

Project Manual

Austin High School Career Tech Center

Decatur City Schools



Architect's Project Number 17922

Alabama Building Commission Number 2018112

April 25, 2018



SECTION 00 01 01

TITLE PAGE

PROJECT MANUAL FOR:

PROJECT:	Austin High School, Career Tech Center Decatur, Alabama
RELEASE DATE:	April 25, 2018
ARCHITECT'S PROJECT NUMBER:	17922
B. C. NUMBER:	2018112
OWNER:	Decatur City Schools 301 Fourth Avenue Decatur, AL 35601 (256) 552-3000
ARCHITECT:	Nola VanPeursem Architects, PC 301 Jefferson Street Huntsville, AL 35801 (256) 533-6617 Phone
STRUCTURAL ENGINEER:	PEC Structural Engineering, Inc. 3005 L&N Drive, Suite 3 Huntsville, AL 35801 (256) 533-3042 Phone
MECHANICAL ENGINEER:	Mims Engineering, Inc. 112 Southside Square, Suite B Huntsville, AL 35801 (256) 881-4126 Phone
ELECTRICAL ENGINEER	EE Group, Inc. 71 Thunderbird Lane Gadsden, AL 35904 (256) 413-7717 Phone

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BID DOCUMENTS AND FORMS

PART 1 GENERAL

1.01 DOCUMENTS

- A. Advertisement for Bids - ABC Form C-1, dated August 2001.
- B. Instructions to Bidders - ABC Form C-2, dated August 2001.
- C. Proposal Form - ABC Form C-3, dated August 2001.
- D. Form of Bid Bond - ABC Form C-4, dated August 2001.

1.02 DOCUMENT AVAILABILITY

- A. A copy of the documents and forms noted above is attached hereto, as provided by the Alabama Building Commission.
- B. Additional copies may be obtained from the office of the Alabama Building Commission, RSA Plaza, 770 Washington Avenue, Suite 444, Montgomery, Alabama 36130, phone (334) 242-4082.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

ADVERTISEMENT FOR BIDS

Sealed proposals will be received by Decatur City Schools
at the office of the Superintendent, 302 Fourth Avenue, Decatur, Alabama _____
(Name and address of Owner's authorized representative)

until 2:00 p.m. CDT May 22, 2018 for
(Hours) (Month) (Date), (Year)

Austin High School Career Tech Center

at which time and place they will be publicly opened and read.

A Pre-Bid Conference is scheduled for 11:00 a.m. on May 10, 2018 at Austin High School located at 1625 Danville Road SW, Decatur, Alabama 35601.

A cashier's check or bid bond payable to Decatur City Schools
(Owner's legal title)

in an amount not less than five (5) percent of the amount of the bid, but in no event more than \$10,000, must accompany the bidder's proposal. Performance and Payment Bonds and evidence of insurance required in the bid documents will be required at the signing of the Contract.

Drawings and specifications may be examined at the office of Nola | Van Peurse Architects, PC. 301 Jefferson Street, Huntsville, Alabama 35801; Phone 256-533-6617; Fax 256-533-6619.

Bid Documents will be available May 1, 2018, and may be obtained from the Architect upon deposit of \$200.00 per set, which will be refunded in full on the first 2 sets issued to each general contract bidder submitting a bona fide bid, upon return of documents in good condition within ten days of bid date. Other sets for general contractors, and sets for subcontractors and dealers, may be obtained with the same deposit, which will be refunded as above, less cost of printing, reproduction, handling, and distribution.

Bids must be submitted on proposal forms furnished by the Architect or copies thereof. All bidders bidding in amounts exceeding that established by the State Licensing Board for General Contractors must be licensed under the provisions of Title 34, Chapter 8, Code of Alabama, 1975, and must show evidence of license before bidding or bid will not be received or considered by the Architect; the bidder shall show such evidence by clearly displaying his or her current license number on the outside of the sealed envelope in which the proposal is delivered. The Owner reserves the right to reject any or all proposals and to waive technical errors if, in the Owner's judgment, the best interests of the Owner will thereby be promoted.

