and where an Identifier (card credential, PIN or other biometrics) is authorized.
4. System shall be able to create multiple door and time zone combinations under same access level so that an Identifier may be valid during different time periods at different readers even if the readers are on the same Controller.

M. User-Defined Fields:

1. System shall provide a minimum of 20 user-defined fields, each with up to 50 characters, for specific information about each credential holder.
2. System shall accommodate a title for each field; field length shall be 20 characters.
3. A "Required" option may be applied to each user-defined field that, when selected, forces the operator to enter data in the user-defined field before the credential can be saved.
4. A "Unique" option may be applied to each user-defined field that, when selected, will not allow duplicate data from different credential holders to be entered.
5. Data format option may be assigned to each user-defined field that will require the data to be entered with certain character types in specific spots in the field entry window.
6. A user-defined field, if selected, will define the field as a deactivate date. The selection shall automatically cause the data to be formatted with the windows MM/DD/YYYY date format. The credential of the holder will be deactivated on that date.
7. A search function shall allow any one user-defined field or combination of user-defined fields to be searched to find the appropriate cardholder. The search function shall include search for a character string.
8. System shall have the ability to print cardholders based on and organized by the user-defined fields.

N. Code Tracing:

1. System shall perform code tracing selectable by cardholder and by reader.
2. Any code may be designated as a "traced code" with no limit to how many codes can be traced.
3. Any reader may be designated as a "trace reader" with no limit to which or how many readers can be used for code tracing.
4. When a traced code is used at a trace reader, the access-granted message that usually appears on the monitor window of the Central Station shall be highlighted with a different color than regular messages. A short singular beep shall occur at the same time the highlighted message is displayed on the window.
5. The traced cardholder image (if image exists) shall appear on workstations when used at a trace reader.

2.4 SURGE AND TAMPER PROTECTION

A. Surge Protection: Protect components from voltage surges originating external to equipment housing and entering through power, communication, signal, control, or sensing leads. Include surge protection for external wiring of each conductor-entry connection to components.

2.5 CENTRAL-STATION HARDWARE (NOC)

A. SEPARATE Central-Station Computer: Standard unmodified PC of modular design. The CPU shall be as follows:.

1. Memory: 512 MB of usable installed memory, expandable to a minimum of 1024 MB without additional chassis or power supplies. Minim 2.33Ghz.
2. Power Supply: Minimum capacity of 250 W.
3. 64 RAM
4. Real-Time Clock:
   a. Accuracy: Plus or minus 1 minute per month.
   b. Time Keeping Format: 24-hour time format including seconds, minutes, hours, date, day, and month; resettable by software.
   c. Clock shall function for 1 year without power.

d. Provide automatic time correction once every 24 hours by synchronizing clock with the Time Service Department of the U.S. Naval Observatory.

5. Serial Ports: Provide two RS-232-F serial ports for general use, with additional ports as required. Data transmission rates shall be selectable under program control.

6. Parallel Port: An enhanced parallel port.

7. LAN Adapter Card: 10/100/1000 Mbps PCI bus, internal network interface card.

8. Sound Card: For playback and recording of digital WAV sound files that are associated with audible warning and alarm functions.

9. Color Monitor: Not less than a 17 inch LCD, with a minimum resolution of 1280 by 1024 Insert numbers pixels, non-interlaced, and a maximum dot pitch of 0.28 mm. The video card shall support at least 256 colors at a resolution of 1280 by 1024 at a minimum refresh rate of 70 Hz.

10. Keyboard: With a minimum of 64 characters, standard ASCII character set based on ANSI X3.154.

11. Mouse: USB Standard, compatible with the installed software.

12. Disk storage shall include the following, each with appropriate controller:
    a. Minimum 140 GB hard disk, maximum average access time of 10 ms.
    b. PCMCIA slot with removable 500 MB media.
    c. 100 MB Iomega Zip drive.
    d. 250 MB Iomega Jaz drive.

13. Magnetic Tape System: 4-mm cartridge magnetic tape system with minimum 20 GB formatted capacity per tape. Provide 10 tapes, each in a rigid cartridge with spring-loaded cover and operator-settable write-protect feature.

14. Audible Alarm: Manufacturer's standard.

15. CD-ROM Drive:
    a. Nominal storage capacity of 650 MB.
    b. Data Transfer Rate: 1.2 Mbps.
    c. Average Access Time: 150 ms.
    d. Cache Memory: 256 KB.
    e. Data Throughput: 1 MB/second, minimum.

16. Ink Jet Alarm Printer:
    a. Connected to the Central Station.
    b. Minimum of 96 characters, standard ASCII character set based on ANSI X3.154, and with graphics capability and programmable control of top-of-form.
    c. Prints in both red and black without ribbon change.
    d. Adjustable sprockets for paper width up to 11 inches.
    e. 80 columns per line, minimum speed of 200 characters per second.
    f. Character Spacing: Selectable at 10, 12, or 17 characters per inch.
    g. Paper: Sprocket-fed fan fold paper.

17. Report Printer:
    a. Connected to the Central Station and designated workstations.
    b. Laser printer with minimum resolution of 600 dpi.
    c. RAM: 2 MB, minimum.
    d. Printing Speed: Minimum 12 pages per minute.
    e. Paper Handling: Automatic sheet feeder with 250-sheet paper cassette and with automatic feed.

18. Interface: Bidirectional parallel and universal serial bus.

19. LAN Adapter Card: 10/100/1000 Mbps internal network interface card.

20. UPS: Provide one 2,000VA UPS rack-mounted. See Communications Sections for more information.

B. Approved Manufacturers:
1. HP Proliant series.
2. Dell Power Edge series
3. IBM Power 7 express series.

2.6 STANDARD WORKSTATION HARDWARE (BUILDING)

A. SEPARATE Workstation shall consist of a standard unmodified PC, with accessories and peripherals that configure the workstation for a specific duty.

B. Workstation Computer: Standard unmodified PC of modular design. The CPU word size shall be as follows:

1. Memory: 512 MB of usable installed memory, expandable to a minimum of 1024 MB without additional chassis or power supplies. Min 2.33 GHz.

2. Power Supply: Minimum capacity of 250 W.

3. Real-Time Clock:
   a. Accuracy: Plus or minus 1 minute per month.
   b. Time Keeping Format: 24-hour time format including seconds, minutes, hours, date, day, and month; resettable by software.
   c. Provide automatic time correction once every 24 hours by synchronizing clock with the Central Station.

4. Serial Ports: Provide two RS-232-F serial ports for general use, with additional ports as required. Data transmission rates shall be selectable under program control.

5. Parallel Port: An enhanced parallel port.

6. LAN Adapter Card: 10/100/1000 Mbps PCI bus, internal network interface card.

7. Sound Card: For playback and recording of digital WAV sound files that are associated with audible warning and alarm functions.

8. Color Monitor: Not less than 17 inch LCD, with a minimum resolution of 1280 by 1024 pixels, non-interlaced, and a maximum dot pitch of 0.28 mm. The video card shall support at least 256 colors at a resolution of 1280 by 1024 at a minimum refresh rate of 70 Hz.

9. Keyboard: With a minimum of 64 characters, standard ASCII character set based on ANSI X3.154.

10. Mouse: USB Standard, compatible with the installed software.

11. Disk storage shall include the following, each with appropriate controller:
   a. Minimum 140 GB hard disk, maximum average access time of 10 ms.

12. CD-ROM Drive:
   a. Nominal storage capacity of 650 MB.
   b. Data Transfer Rate: 1.2 Mbps.
   c. Average Access Time: 150 ms.
   d. Cache Memory: 256 KB.
   e. Data Throughput: 1 MB/second, minimum.

13. Printer:
   a. Connected to the Central Station and designated workstations.
   b. Laser printer with minimum resolution of 600 dpi.
   c. RAM: 2 MB, minimum.
   d. Printing Speed: Minimum 12 pages per minute.

e. Paper Handling: Automatic sheet feeder with 250-sheet paper cassette and with automatic feed.

14. Interface: Bidirectional parallel and universal serial bus.

15. LAN Adapter Card: 10/100/1000 Mbps internal network interface card.

C. Approved Manufacturers:
1. HP Proliant series.
2. Dell Power Edge series
3. IBM Power 7 express series.

2.7 DOOR CONTROLLERS

A. Controllers: Intelligent peripheral control unit, complying with UL 294, that stores time, date, valid codes, access levels, and similar data downloaded from the Central Station or workstation for controlling its operation.

B. Subject to compliance with requirements in this Article, manufacturers may use multipurpose Controllers.

C. Alarm Annunciation Controller:

1. The Controller shall automatically restore communication within 10 seconds after an interruption with the field device network.

a. Inputs: Monitor dry contacts for changes of state that reflect alarm conditions. Provides at least eight alarm inputs, which are suitable for wiring as normally open or normally closed contacts for alarm conditions.

b. Alarm-Line Supervision:

1) Supervise the alarm lines by monitoring each circuit for changes or disturbances in the signal, and for conditions as described in UL 1076 for line security equipment by monitoring for abnormal open, grounded, or shorted conditions using dc change measurements. System shall initiate an alarm in response to an abnormal current, which is a dc change of 10 percent or more for longer than 500 ms.

2) Transmit alarm-line-supervision alarm to the Central Station during the next interrogation cycle after the abnormal current condition.

c. Outputs: Managed by Central Station software.

D. Entry-Control Controller:

1. Function: Provide local entry-control functions including one- and two-way communications with access-control devices such as card readers, door strikes, magnetic latches, and gate and door operators.

a. Operate as a stand-alone portal Controller using the downloaded database during periods of communication loss between the Controller and the field-device network.

b. Accept information generated by the entry-control devices; automatically process this information to determine valid identification of the individual present at the portal:

1) On authentication of the credentials or information presented, check privileges of the identified individual, allowing only those actions granted as privileges.

2) Privileges shall include, but not be limited to, time of day control, day of week control, group control, and visitor escort control.

c. Maintain a date-, time-, and Location-stamped record of each transaction. A transaction is defined as any successful or unsuccessful attempt to gain access through a controlled portal by the presentation of credentials or other identifying information.

d. Door controller shall control 2, 3 or 4 doors.

2. Inputs:

a. Data from entry-control devices; use this input to change modes between access and secure.

b. Database downloads and updates from the Central Station that include enrollment and privilege information.

c. LAN connection: 10/100/1000Mbps network interface IP card.

3. Outputs:

a. Indicate success or failure of attempts to use entry-control devices and make comparisons of presented information with stored identification information.

b. Grant or deny entry by sending control signals to portal-control devices and mask intrusion alarm annunciation from sensors stimulated by authorized entries.

c. Maintain a date-, time-, and Location-stamped record of each transaction and transmit transaction records to the Central Station.

d. Door Prop Alarm: If a portal is held open for longer than 20 seconds, alarm sounds.

4. With power supplies sufficient to power at voltage and frequency required for field devices and portal-control devices. Provide power plug to plug in the receptacle in the junction box above each door.

5. Data Line Problems: For periods of loss of communications with Central Station, or when data transmission is degraded and generating continuous checksum errors, the Controller shall continue to control entry by accepting identifying information, making authentication decisions, checking privileges, and controlling portal-control devices.

a. Store up to 1000 transactions during periods of communication loss between the Controller and access-control devices for subsequent upload to the Central Station on restoration of communication.

6. Controller Power: NFPA 70, Class II power supply transformer, with 12- or 24-V ac secondary, backup battery and charger.

a. Backup Battery: Premium, valve-regulated, recombinant-sealed, lead-calcium battery; spill proof; with a full 1-year warranty and a pro rata 19-year warranty. With single-stage, constant-voltage-current, limited battery charger, comply with battery manufacturer's written instructions for battery terminal voltage and charging current recommendations for maximum battery life.

b. Backup Power Supply Capacity: 90 minutes of battery supply. Submit battery and charger calculations.

c. Power Monitoring: Provide manual dynamic battery load test, initiated and monitored at the control center; with automatic disconnection of the Controller when battery voltage drops below Controller limits. Report by using local Controller-mounted LEDs and by communicating status to Central Station. Indicate normal power on and battery charger on trickle charge. Indicate and report the following:

1) Trouble Alarm: Normal power off load assumed by battery.

2) Trouble Alarm: Low battery.

3) Alarm: Power off.

d. Provide power plug to plug in the receptacle in the junction box above each door.

7. Enclosure:

a. Provide a minimum of 24" x 20" x 6" hinged enclosure to house all the multiple board configurations, auxiliary inputs and outputs,, back-up battery, power supply, RJ45 jack, 120 volt receptacle, power cord, etc., and/or as required.

b. Provide plywood as needed.

8. Provide two door controllers, three door controllers or four door controllers as required.

2.8 POWER SUPPLY

A. Power Supply Unit shall be12VAC, 5 Amp power supply for primary power supply with battery unit(s) as secondary power supply (backup).

B. Provide battery unit(s) for backup for system control panel(s) to maintain supervisory functions for 24 hours and operation of access control and alarm monitoring system hardware for a period of not less than 90 minutes in the event of a power outage.

C. Submit battery calculations indicating compliance with this requirement.

2.9 PROXIMITY CARD READERS AND PROXIMITY CARDS

A. Provide proximity reader (card reader) at entry/exit doors as shown on the drawings.

B. Proximity card reader shall be powered from its associated door controller or access control panel including its standby power source.

C. Reader shall fit on a standard single gang electrical box.

D. Reader shall be 4.6 “H x 3 “W and .4 “ thick.

E. Reader shall be suitable for outdoor application.

F. Reader range from 4-8 inches.

G. Reader shall be HID compatible.

H. Reader shall be Black or White as selected by the owner.

I. Provide one spare reader.

J. Provide one reader in the main access control location for programming.

K. Proximity card reader shall have the following requirements:
1. Proximity iClass (Wiegand 26, 34, 40 or 56 bit) entry card reader shall be mounted with a recess mounted single-gang back box and stainless steel cover plate. Entry proximity card readers shall be located on the unsecure side of each door requiring card readers.
2. Approved Manufacturer
   a. HID R40/ 6120C series
   b. Keri System p300 series and/or P500 series
   c. AMAG Symmetry S820 series
   d. Farpointe P-500 HID series.
   e. DMP Proxpro II /PR5455 series
   f. Honeywell
   g. RS-2
   h. Kantech P325/P325KP series
   i. Assa Abloy RP40 series, RP15 mullion mount

L. Proximity Card Requirements: PVC & Composite PVC, Card width/length ISO CR-80-ISO 7810, 2.125" x 3.385", .030" thickness, cards must have HID proximity antenna. Provide proximity cards per the following requirements:
1. Proximity KEYFOBS: Provide proximity keyfobs that are compatible with the system/readers, external card numbering - sequentially, horizontally hole/slot punched for strap clip, 26 bit wiegand format, passive, 137 billion unique codes, read range 3 inch minimum. Provide a quantity of 250 fobs and 250 cards
2. Approved manufacturer
   a. HID I Class 2050PKNMN.
   b. Keri Systems PS-x-xx series
   c. Philips MIFARE - series
   d. DMP ProxKEY III or II fobs / ISOPROX II cards
   e. Honeywell PX-KEY-H fobs/ 469012 or 469305 cards.
   f. Kantech P40KEY fobs / P30DMG cards
   g. Farpointe PSK-3H fobs and .PSM-2H cards.