Nonresident bidders must accompany any written bid documents with a written opinion of an attorney at law licensed to practice law in such nonresident bidder's state of domicile, as to the preferences, if any or none, granted by the law of that state to its own business entities whose principal places of business are in that state in the letting of any or all public contracts.

Decatur City Schools
(Awarding Authority)

Nola | Van Peurse Architects, PC
(Architect)

INSTRUCTIONS TO BIDDERS

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1. BID DOCUMENTS

The Bid Documents consist of the Advertisement for Bids, these Instructions to Bidders, any modifications of or supplements to these Instructions to Bidders, the Proposal Form, and the proposed Contract Documents. The proposed Contract Documents consist of the Construction Contract, the Performance Bond and Payment Bond, the Conditions of the Contract (General, Supplemental, and other Conditions), Drawings, Specifications and all addenda issued prior to execution of the Construction Contract. Bid Documents may be obtained or examined as set forth in the Advertisement for Bids.

2. GENERAL CONTRACTOR'S STATE LICENSING REQUIREMENTS:

When the amount bid for a contract exceeds \$50,000, the bidder must be licensed by the State Licensing Board for General Contractors and must show the Architect evidence of license before bidding or the bid will not be received by the Architect or considered by the Awarding Authority. A bid exceeding the bid limit stipulated in the bidder's license, or which is for work outside of the type or types of work stipulated in the bidder's license, will not be considered. In case of a joint venture of two or more contractors, the amount of the bid shall be within the maximum bid limitation as set by the State Licensing Board for General Contractors of the combined limitations of the partners to the joint venture.

3. QUALIFICATIONS of BIDDERS and PREQUALIFICATION PROCEDURES:

- a. Any special qualifications required of general contractors, subcontractors, material suppliers, or fabricators are set forth in the Bid Documents.
- b. The Awarding Authority may have elected to prequalify bidders. Parties interested in bidding for this contract are directed to the Advertisement for Bids and Supplemental Instructions to Bidders to determine whether bidders must be prequalified and how they may obtain copies of the Awarding Authority's published prequalification procedures and criteria.
- c. Release of Bid Documents by the Architect to a prospective bidder will not constitute any determination by the Awarding Authority or Architect that the bidder has been found to be qualified, prequalified, or responsible.

4. PREFERENCE to RESIDENT CONTRACTORS:

(If this project is federally funded in whole or in part, this Article shall not apply.)

a. In awarding the Contract, preference will be given to Alabama resident contractors and a nonresident bidder domiciled in a state having laws granting preference to local contractors shall be awarded the Contract only on the same basis as the nonresident bidder's state awards contracts to Alabama contractors bidding under similar circumstances.

b. A nonresident bidder is a contractor which is neither organized and existing under the laws of the State of Alabama, nor maintains its principal place of business in the State of Alabama. A nonresident contractor which has maintained a permanent office within the State of Alabama for at least five continuous years shall not thereafter be deemed to be a non-resident contractor so long as the contractor continues to maintain a branch office within Alabama.

5. EXAMINATION of BID DOCUMENTS and the SITE of the WORK :

Before submitting a bid for the Work, the bidders shall carefully examine the Bid Documents, visit the site, and satisfy themselves as to the nature and location of the Work, and the general and local conditions, including weather, the general character of the site or building, the character and extent of existing work within or adjacent to the site and any other work being performed thereon at the time of submission of their bids. They shall obtain full knowledge as to transportation, disposal, handling, and storage of materials, availability of water, electric power, and all other facilities in the area which will have a bearing on the performance of the Work for which they submit their bids. The submission of a bid shall constitute a representation by the bidder that the bidder has made such examination and visit and has judged for and satisfied himself or herself as to conditions to be encountered regarding the character, difficulties, quality, and quantities of work to be performed and the material and equipment to be furnished, and as to the contract requirements involved.

6. EXPLANATIONS and INTERPRETATIONS:

a. Should any bidder observe any ambiguity, discrepancy, omission, or error in the drawings and specifications, or in any other bid document, or be in doubt as to the intention and meaning of these documents, the bidder should immediately report such to the Architect and request clarification.

b. Clarification will be made only by written Addenda sent to all prospective bidders. Neither the Architect nor the Awarding Authority will be responsible in any manner for verbal answers or instructions regarding intent or meaning of the Bid Documents.

c. In the case of inconsistency between drawings and specifications or within either document, a bidder will be deemed to have included in its bid the better quality or greater quantity of the work involved unless the bidder asked for and obtained the Architect's written clarification of the requirements before submission of a bid.