2.10 CARD READERS

A. Power: Card reader shall be powered from its associated Controller, including its standby power source.

B. Response Time: Card reader shall respond to passage requests by generating a signal that is sent to the Controller. Response time shall be 800 ms or less, from the time the card reader finishes reading the credential card until a response signal is generated.

C. Enclosure: Suitable for surface, semi-flush, or pedestal mounting. Mounting types shall additionally be suitable for installation in the following locations:

1. Indoors, controlled environment.
2. Indoors, uncontrolled environment.
3. Outdoors, with built-in heaters or other cold-weather equipment to extend the operating temperature range as needed for operation at the site.

D. Display: LED or other type of visual indicator display shall provide visual and audible status indications and user prompts. Indicate power on/off, whether user passage requests have been accepted or rejected, and whether the door is locked or unlocked.

E. Stripe Swipe Readers: Bidirectional, reading cards swiped in both directions, powered by the Controller. Reader shall be set up for ABA Track.

1. Readers for outdoors shall be in a polymeric plastic enclosure, with all electronics potted in plastic. Rated for operation in ambient conditions of minus 40 to plus 160 deg F in a humidity range of 10 to 90 percent.

F. Touch Plate and Proximity Readers:

1. Passive detection proximity card readers shall use a swept-frequency, RF field generator to read the resonant frequencies of tuned circuits laminated into compatible credential cards. The resonant frequencies read shall constitute a unique identification code number.
2. The card reader shall read proximity cards in a range from contact with to at least 6 inches from the reader.

2.11 ENROLLMENT CENTER/PHOTO ID CARD

A. Equipment for enrolling personnel into, and removing personnel from, system database, using [a dedicated workstation PC] [central-station equipment].

B. Enrollment equipment shall support encoding of credential cards including cryptographic and other internal security checks as required for system.

1. Allow only authorized entry-control enrollment personnel to access the enrollment equipment using passwords.
2. Include enrollment subsystem configuration controls and electronic diagnostic aids for subsystem setup and troubleshooting at the Central Station.
3. Enrollment station records printer shall meet requirements of the report printer.

C. System Capacity: Number of badges shall be limited only by hard disk space. Badge templates and images shall be in color, supporting the maximum color capability of Microsoft Windows operating system.

D. Badge Configuration:

1. Software for badge template creation shall include a template consisting of background and predetermined locations of photographs, text objects and data fields for text, and bar-code and biometric information. Include automatic sizing of data fields placed on a badge to compensate for names, which may otherwise be too large to fit in the area designated.

2. Allow different badge templates to be used for each department, tenant, or visitor.

3. As a setup option, templates shall be automatically selected for the badge, based on the group the credential holder is assigned to. Allow the operator to override the automatic template selection and use a template chosen by the operator for creating a badge.

4. Setup shall determine which graphics and credential holder information will be displayed and where on the card it will be placed. All data in the security access system such as name, code, group, access level, and any of the 99 user-defined fields shall be selectable, with the ability to place them anywhere on the card.

5. System shall include an importing, filing, and recall system of stored images and shapes that can be placed on the badge.

6. Allow multiple images on same badge, including, but not be limited to, bar codes, digital photos, and signatures.

7. Support transparent backgrounds so that image is only surrounded by the intended background, but not its immediate background.

E. Photo Imaging: Integral to security access.

1. Import images from bitmap file formats, digital cameras, TWAIN cameras, or scanners. Allow image cropping and editing, WYSIWYG badge building application, and badge print preview and printing capabilities.

2. System shall support multiple images stored for each credential holder, including signatures, portrait views, and profile views.

F. Text Objects: Badge configuration shall provide for creation of custom text as an object, allowing font selection, typing, scaling, and formatting of the text object. Formatting options shall include changing font, font size, text flow, and text alignment; bending or curving the text object into a circle or semicircle; applying 3-D effects; and applying predefined effects such as tilt, extrusion, or beveling. Text shall be placed and optionally automatically centered within any region of the badge layout.

G. Badges and Credential Cards (Provide a minimum of 1000 cards):

1. Badges are credential cards that do not contain data to be read by card readers.

2. Credential cards shall store uniquely coded data used by card readers as an Identifier.

a. Magnetic-Stripe Cards: Comply with ISO 7810, ISO 7811-1, ISO 7811-2, ISO 7811-3, and ISO 7811-6. Use single-layer magnetic tape material that is coated with a plastic slick protective coat and affixed to the back of the credential card near the top.

b. Proximity [Cards] [Key Fobs]: Use proximity detection without physical contact with the proximity reader for proper operation.

3. Allow entry-control card to be modified by lamination or direct print process during the enrollment process for use as a picture and identification badge without reduction of readability. The design shall allow for the addition of at least one slot or hole to accommodate the attachment of a clip for affixing the credential card to the type of badge holder used at the site.

a. Card Size and Dimensional Stability: Standard size, 2-1/8 by 3-3/8 inches; dimensionally stable so that an undamaged card with deformations resulting from normal use is readable by the card reader.

b. Card Material: Abrasion resistant, nonflammable, and nontoxic; and impervious to solar radiation and effects of ultraviolet light.

c. Card Construction: Core and laminate or monolithic construction. Lettering, logos, and other markings shall be hot stamped into the credential material or direct printed.

1) Furnish equipment for on-site assembly and lamination of credential cards.

d. Card Durability and Maintainability: Designed and constructed to yield a useful lifetime of at least 5 years or 5000 insertions or swipes, whichever results in a longer period of

time. Allow credential cards to be cleaned by wiping with a sponge or cloth wetted with soap and water.

H. Card-Making Equipment: Consisting of a workstation, video camera, video-imaging equipment, and a printer.

1. Camera: NTSC color standard, RGB video output, 470 lines minimum horizontal resolution, and automatic white balance with full rated output under illumination of 0.5 fc.

2. Video Imaging: Live-image capture software and hardware and a digital signature capture pad.

3. Standard workstation, modified as follows:

a. Redundant workstation is not required.

b. Printer is not required.

c. UPS is not required.

d. Sound card is not required.

4. Printer: Dye-sublimation resin thermal transfer, 300 dpi resolution, 16.7 million colors, accepting cards ranging in size from 2.1 by 3 inches to 2.6 by 3.7 inches and having card thickness ranging from 0.020 to 0.060 inch. Printer shall have options for encoding magnetic stripe using tracks 1, 2, and 3. Throughput shall be not less than 60 seconds per card.

I. Card personalization software.

1. Operation system: Windows 7, Vista and XP.

2. Software shall be networkable.

3. Languages: English, French, Spanish, up to 7 languages.

4. Native/Live link: Microsoft access 2000,2003 and 2007.

5. Password log in

6. Microsoft SQL Server 2000, 2003 and 2008.

7. DVTEL

8. Dual sided template designs.

9. Add photo field.

10. Import image, logos, and graphics.

11. Add a linear barcode.

12. Add magnetic stipes.

13. Unlimited data fields.

14. Add signature.

15. Add 2D barcode.

16. Integrated photo capture.

17. Unlimited save and search records.

18. Integrated signature capture.

19. Batch and data sheet printing.

20. Custom and standard reports.

21. Single DB/Multi table live link.

22. Data view connectivity.

23. Free updates.

24. Student interoperability framework agent (SIF).

2.12 ENROLLMENT CENTER FOR FOBS

A. Equipment for enrolling personnel into, and removing personnel from, system database, using a dedicated workstation PC.

B. Enrollment equipment shall support encoding fobs.

1. Allow only authorized entry-control enrollment personnel to access the enrollment equipment using passwords.

2. Include enrollment subsystem configuration controls and electronic diagnostic aids for subsystem setup and troubleshooting at the Central Station.

C. Software Configuration:

1. Software for fobs creation shall include a template consisting of background and predetermined locations of photographs, text objects and data fields for text, and bar-code and biometric information. Include automatic sizing of data fields placed on a badge to compensate for names, which may otherwise be too large to fit in the area designated.

2. Allow different badge templates to be used for each department, tenant, or visitor.

3. As a setup option, templates shall be automatically selected for the badge, based on the group the credential holder is assigned to. Allow the operator to override the automatic template selection and use a template chosen by the operator for creating a badge.

4. Setup shall determine which graphics and credential holder information will be displayed and where on the card it will be placed. All data in the security access system such as name, code, group, access level, and any of the 99 user-defined fields shall be selectable, with the ability to place them anywhere on the card.

5. System shall include an importing, filing, and recall system of stored images and shapes that can be placed on the badge.

6. Allow multiple images on same badge, including, but not be limited to, bar codes, digital photos, and signatures.

7. Support transparent backgrounds so that image is only surrounded by the intended background, but not its immediate background.

D. Text Objects: Badge configuration shall provide for creation of custom text as an object, allowing font selection, typing, scaling, and formatting of the text object. Formatting options shall include changing font, font size, text flow, and text alignment; bending or curving the text object into a circle or semicircle; applying 3-D effects; and applying predefined effects such as tilt, extrusion, or beveling. Text shall be placed and optionally automatically centered within any region of the badge layout.

E. Badges and Credential Cards (Provide a minimum of 1000 cards):

1. Badges are credential cards that do not contain data to be read by card readers.

2. Credential cards shall store uniquely coded data used by card readers as an Identifier.

a. Magnetic-Stripe Cards: Comply with ISO 7810, ISO 7811-1, ISO 7811-2, ISO 7811-3, and ISO 7811-6. Use single-layer magnetic tape material that is coated with a plastic slick protective coat and affixed to the back of the credential card near the top.

b. Proximity [Cards] [Key Fobs]: Use proximity detection without physical contact with the proximity reader for proper operation.

3. Allow entry-control card to be modified by lamination or direct print process during the enrollment process for use as a picture and identification badge without reduction of readability. The design shall allow for the addition of at least one slot or hole to accommodate the attachment of a clip for affixing the credential card to the type of badge holder used at the site.

a. Card Size and Dimensional Stability: Standard size, 2-1/8 by 3-3/8 inches; dimensionally stable so that an undamaged card with deformations resulting from normal use is readable by the card reader.

b. Card Material: Abrasion resistant, nonflammable, and nontoxic; and impervious to solar radiation and effects of ultraviolet light.

c. Card Construction: Core and laminate or monolithic construction. Lettering, logos, and other markings shall be hot stamped into the credential material or direct printed.

1) Furnish equipment for on-site assembly and lamination of credential cards.

d. Card Durability and Maintainability: Designed and constructed to yield a useful lifetime of at least 5 years or 5000 insertions or swipes, whichever results in a longer period of time. Allow credential cards to be cleaned by wiping with a sponge or cloth wetted with soap and water.

F. Card-Making Equipment: Consisting of a workstation, video camera, video-imaging equipment, and a printer.

1. Camera: NTSC color standard, RGB video output, 470 lines minimum horizontal resolution, and automatic white balance with full rated output under illumination of 0.5 fc.

2. Video Imaging: Live-image capture software and hardware and a digital signature capture pad.

3. Standard workstation, modified as follows:

a. Redundant workstation is not required.

b. Printer is not required.

c. UPS is not required.

d. Sound card is not required.

4. Printer: Dye-sublimation resin thermal transfer, 300 dpi resolution, 16.7 million colors, accepting cards ranging in size from 2.1 by 3 inches to 2.6 by 3.7 inches and having card thickness ranging from 0.020 to 0.060 inch. Printer shall have options for encoding magnetic stripe using tracks 1, 2, and 3. Throughput shall be not less than 60 seconds per card.

G. Card personalization software.

1. Operation system: Windows 7, Vista and XP.

2. Software shall be networkable.

3. Languages: English, French, Spanish, up to 7 languages.

4. Native/Live link: Microsoft access 2000,2003 and 2007.

5. Password log in

6. Microsoft SQL Server 2000, 2003 and 2008.

7. DVTEL

8. Dual sided template designs.

9. Add photo field.

10. Import image, logos, and graphics.

11. Add a linear barcode.

12. Add magnetic stipes.

13. Unlimited data fields.

14. Add signature.

15. Add 2D barcode.

16. Integrated photo capture.

17. Unlimited save and search records.

18. Integrated signature capture.
19. Batch and data sheet printing.
20. Custom and standard reports.
21. Single DB/Multi table live link.
22. Data view connectivity.
23. Free updates.
24. Student interoperability framework agent (SIF).

2.13 REQUEST FOR EXIT MOTION DETECTOR

A. Provide request for exit motion detectors as follows:
1. An infrared exit request sensor shall be installed on the inner side of doors that are controlled or as per the instructions on the door grid to enable automatic unlocking of the retaining device and to momentarily suspend door supervision.
2. This sensor shall be linked to the door controller that will give the unlocking command for this information to be stored in the system's history.
3. Characteristics of the exit request sensor:
   a. Passive infrared
   b. Digital signal processing filtered (DSP)
   c. Microprocessor controlled
   d. Equipped with a 90 dB buzzer
   e. Red/green LCD visibility indicator
   f. Tamper proof contact (contact normally open)
   g. Adjustable detection direction
   h. Vertical (barrel rotation)
   i. Horizontal (individual component)
   j. 12 to 28 volts DC 35mA
   k. Dimensions : H: 4.5 cm ; W: 19 cm; D: 4.75 cm
   l. Maximum detection distance for the hand on the handle (3 meters);
   m. Maximum detection distance for persons (6 meters).
4. The request for exit motion detector shall be installed per manufacturers' recommendations.

2.14 PUSH-BUTTON SWITCHES

A. Push-Button Switches: Momentary-contact back-lighted push buttons, with stainless-steel switch enclosures.

1. Electrical Ratings:
   a. Minimum continuous current rating of 10 A at 120 V ac or 5 A at 240-V ac.
   b. Contacts that will make 720 VA at 60 A, that will break at 720 VA at 10 A.
2. Enclosures: Flush or surface mounting. Push buttons shall be suitable for flush mounting in the switch enclosures.
3. Enclosures shall additionally be suitable for installation in the following locations:
   a. Indoors, controlled environment.
   b. Indoors, uncontrolled environment.
   c. Outdoors.
4. Power: Push-button switches shall be powered from their associated Controller, using dc control.

2.15 DOOR CONTACT AND WINDOW SWITCHES

A. Description: Balanced-magnetic switch, complying with UL 634, installed on frame with integral over current device to limit current to 80 percent of switch capacity.

B. Bias magnet and minimum of two encapsulated reed switches shall resist compromise from introduction of foreign magnetic fields.

C. Contact and magnetic housing shall snap lock into the ¾ diameter hole.

D. Flush-Mounted Switches: Unobtrusive and flush with surface of door and window frame.

E. Overhead Door Switch: Balanced-magnetic type, listed for outdoor locations, and having door-mounting magnet and floor-mounting switch unit.

2.16 PIR SENSORS (MOTION DETECTORS)

A. Description: Sensors detect motion by monitoring infrared wavelengths emitted from a human body within their protected zone and by being insensitive to general thermal variations.

1. Wall-Mounting Unit Maximum Detection Range: Not less than 50 feet.

B. Device Performance:

1. Sensitivity: Adjustable pattern coverage to detect a change in temperature of 2 deg F or less, and movement within sensor's detection patterns at any speed between 0.3 to 7.5 fps across 2 adjacent segments of detector's field of view.

2. Test Indicator: LED test indicator that is not visible during normal operation. When visible, indicator shall light when sensor detects motion. Locate test enabling switch under sensor housing cover.