7. SUBSTITUTIONS

- a. The identification of any product, material, system, item of equipment, or service in the Bid Documents by reference to a trade name, manufacturer's name, model number, etc. (hereinafter referred to as "source"), is intended to establish a required standard of performance, design, and quality and is not intended to limit competition unless the provisions of paragraph "d" below apply.
- b. When the Bid Documents identify only one or two sources, or three or more sources followed by "or approved equal" or similar wording, the bidder's proposal may be based on a source not identified but considered by the bidder to be equal to the standard of performance, design and quality as specified; however, such substitutions must ultimately be approved by the Architect. If the bidder elects to bid on a substitution without "Pre-bid Approval" as described below, then it will be understood that proof of compliance with specified requirements is the exclusive responsibility of the bidder.
- c. When the Bid Documents identify three or more sources and the list of sources is not followed by "or approved equal" or similar wording, the bidder's proposal shall be based upon one of the identified sources, unless the bidder obtains "Pre-bid Approval" of another source as described below. Under these conditions it will be expressly understood that no product, material, system, item of equipment, or service that is not identified in the Bid Documents or granted "Pre-Bid Approval" will be incorporated into the Work unless such substitution is authorized and agreed upon through a Contract Change Order.
- d. If the Bid Documents identify only one source and expressly provide that it is an approved sole source for the product, material, system, item of equipment, or service, the bidder's proposal must be based upon the identified sole source.
- e. **Procedures for "Pre-bid Approval".** If it is desired that a product, material, system, piece of equipment, or service from a source different from those sources identified in the Bid Documents be approved as an acceptable source, application for the approval of such source must reach the hands of the Architect at least ten days prior to the date set for the opening of bids. At the Architect's discretion, this ten day provision may be waived. The application for approval of a proposed source must be accompanied by technical data which the applicant desires to submit in support of the application. The Architect will give consideration to reports from reputable independent testing laboratories, verified experience records showing the reputation of the proposed source with previous users, evidence of reputation of the source for prompt delivery, evidence of reputation of the source for efficiency in servicing its products, or any other pertinent written information. The application to the Architect for approval of a proposed source must be accompanied by a schedule setting forth in which respects the materials or equipment submitted for consideration differ from the materials or equipment designated in the Bid Documents. The burden of proof of the merit of the proposed substitution is upon the proposer. To be approved, a proposed source must also meet or exceed all express requirements of the Bid Documents. Approval, if granted, shall not be effective until published by the Architect in an addendum to the Bid Documents.

8. PREPARATION and DELIVERY of BIDS:

a. Proposal Form:

- (1) Bids must be submitted on the Proposal Form as contained in the Bid Documents; only one copy is required to be submitted.
- (2) All information requested of the bidder on the Proposal Form must be filled in. The form must be completed by typewriter or hand-printed in ink.
- (3) Identification of Bidder: On the first page of the Proposal Form the bidder must be fully identified by completing the spaces provided for:
 - (a) the legal name of the bidder,
 - (b) the state under which laws the bidder's business is organized and existing,
 - (c) the city (and state) in which the bidder has its principal offices,
 - (d) the bidder's business organization, i.e., corporation, partnership, or individual (to be indicated by marking the applicable box and writing in the type of organization if it is not one of those listed), and
 - (e) the partners or officers of the bidder's organization, if the bidder is other than an individual. If the space provided on the Proposal Form is not adequate for this listing, the bidder may insert "See Attachment" in this space and provide the listing on an attachment to the Proposal Form.
- (4) Where indicated by the format of the Proposal Form, the bidder must specify lump sum prices in both words and figures. In case of discrepancy between the prices shown in words and in figures, the words will govern.
- (5) All bid items requested in the Proposal Form, including alternate bid prices and unit prices for separate items of the Work, must be bid. If a gross sum of bid items is requested in the Proposal Form, the gross sum shall be provided by the bidder.
- (6) In the space provided in the Proposal Form under "Bidder's Alabama License", the bidder must insert his or her current general contractor's state license number, current bid limit, and type(s) of work for which bidder is licensed.
- (7) The Proposal Form shall be properly signed by the bidder. If the bidder is:
 - (a) **an individual**, that individual or his or her "authorized representative" must sign the Proposal Form;
 - (b) **a partnership**, the Proposal Form must be signed by one of the partners or an "authorized representative" of the Partnership;
 - (c) **a corporation**, the president, vice-president, secretary, or "authorized representative" of the corporation shall sign and affix the corporate seal to the Proposal Form.