3. Detector shall be dual technology unit.

C. Provide wire guard for motion detectors in the Gym.

2.17 DOOR AND GATE HARDWARE INTERFACE

A. Electric Door Strikes: Use end-of-line resistors to provide power line supervision. Signal switches shall transmit data to Controller to indicate when the bolt is not engaged and the strike mechanism is unlocked, and shall report a forced entry. Power and signal shall be from the Controller. Electric strikes are specified in Division 08 "Door Hardware."

B. Electrically Retractable Latches: Electrically retractable latches integrated into panic hardware. End-of-line resistors shall provide power line supervision. Signal switches shall transmit data to Controller to indicate when the bolt is not engaged and the mechanism is unlocked, and shall report a forced entry. Power and signal shall be from the Controller. Electrically retractable latches, electric power transfer, and panic hardware are specified in Division 08 Section "Door Hardware."

C. Electromagnetic Locks: End-of-line resistors shall provide power line supervision. Lock status sensing signal shall positively indicate door is secure. Power and signal shall be from the Controller. Electromagnetic locks are specified in Division 08 Section "Door Hardware."

D. Vehicle Gate Operator: Interface electrical operation of gate with controls of this Section. Vehicle gate operators shall be connected, monitored, and controlled, by the security access Controllers. Vehicle gate and accessories are specified in Division 32 Section "Chain Link Fences and Gates."

E. RS-232 ASCII INTERFACE SPECIFICATIONS

1. Retain this Article if integration with video surveillance, intrusion detection, digital paging, and similar systems is required. RS-232 communications connections are not recommended for distances of more than 50 feet, although transmission over distances of 300 feet is possible with specialized equipment.

F. ASCII interface shall allow RS-232 connections to be made between the control station operating as the host PC and any equipment that will accept RS-232 ASCII command strings, such as CCTV switchers, intercoms, and paging systems.

1. Each alarm input in system shall allow for individual programming to output up to four unique ASCII character strings through two different COM ports on the host PC.

2. Each input shall have the ability to be defined to transmit a unique ASCII string for alarm and one for restore through one COM port, and a unique ASCII string for a non-alarm abnormal condition and one for a normal condition through the same or different COM port.

3. The predefined ASCII character strings shall have the ability to be up to 420 characters long with full use of all the ASCII control characters, such as return or line feed. The character strings shall be defined in database of system and then assigned to the appropriate inputs.

4. The COM ports of the host PC used to interface with external equipment shall be defined in the setup portion of the software. The COM port's baud rate, word length, stop bits, and parity shall be definable in the software to match that of the external equipment.

G. Pager System Interface: Alarms shall be able to activate a pager system with customized message for each input alarm.

1. RS-232 output shall be capable of connection to a pager interface that can be used to call a paging system or service and send a signal to a portable pager. System shall allow an individual alphanumeric message per alarm input to be sent to the paging system. This interface shall support both numeric and alphanumeric pagers.

H. Alarm System Interface:

1. RS-232 output shall be capable of transmitting alarms from other monitoring and alarm systems to central-station automation software.

2. Alternatively, alarms that are received by this access control system are to be transferred to alarm automation system as if they were sent through a digital alarm receiver.

a. System shall be able to transmit an individual message from any alarm input to a burglar alarm automation monitoring system.

b. System shall be able to append to each message a predefined set of character strings as a prefix and suffix.

2.18 FLOOR SELECT ELEVATOR CONTROL

A. Elevator access control shall be integral to security access.

1. System shall be capable of providing full elevator security and control through dedicated Controllers without relying on the control-station host PC for elevator control decisions.

2. Access-control system shall enable and disable car calls on each floor and floor select buttons in each elevator car, restricting passengers' access to the floors where they have been given access.

3. System setup shall, through programming, automatically secure and unsecure each floor select button of a car individually by time and day. Each floor select button within a car shall be separately controlled so that some floors may be secure while others remain unsecure.

4. When a floor select button is secure, it shall require the passenger to use his/her access code and have access to that floor before the floor select button will operate. The passenger's credential shall determine which car calls and floor select buttons are to be enabled, restricting access to floors unless authorized by system's access code database. Floor select button shall be enabled only in the car where the credential holder is the passenger.

B. Security access system shall record which call button is pressed, along with credential and time information.

1. System Controller shall record elevator access data.
2. The Controller shall reset all additional call buttons that may have been enabled by the user's credential.
3. The floor select elevator control shall allow for manual override either individually by floor or by cab as a group from a workstation PC.

2.19 AFTER-HOURS HVAC CONTROL

A. After-Hours HVAC Control: Provide for any credential read to activate or control individual HVAC zones based on access level. This control module shall control and record the after-hours use of the heating and cooling system in zones space.

1. At the specified time every day, the HVAC shall automatically go into its after-hours mode. It shall then revert into its normal business hours mode by an occupant using an access card at a designated reader.
2. Once enabled, the occupant's HVAC zone shall be under thermostat control for a preset amount of time. When the preset amount of time elapses, the HVAC for that zone shall revert back to after-hours mode unless an occupant uses his/her card again. This shall continue until the unit automatically returns to its normal business hours operation.

B. Control module activates the HVAC system after a valid access by any of three methods; however, the HVAC control shall always allow for manual override from the PC.

1. By time expiration after access of an adjustable period from 1 second to 546 minutes (9.1 hours).
2. By use of the card again at the same or different reader.
3. By system returning to its normal business hours operation.

C. After-hours HVAC control shall operate with all other features running simultaneously and use the central-station PC that controls access for the building but shall not rely on the host PC for any HVAC control decisions.

2.20 MISCELLANEOUS EQUIPMENT

A. Provide Intrusion Siren as needed, verify location with owner.

B. Provide lock door universal button to lock down all the doors when the station is activated.

C. Provide door release or door lock universal button, so doors can be released or locked from this location.

D. Provide Door Intercom System: Door Intercom System shall consist of door intercom stations and a door entry controller.

E. Door intercom stations shall provide two-way communication via phone line interface to connect to the building telephone system and shall have the capability of dialing a primary extension and a secondary extension if the primary extension does not respond.

F. The door entry controller shall interface with access control system to release electric door strike(s) at location of intercom station via numeric/character entry sequence by any telephone on the building's telephone system.

G. Coordinate programming of the door intercom system with the Owner and provide two-way communication capability to telephone locations as instructed by the Owner.

H. Intercom stations shall be flush mounted with weatherproof/vandal proof stainless steel cover, locations as shown on the Drawings.

2.21 VIDEO AND CAMERA CONTROL

A. Control station or designated workstation displays live video from a CCTV source.

1. Control Buttons: On the display window, with separate control buttons to represent Left, Right, Up, Down, Zoom In, Zoom Out, Scan, and a minimum of two custom command auxiliary controls.

2. Provide at least seven icons to represent different types of cameras, with ability to import custom icons. Provide option for display of icons on graphic maps to represent their physical location.

3. Provide the alarm-handling window with a command button that will display the camera associated with the alarm point.

B. Display mouse-selectable icons representing each camera source, to select source to be displayed. For CCTV sources that are connected to a video switcher, control station shall automatically send control commands through a COM port to display the requested camera when the camera icon is selected.

C. Allow cameras with preset positioning to be defined by displaying a different icon for each of the presets. Provide control with Next and Previous buttons to allow operator to cycle quickly through the preset positions.

2.22 DOOR INTERCOM ENTRY SYSTEM

A. The Door Intercom Entry System shall consist of door intercom call in speaker phone and a master intercom entry controller.

B. Door intercom call in speaker phone station shall provide two-way communication via phone line interface to connect to the building telephone system and shall have the capability of dialing a primary extension and a secondary extension if the primary extension does not respond. The unit shall be housed in a 2 gang deep box or as recommended by the manufacturer, unit shall be weather proof.