As used in these Instructions to Bidders, "authorized representative" is defined as a person to whom the bidder has granted written authority to conduct business in the bidder's behalf by signing and/or modifying the bid. Such written authority shall be

signed by the bidder (the individual proprietor, or a member of the Partnership, or an officer of the Corporation) and shall be attached to the Proposal Form.

(8) Interlineation, alterations or erasures on the Proposal Form must be initialed by the bidder or its “authorized representative”.

b. Bid Guaranty

(1) The Proposal Form must be accompanied by a cashier’s check, drawn on an Alabama bank, or a Bid Bond, executed by a surety company duly authorized and qualified to make such bonds in the State of Alabama, payable to the Awarding Authority.

(2) If a Bid Bond is provided in lieu of a cashier’s check, the bond shall be on the Bid Bond form as stipulated in the Bid Documents.

(3) The amount of the cashier’s check or Bid Bond shall not be less than five percent of the contractor’s bid, but is not required to be in an amount more than ten thousand dollars.

c. Delivery of Bids:

(1) Bids will be received until the time set, and at the location designated, in the Advertisement for Bids unless notice is given of postponement. Any bid not received prior to the time set for opening bids will be rejected absent extenuating circumstances and such bids shall be rejected in all cases where received after other bids are opened.

(2) Each bid shall be placed, together with the bid guaranty, in a sealed envelope. On the outside of the envelope the bidder shall write in large letters “Proposal”, below which the bidder shall identify the Project and the Work bid on, the name of the bidder, and the bidder’s current general contractor’s state license number.

(3) Bids may be delivered in person, or by mail if ample time is allowed for delivery. When sent by mail, the sealed envelope containing the bid, marked as indicated above, shall be enclosed in another envelope for mailing.

9. WITHDRAWAL or REVISION of BIDS:

a. A bid may be withdrawn prior to the time set for opening of bids, provided a written request, executed by the bidder or the bidder’s “authorized representative”, is filed with the Architect prior to that time. The bid will then be returned to the bidder unopened.

b. A bid which has been sealed in its delivery envelope may be revised by writing the change in price on the outside of the delivery envelope over the signature of the bidder or the bidder’s “authorized representative”. In revising the bid in this manner, the bidder must only write the amount of the change in price on the envelope **and must not reveal the bid price.**

c. Written communications, signed by the bidder or its “authorized representative”, to revise bids will be accepted if received by the Architect prior to the time set for opening bids. The Architect will record the instructed revision upon opening the bid. Such written communication

may be by facsimile if so stipulated in Supplemental Instructions to Bidders. In revising the bid in this manner, the bidder must only write the amount of the change in price **and must not reveal the bid price.**

d. Except as provided in Article 12 of these Instructions to Bidders, no bid shall be withdrawn, modified, or corrected after the time set for opening bids.

10. OPENING of BIDS:

Bids will be opened and read publicly at the time and place indicated in the Advertisement for Bids. Bidders or their authorized representatives are invited to be present.

11. INCOMPLETE and IRREGULAR BIDS:

A bid that is not accompanied by data required by the Bid Documents, or a bid which is in any way incomplete, may be rejected. Any bid which contains any uninitialed alterations or erasures, or any bid which contains any additions, alternate bids, or conditions not called for, or any other irregularities of any kind, will be subject to rejection.

12. BID ERRORS

a. **Errors and Discrepancies in the Proposal Form.** In case of error in the extension of prices in bids, the unit price will govern. In case of discrepancy between the prices shown in the figures and in words, the words will govern.

b. **Mistakes within the Bid.** If the low bidder discovers a mistake in its bid, the low bidder may seek withdrawal of its bid without forfeiture of its bid guaranty under the following conditions:

(1) **Timely Notice:** The low bidder must notify the Awarding Authority and Architect in writing, within three working days after the opening of bids, that a mistake was made. This notice must be given within this time frame whether or not award has been made.