C. The master intercom entry controller shall interface with access control system to release electric door strike(s) at location of intercom station via numeric/character entry sequence by any telephone on the building's telephone system.

D. The master intercom entry controller shall have 5A relay contacts with 8REN ring outputs

E. The unit shall handle at least four door intercom call in speaker phones.

F. The unit shall be connected to the building telephone system.

G. Coordinate programming of the door intercom entry system with the Owner and provide two-way communication capability to telephone locations as instructed by the Owner.

H. Intercom stations shall be flush mounted with weatherproof/vandal proof stainless steel cover, locations as shown on the Drawings.

I. Approved Manufacturers:
   a. Viking E-30 intercom call in speaker phone station
   b. Viking C-2000 B master intercom entry door controller
   c. Bogen.
   d. Dukane.
   e. Valcom V-1073 series door intercom station.
   f. Valcom V2901A door answering controller
   g. Aiphone

h. Commend

2.23 CABLES

A. Access control cable shall be provided by the cabling contractor, the access control system contractor SHALL verify all cabling and shall provide any additional cabling as required for their system.

B. The Access Control Contractor Shall verifies all existing cabling (IF ANY) and provides all cabling per manufacturers recommendations for a complete operational system.

C. The Access Control Contractor shall interface the Access control System with the Automatic Door Operators (ADO) and SHALL provide all cabling, hardware as needed.

2.24 TRANSFORMERS

A. NFPA 70, Class II control transformers, NRTL listed. Transformers for security access-control system shall not be shared with any other system.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine pathway elements intended for cables. Check raceways, cable trays, and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting installation.

B. Examine roughing-in for LAN and control cable conduit systems to PCs, Controllers, card readers, and other cable-connected devices to verify actual locations of conduit and back boxes before device installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Comply with recommendations in SIA CP-01.

B. Comply with EIA/TIA-606, "Administration Standard for the Telecommunications Infrastructure of Commercial Buildings."

C. Obtain detailed Project planning forms from manufacturer of access-control system; develop custom forms to suit Project. Fill in all data available from Project plans and specifications and publish as Project planning documents for review and approval.

1. Record setup data for control station and workstations.
2. For each Location, record setup of Controller features and access requirements.
3. Propose start and stop times for time zones and holidays, and match up access levels for doors.
4. Set up groups, facility codes, linking, and list inputs and outputs for each Controller.
5. Assign action message names and compose messages.
6. Set up alarms. Establish interlocks between alarms, intruder detection, and video surveillance features.
7. Prepare and install alarm graphic maps.
8. Develop user-defined fields.
9. Develop screen layout formats.
10. Discuss badge layout options; design badges.

11. Complete system diagnostics and operation verification.
12. Prepare a specific plan for system testing, startup, and demonstration.
13. Develop acceptance test concept and, on approval, develop specifics of the test.

D. In meetings with Architect/Engineer and Owner, present Project planning documents and review, adjust, and prepare final setup documents. Use final documents to set up system software.

3.3 CABLING

A. Comply with NECA 1, "Good Workmanship in Electrical Contracting."

B. The security contractor shall be responsible for ALL the cabling for the access control system as shown and/or as recommended by the system manufacturer for a complete operational system.

C. The access control system shall be integrated with the Intrusion alarm system for arming and disarming functions as directed by the owner, any system that does not meet this requirement SHALL be replaced with a new system at the security contractor's expense.

D. Install cables and wiring according to requirements in Division 28 Section "Conductors and Cables for Electronic Safety and Security."

E. Wiring Method: Install wiring in raceway and cable tray except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces where unenclosed wiring method may be used. Use NRTL-listed plenum cable in environmental air spaces, including plenum ceilings. Conceal raceway and cables except in unfinished spaces.

F. Install LAN cables using techniques, practices, and methods that are consistent with Category 5E/6 rating of components and that ensure Category 5E/6 performance of completed and linked signal paths, end to end.

G. Install cables without damaging conductors, shield, or jacket.

H. Boxes and enclosures containing security system components or cabling, and which are easily accessible to employees or to the public, shall be provided with a lock. Boxes above ceiling level in occupied areas of the building shall not be considered to be accessible. Junction boxes and small device enclosures below ceiling level and easily accessible to employees or the public shall be covered with a suitable cover plate and secured with tamperproof screws.

I. Install end-of-line resistors at the field device location and not at the Controller or panel location.

3.4 CABLE APPLICATION

A. Comply with EIA/TIA-569, "Commercial Building Standard for Telecommunications Pathways and Spaces."

B. Cable application requirements are minimum requirements and shall be exceeded if recommended or required by manufacturer of system hardware.

C. RS-232 Cabling: Install at a maximum distance of 50 feet.

D. RS-485 Cabling: Install at a maximum distance of 4000 feet.

E. Card Readers:

1. Install number of conductor pairs recommended by manufacturer for the functions specified.
2. Unless manufacturer recommends larger conductors, install No. 20 AWG wire if maximum distance is 500 feet.

3. For greater distances, install "extender" or "repeater" modules recommended by manufacturer of the Controller.

4. Install minimum No. 18 AWG shielded cable to readers that draw 50 mA or more.

F. Install minimum No. 16 AWG cable from Controller to electrically powered locks. Do not exceed 500 feet.

G. Install minimum No. 18 AWG ac power wire from transformer to Controller, with a maximum distance of 25 feet.

3.5 GROUNDING

A. Comply with Division 26 and 27 Section "Grounding and Bonding for Electrical and Communications Systems."

B. Comply with IEEE 1100, "Power and Grounding Sensitive Electronic Equipment."

C. Ground cable shields, drain conductors, and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.

D. Bond shields and drains conductors to ground at only one point in each circuit.

E. Signal Ground:

1. Terminal: Locate in each equipment room and wiring closet; isolate from power system and equipment grounding.

2. Bus: Mount on wall of main equipment room with standoff insulators.

3. Backbone Cable: Extend from signal ground bus to signal ground terminal in each equipment room and wiring closet.

3.6 INSTALLATION

A. Push Buttons: Where multiple push buttons are housed within a single switch enclosure, they shall be stacked vertically with each push-button switch labeled with 1/4-inch- high text and symbols as required. Push-button switches shall be connected to the Controller associated with the portal to which they are applied, and shall operate the appropriate electric strike, electric bolt, or other facility release device.

B. Install card readers.

3.7 IDENTIFICATION

A. In addition to requirements in this Article, comply with applicable requirements in Division 26 Section "Identification for Electrical Systems" and with TIA/EIA-606.

B. Use unique, alphanumeric designation for each cable, and label cable and jacks, connectors, and terminals to which it connects with same designation. Use logical and systematic designations for facility's architectural arrangement.

C. Label each terminal strip and screw terminal in each cabinet, rack, or panel.

1. All wiring conductors connected to terminal strips shall be individually numbered, and each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with the name and number of the particular device as shown.

2. Each wire connected to building-mounted devices is not required to be numbered at the device if the color of the wire is consistent with the associated wire connected and numbered within the panel or cabinet.

3.8 SYSTEM SOFTWARE

A. Develop, install, and test software and databases for the complete and proper operation of systems involved. Assign software license to Owner.

3.9 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:

1. LAN Cable Procedures: Inspect for physical damage and test each conductor signal path for continuity and shorts. Use Class 2, bidirectional, Category 5 tester. Test for faulty connectors, splices, and terminations. Test according to TIA/EIA-568-1, "Commercial Building Telecommunications Cabling Standards - Part 1 General Requirements." Link performance for UTP cables must comply with minimum criteria in TIA/EIA-568-B.