(2) **Substantial Mistake:** The mistake must be of such significance as to render the bid price substantially out of proportion to the other bid prices.

(3) **Type of Mistake:** The mistake must be due to calculation or clerical error, an inadvertent omission, or a typographical error which results in an erroneous sum. A mistake of law, judgment, or opinion shall not constitute a valid ground for withdrawal without forfeiture.

(4) **Documentary Evidence:** Clear and convincing documentary evidence of the mistake must be presented to the Awarding Authority and the Architect as soon as possible, but no later than three working days after the opening of bids.

The Awarding Authority's decision regarding a low bidder's request to withdraw its bid without penalty shall be made within 10 days after receipt of the bidder's evidence or by the next regular meeting of the Awarding Authority. Upon withdrawal of bid without

penalty, the low bidder shall be prohibited from (1) doing work on the project as a subcontractor or in any other capacity and (2) bidding on the same project if it is re-bid.

13. DISQUALIFICATION of BIDDERS:

Any bidder(s) may be disqualified from consideration for contract award for the following reasons:

- a. Collusion.** Any agreement or collusion among bidders or prospective bidders in restraint of freedom of competition to bid at a fixed price or to refrain from bidding or otherwise shall render the bids void and shall cause the bidders or prospective bidders participating in such agreement or collusion to be disqualified from submitting further bids to the Awarding Authority on future lettings. (See § 39-2-6, Code of Alabama 1975, for possible criminal sanctions.)
- b. Advance Disclosure.** Any disclosure in advance of the terms of a bid submitted in response to an Advertisement for Bids shall render the proceedings void and require re-advertisement and rebid.
- c. Failure to Settle Other Contracts.** The Awarding Authority may reject a bid from a bidder who has not paid, or satisfactorily settled, all bills due for labor and material on other contracts in force at the time of letting.

14. CONSIDERATION of BIDS:

- a.** After the bids are opened and read publicly, the bid prices will be compared and the results of this comparison will be available to the public. Until the final award of the contract, however, the Awarding Authority shall have the right to reject any or all bids, and it shall have the right to waive technical errors and irregularities if, in its judgment, the bidder will not have obtained a competitive advantage and the best interests of the Awarding Authority will be promoted.
- b.** If the Bid Documents request bids for projects or parts of projects in combination or separately, the Bid Documents must include modifications of, or supplements to, these Instructions to Bidders setting forth applicable bid procedures. Award or awards will be made to the lowest responsible and responsive bidder or bidders in accordance with such bid procedures.

15. DETERMINATION of LOW BIDDER by USE of ALTERNATES

- a.** The Awarding Authority may request alternate bid prices (alternates) to facilitate either reducing the base bid to an amount within the funds available for the project or adding items to the base bid within the funds available for the project. Alternates, if any, are listed in the Proposal Form in the order in which they shall cumulatively deduct from or add to the base bid for determining the lowest bidder.

b. If alternates are included in the Proposal Form, the Awarding Authority shall determine the dollar amount of funds available and immediately prior to the opening of bids shall announce publicly the funds available for the project. The dollar amount of such funds shall be used to determine the lowest bidder as provided herein below, notwithstanding that the actual funds available for the project may subsequently be determined to be more or less than the expected funds available as determined immediately prior to the time of the opening of bids.

c. If the base bid of the lowest bidder exceeds the funds available and alternate bid prices will reduce the base bids to an amount that is within the funds available, the lowest bidder will be determined by considering, in order, the fewest number of the alternates that produces a price within the funds available. If the base bid of the lowest bidder is within the funds available and alternate bid prices will permit adding items to the base bid, the lowest bidder will be determined by considering, in order, the greatest number of the alternates that produces a price within the funds available.

d. After the lowest bidder has been determined as set forth above, the Awarding Authority may award that bidder any combination of alternates, provided said bidder is also the low bidder when only the Base Bid and such combination of alternates are considered.