2. Test each circuit and component of each system. Tests shall include, but are not limited to, measurements of power supply output under maximum load, signal loop resistance, and leakage to ground where applicable. System components with battery backup shall be operated on battery power for a period of not less than 10 percent of the calculated battery operating time. Provide special equipment and software if testing requires special or dedicated equipment.

3. Operational Test: After installation of cables and connectors, demonstrate product capability and compliance with requirements. Test each signal path for end-to-end performance from each end of all pairs installed. Remove temporary connections when tests have been satisfactorily completed.

C. Remove and replace malfunctioning devices and circuits and retest as specified above.

3.10 STARTUP SERVICE

A. Engage a factory-authorized service representative to supervise and assist with startup service. Complete installation and startup checks according to approved procedures that were developed in "Preparation" Article and with manufacturer's written instructions.

1. Enroll and prepare badges and access cards for Owner's operators, management, and security personnel.

3.11 PROTECTION

A. Maintain strict security during the installation of equipment and software. Rooms housing the control station, and workstations that have been powered up shall be locked and secured, with an activated burglar alarm and access-control system reporting to a Central Station complying with UL 1610, "Central-Station Burglar-Alarm Units," during periods when a qualified operator in the employ of Contractor is not present.

3.12 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain security access system. Refer to Division 01 Section "Demonstration and Training"

B. Develop separate training modules for the following:

1. Computer system administration personnel to manage and repair the LAN and databases and to update and maintain software.

2. Operators who prepare and input credentials to man the control station and workstations and to enroll personnel.

3. Security personnel.
4. Hardware maintenance personnel.
5. Corporate management.

END OF SECTION 28 13 10

SECTION 28 31 11 – DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. System smoke detectors.
   2. Fire alarm wire and cable.

1.2 DEFINITIONS

A. LED: Light-emitting diode.

B. NICET: National Institute for Certification in Engineering Technologies.

1.3 SYSTEM DESCRIPTION

A. Noncoded addressable system, with automatic sensitivity control of certain smoke detectors and multiplexed signal transmission, dedicated to fire-alarm service only.

1.4 SUBMITTALS

A. Shop Drawings: For fire-alarm system. Include plans, elevations, sections, details, and attachments to other work. Submit simultaneously with Product Data. Include the following as a minimum shop drawing requirement.
   1. Submit to authorities having jurisdiction for approval, submittals reviewed and marked “No Exceptions Taken” by Architect.
   2. Shop Drawings shall be prepared by persons with the following qualifications:
      a. Trained and certified by manufacturer in fire-alarm system design.
      b. NICET-certified fire-alarm technician, Level III minimum.
      c. Licensed or certified by authorities having jurisdiction.
   3. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.
   4. Include voltage drop calculations for notification appliance circuits.
   5. Include battery-size calculations.
   6. Include performance parameters and installation details for each detector, verifying that each detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
   7. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale and coordinating installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.
   8. Include 1/8-inch scale floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.
   9. Provide written Warranty as follows
      a. The Fire System shall have a 1 year warranty starting for the date of Beneficial Occupancy.
      b. Batteries shall have a full 1-year warranty and a 10-year pro rata warranty starting for the date of Beneficial Occupancy.

B. Quality Assurance/Control Submittals:
   1. Product Data: For each type of product indicated.
   2. Qualification Data: Provide Certification form, from the manufacturer, that the Installer and Persons preparing Shop Drawings are Qualified by the manufacturer. Submit qualifications simultaneously with Product Data.
   3. Field quality-control reports.

1.5 CLOSEOUT DOCUMENTS

A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
   1. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
      a. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
      b. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.
      c. Record copy of site-specific software.
      d. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:
         1) Frequency of testing of installed components.
         2) Frequency of inspection of installed components.
         3) Requirements and recommendations related to results of maintenance.
         4) Manufacturer's user training manuals.
      e. Manufacturer's required maintenance related to system warranty requirements.
      f. Abbreviated operating instructions for mounting at fire-alarm control unit.
   2. Software and Firmware Operational Documentation:
      a. Software operating and upgrade manuals.
      b. Program Software Backup: On magnetic media or compact disk, complete with data files.
      c. Device address list.
      d. Printout of software application and graphic screens.
   3. Extra Materials: Receipt for extra materials.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.
   1. Installation shall be by personnel certified by NICET as fire-alarm Level II technician.
   2. Distributors shall also be certified by the manufacturer.

B. Source Limitations for Fire-Alarm System and Components: Obtain fire-alarm system from single source from single manufacturer. Components shall be compatible with, and operate as, an extension of existing system.

C. Fire Alarm Wire and Cable Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Flame-Spread Index: 25 or less.
   2. Smoke-Developed Index: 50 or less.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.7 PROJECT CONDITIONS

A. Interruption of Existing Fire-Alarm Service: Do not interrupt fire-alarm service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary guard service according to requirements indicated:
   1. Notify Construction Manager no fewer than two weeks in advance of proposed interruption of fire-alarm service.
   2. Do not proceed with interruption of fire-alarm service without Construction Manager's written permission.

1.8 SEQUENCING AND SCHEDULING

A. Existing Fire-Alarm Equipment: Maintain existing equipment fully operational until new equipment has been tested and accepted. As new equipment is installed, label it "NOT IN SERVICE" until it is accepted. Remove labels from new equipment when put into service and label existing fire-alarm equipment "NOT IN SERVICE" until removed from the building.

B. Equipment Removal: After acceptance of new fire-alarm system, remove existing disconnected fire-alarm equipment and wiring.

1.9 SOFTWARE SERVICE AGREEMENT

A. Comply with UL 864.

B. Technical Support: Beginning with Substantial Completion, provide software support for two years.

C. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.
   1. Provide 30 days' notice to Owner to allow scheduling and access to system.

1.10 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Lamps for Remote Indicating Lamp Units: Quantity equal to 10 percent of amount installed, but no fewer than 1 unit.
   2. Lamps for Strobe Units: Quantity equal to 10 percent of amount installed, but no fewer than 1 unit.
   3. Smoke Detectors, Fire Detectors: Quantity equal to 10 percent of amount of each type installed, but no fewer than 1 unit of each type.
   4. Detector Bases: Quantity equal to 2 percent of amount of each type installed, but no fewer than 1 unit of each type.
   5. Keys and Tools: One extra set for access to locked and tamperproofed components.
   6. Audible and Visual Notification Appliances: One of each type installed.
   7. Fuses: Two of each type installed in the system.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by Notifier to be compatible with existing fire alarm equipment.

2.2 SYSTEMS OPERATIONAL DESCRIPTION

A. Existing operational parameters shall remain as-is.

2.3 FIRE-ALARM CONTROL UNIT

A. Existing fire alarm control unit shall remain as-is, new devices shall be programmed into system as required.

B. Circuits:
   1. Initiating Device, Notification Appliance, and Signaling Line Circuits: NFPA 72, Class B.
      a. Initiating Device Circuits: Style A.

b. Notification Appliance Circuits: Style Y.
c. Signaling Line Circuits: Style 4.
d. Install no more than 70 percent rated capacity of addressable devices on each signaling line circuit.
e. Install no more than 70 percent rated capacity of notification appliances on each notification appliance circuit.

2. Serial Interfaces: Two RS-232 ports for service modem and printer.

C. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory, and print out the final adjusted values on system printer.

D. Event Log: On receipt of signal, capture alarm, supervisory, and trouble events. Identify zone, device, and function. Include type of signal (alarm, supervisory, or trouble) and date and time of occurrence. Differentiate alarm signals from all other indications. Also log system reset event, including same information for device, location, date, and time

2.4 NOTIFICATION APPLIANCES

A. General Requirements for Notification Appliances: Connected to notification appliance signal circuits, zoned as indicated, with screw terminals for system connections, and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.

1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated and with screw terminals for system connections.

B. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet from the horn, using the coded signal prescribed in UL 464 test protocol.