16. UNIT PRICES:

a. **Work Bid on a Unit Price Basis.** Where all, or part(s), of the planned Work is bid on a unit price basis, both the unit prices and the extensions of the unit prices constitute a basis of determining the lowest responsible and responsive bidder. In cases of error in the extension of prices of bids, the unit price will govern. A bid may be rejected if any of the unit prices are obviously unbalanced or non-competitive.

b. **Unit Prices for Application to Change Orders.** As a means of predetermining unit costs for changes in certain elements of the Work, the Bid Documents may require that the bidders furnish unit prices for those items in the Proposal Form. Unit prices for application to changes in the work are not a basis for determining the lowest bidder. Non-competitive unit prices proposed by the successful bidder may be rejected and competitive prices negotiated by the Awarding Authority prior to contract award. Unit prices for application to changes in the work are not effective unless specifically included and agreed upon in the Construction Contract.

17. AWARD of CONTRACT:

a. The contract shall be awarded to the lowest responsible and responsive bidder unless the Awarding Authority finds that all the bids are unreasonable or that it is not in the best interest of the Awarding Authority to accept any of the bids. A responsible bidder is one who, among other qualities determined necessary for performance, is competent, experienced, and financially able to perform the contract. A responsive bidder is one who submits a bid that complies with the terms and conditions of the Advertisement for Bids and the Bid Documents. Minor irregularities in the bid shall not defeat responsiveness.

b. A bidder to whom award is made will be notified by telegram, confirmed facsimile, or letter to the address shown on the Proposal Form at the earliest possible date. Unless other

time frames are stipulated in Supplemental Instructions to Bidders, the maximum time frames allowed for each step of the process between the opening of bids and the issuance of an order to proceed with the work shall be as follows:

(1) Award of contract by Awarding Authority	30 calendar days after the opening of bids
(2) Contractor's return of the fully executed contract, with bonds and evidence of insurance, to the Awarding Authority	15 calendar days after the contract has been presented to the contractor for signature
(3) Awarding Authority's approval of the contractor's bonds and evidence of insurance and completion of contract execution	20 calendar days after the contractor presents complete and acceptable documents to the Architect
(4) Notice To Proceed issued to the contractor	15 calendar days after final execution of contract by the Awarding Authority, and by the Governor if his or her signature on the contract is required by law

The time frames stated above, or as otherwise specified in the Bid Documents, may be extended by written agreement between the parties. Failure by the Awarding Authority to comply with the time frames stated above or stipulated in Supplemental Instructions to Bidders, or agreed extensions thereof, shall be just cause for the withdrawal of the contractor's bid and contract without forfeiture of bid security.

c. Should the successful bidder or bidders to whom the contract is awarded fail to execute the Construction Contract and furnish acceptable Performance and Payment Bonds and satisfactory evidence of insurance within the specified period, the Awarding Authority shall retain from the bid guaranty, if it is a cashier's check, or recover from the principal or the sureties, if the guaranty is a bid bond, the difference between the amount of the contract as awarded and the amount of the bid of the next lowest responsible and responsive bidder, but not more than \$10,000. If no other bids are received, the full amount of the bid guaranty shall be so retained or recovered as liquidated damages for such default. Any sums so retained or recovered shall be the property of the Awarding Authority.

d. All bid guaranties, except those of the three lowest bona fide bidders, will be returned immediately after bids have been checked, tabulated, and the relation of the bids established. The bid guaranties of the three lowest bidders will be returned as soon as the contract bonds and the contract of the successful bidder have been properly executed and approved. When the award is deferred for a period of time longer than 15 days after the opening of the bids, all bid guaranties, except those of the potentially successful bidders, shall be returned. If no award is made within the specified period, as it may by agreement be extended, all bids will be rejected, and all guaranties returned. If any potentially successful bidder agrees in writing to a stipulated extension in time for consideration of its bid and its bid was guaranteed with a cashier's check, the Awarding Authority may permit the potentially successful bidder to substitute a satisfactory bid bond for the cashier's check.