C. Visible Notification Appliances: Xenon strobe lights comply with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- high letters on the lens.

1. Rated Light Output: 110 cd, unless indicated otherwise.
2. Mounting: Wall mounted unless otherwise indicated.
3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
4. Flashing shall be in a temporal pattern, synchronized with other units.
5. Strobe Leads: Factory connected to screw terminals.
6. Mounting Faceplate: Factory finished, red.

D. Weatherproof Bells: Electric-vibrating, 24-V dc, under-dome type; with provision for housing operating mechanism behind bell. Bells shall produce a sound-pressure level of 94 dBA, measured 10 feet from bell. 10-inch size, unless otherwise indicated.

E. Voice/Alarm Notification Appliances:

1. Appliances shall comply with UL 1480 and shall be listed and labeled by an NRTL.
   a. Cone-Type Loudspeakers:
      1) High-Range Units: Rated 2 to 8 W.
         a) Minimum Axial Sensitivity: 93 dB at 10 feet at rated output.
      2) Low-Range Units: Rated 1/4 to 2 W.
         a) Minimum Axial Sensitivity: 84 dB at 10 feet at rated output.
      3) Frequency Response: Within plus or minus 3 dB from 400 to 4,000 Hz.
      4) Minimum Dispersion Angle: 100 degrees, minus 6 dB at 2,000 Hz.

5) Matching Transformer: Full-power rated with four taps. Maximum insertion loss of 0.5 dB.
6) Mounting: Flush or semirecessed, wall and ceiling mounted, unless noted otherwise.
a) Flush-Ceiling-Mounting Units: In steel back boxes. Metal ceiling grille with white baked enamel.

b. Horn-Type Loudspeakers:
1) Type: Single- and multiple-horn units, double-reentrant design, with minimum full-range power rating of 15 W.
2) Minimum Axial Sensitivity: 102 dB at 10 feet at rated output.
3) Frequency Response: Within plus or minus 3 dB from 400 to 4,000 Hz.
4) Minimum Dispersion Angle: 70 degrees, minus 6 dB at 2,000 Hz.
5) Matching Transformer: Full-power rated with four standard taps. Maximum insertion loss of 0.5 dB.
6) Mounting: Integral bracket.
a) Multiple-horn Units: Factory installed to prefabricated 10- by 10- by 6-inch nominal steel enclosure suitable for pendent mounting.

2.5 NOTIFICATION APPLIANCE CIRCUIT POWER SUPPLY UNITS

A. General Requirements for Notification Appliance Circuit Power Supply Unit:
1. Power-limited design, complying with UL 864 and listed and labeled by an NRTL.

B. Notification Appliance Circuits: NFPA 72, Class B, Style Y.
1. Install no more than 70 percent rated capacity of notification appliances on each notification appliance circuit.

C. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, trouble signals, and supervisory signals shall be powered by 24-V dc source.
1. Alarm current draw of entire notification appliance circuit power supply unit shall not exceed 80 percent of the power-supply module rating.

D. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.
1. Backup Battery: Premium, valve-regulated, recombinant-sealed, lead-calcium battery; spill proof; with a full 1-year warranty and a pro rata 19-year warranty. With single-stage, constant-voltage-current, limited battery charger, comply with battery manufacturer's written instructions for battery terminal voltage and charging current recommendations for maximum battery life.
2. Backup Power Supply Capacity: Comply with NFPA 72, but not less than 24 hours normal and 30 minutes alarm operation.

2.6 PATHWAYS

A. Support of Open Cabling: NRTL labeled for support of Category 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.
1. Support brackets with cable tie slots for fastening cable ties to brackets.
2. Lacing bars, spools, J-hooks, and D-rings.
3. Straps and other devices.
4. Cable Ties: Comply with Division 26 Section “Identification of Electrical Systems.”

B. Cable Trays: Comply with requirements in Division 26 Section "Cable Trays for Electrical Systems."

C. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems."
1. Outlet boxes shall be no smaller than 2 inches wide, 3 inches high, and 2-1/2 inches deep.

2.7 FIRE ALARM WIRE AND CABLE

A. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.

B. Signaling Line Circuits: Twisted, shielded pair, not less than No. 18 AWG.

C. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation.
   1. Low-Voltage Circuits: No. 16 AWG, minimum.
   2. Line-Voltage Circuits: No. 12 AWG, minimum.
   3. Multiconductor Armored Cable: NFPA 70, Type MC, copper conductors, Type TFN/THHN conductor insulation, copper drain wire, copper armor with red identifier stripe, NTRL listed for fire alarm and cable tray installation, plenum rated, and complying with requirements in UL 2196 for a 2-hour rating.

2.8 IDENTIFICATION PRODUCTS

A. Comply with UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

B. Comply with requirements in Division 26 Section "Identification for Electrical Systems."

2.9 DEVICE GUARDS

A. In Gymnasiums and other spaces subject to damage, provide device guards around devices. Guards for manual pull stations shall not impede operation of pull station. Refer to drawing for additional information.

B. Description: Welded wire mesh of size and shape for the manual station, smoke detector, gong, or other device requiring protection.
   1. Factory fabricated and furnished by manufacturer of device.
   2. Finish: Paint of color to match the protected device.

PART 3 - EXECUTION

3.1 INSTALLATION OF PATHWAYS

A. Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems." for installation of conduits and wireways.

3.2 FIRE ALARM WIRING INSTALLATION

A. Comply with NECA 1 and NFPA 72.

B. Wiring Method: Install wiring in a dedicated raceway system according to Division 26 Section "Raceway and Boxes for Electrical Systems," except within consoles, cabinets, desks, and counters or as noted below. This system shall not be used for any other wire or cable. Conceal raceways except in unfinished spaces.

C. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

D. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.

E. Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and another for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.

F. Wiring to Remote Alarm Transmitting Device: 1-inch conduit between the fire alarm control panel and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

3.3 REMOVAL OF CONDUCTORS AND CABLES

1. For existing building that require demolition, remove abandoned conductors and cables. Refer to Division 26 Section " Electrical Demolition" Specification.

3.4 EQUIPMENT INSTALLATION

A. Comply with NECA 305.

B. Comply with NFPA 72 for installation of fire-alarm equipment.

C. Equipment Mounting: Install wall-mounted equipment, with tops of cabinets not more than 72 inches above the finished floor.

1. Comply with requirements for seismic-restraint devices specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

D. Connecting to Existing Equipment: Verify that existing fire-alarm system is operational before making changes or connections.

1. Connect new equipment to existing control panel in existing part of the building.
2. Connect new equipment to existing monitoring equipment at the supervising station.
3. Expand, modify, and supplement existing control and monitoring equipment as necessary to extend existing control and monitoring functions to the new points. New components shall be capable of merging with existing configuration without degrading the performance of either system.

E. Audible Alarm-Indicating Devices: Install not less than 6 inches below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.

F. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches below the ceiling.

G. Notification Appliance Circuit Power Supply Units: Provide quantity of units required for notification appliances indicated.

1. Provide system smoke detector at each group of units.
2. Provide 120 V, 20 A circuit to each unit.

H. Wire Guards: Install wire guards on fire alarm devices located in gymnasia, multi-purpose rooms, stages, and shop areas.

I. Additional mounting heights are specified in Division 26 Section "Wiring Devices."

3.5 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

B. Install framed instructions in a location visible from fire-alarm control unit.

3.6 FIRESTOPPING

A. Comply with requirements in Division 07 Section "Firestopping."

3.7 GROUNDING

A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100.

3.8 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Tests and Inspections:
   1. Visual Inspection: Conduct visual inspection prior to testing.
      a. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.
      b. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
   2. System Testing: Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
   3. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.

C. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.

D. Fire-alarm system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

F. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

G. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.9 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

END OF SECTION 28 31 11