END of INSTRUCTIONS TO BIDDERS

PROPOSAL FORM

To: _____ Date: _____
(Awarding Authority)

In compliance with your Advertisement for Bids and subject to all the conditions thereof, the undersigned

(Legal Name of Bidder)

hereby proposes to furnish all labor and materials and perform all work required for the construction of
WORK _____

in accordance with Drawings and Specifications, dated _____, prepared by
_____, Architect/Engineer.

The Bidder, which is organized and existing under the laws of the State of _____,
having its principal offices in the City of _____,
is: ☐ a Corporation ☐ a Partnership ☐ an individual ☐ (other) _____.

LISTING OF PARTNERS OR OFFICERS: If Bidder is a Partnership, list all partners and their addresses; if Bidder is a Corporation, list the names, titles, and business addresses of its officers:

BIDDER'S REPRESENTATION: The Bidder declares that it has examined the site of the Work, having become fully informed regarding all pertinent conditions, and that it has examined the Drawings and Specifications (including all Addenda received) for the Work and the other Bid and Contract Documents relative thereto, and that it has satisfied itself relative to the Work to be performed.

ADDENDA: The Bidder acknowledges receipt of Addenda Nos. _____ through _____ inclusively.

BASE BID: For construction complete as shown and specified, the sum of _____
_____ Dollars (\$ _____)

ALTERNATES: If alternates as set forth in the Bid Documents are accepted, the following adjustments are to be made to the Base Bid:

For Alternate No. 1 (.....) (Insert key word for Alternate)	(add)(deduct) \$ _____
For Alternate No. 2 (.....)	(add)(deduct) \$ _____
For Alternate No. 3 (.....)	(add)(deduct) \$ _____
For Alternate No. 4 (.....)	(add)(deduct) \$ _____
For Alternate No. 5 (.....)	(add)(deduct) \$ _____
For Alternate No. 6 (.....)	(add)(deduct) \$ _____

UNIT PRICES - (See Attachment)

BID SECURITY: The undersigned agrees to enter into a Construction Contract and furnish the prescribed Performance and Payment Bonds and evidence of insurance within fifteen calendar days, or such other period stated in the Bid Documents, after the contract forms have been presented for signature, provided such presentation is made within 30 calendar days after the opening of bids, or such other period stated in the Bid Documents. As security for this condition, the undersigned further agrees that the funds represented by the Bid Bond (or cashier's check) attached hereto may be called and paid into the account of the Awarding Authority as liquidated damages for failure to so comply.

Attached hereto is a: *(Mark the appropriate box and provide the applicable information.)*

- ☐ Bid Bond, executed by _____ as Surety,
- ☐ a cashier's check on the _____ Bank of _____,
- for the sum of _____
- Dollars
- (\$ _____) made payable to the Awarding Authority.

BIDDER'S ALABAMA LICENSE:

State License for General Contracting: _____

License Number

Bid Limit

Type(s) of Work

CERTIFICATIONS: The undersigned certifies that he or she is authorized to execute contracts on behalf of the Bidder as legally named, that this proposal is submitted in good faith without fraud or collusion with any other bidder, that the information indicated in this document is true and complete, and that the bid is made in full accord with State law. Notice of acceptance may be sent to the undersigned at the address set forth below.

The Bidder also declares that a list of all proposed major subcontractors and suppliers will be submitted at a time subsequent to the receipt of bids as established by the Architect in the Bid Documents but in no event shall this time exceed twenty-four (24) hours after receipt of bids.

Legal Name of Bidder _____

Mailing Address _____

*** By (Legal Signature)** _____

*** Name (type or print)** _____

(Seal)

*** Title** _____

Telephone Number _____

* If other than the individual proprietor, or an above named member of the Partnership, or the above named president, vice-president, or secretary of the Corporation, attach written authority to bind the Bidder. Any modification to a bid shall be over the initials of the person signing the bid, or of an authorized representative.

USE BLACK INK ONLY

BID BOND

The **PRINCIPAL** (*Bidder's Name and Address*)

The **SURETY** (*Name and Principal Place of Business*)

The **OWNER** (*Name and Address*)

The **PROJECT** for which the Principal's Bid is submitted: (*Project name as it appears in the Bid Documents*)

KNOW ALL MEN BY THESE PRESENTS, that we, the undersigned Principal and Surety, jointly and severally, hereby bind ourselves, our heirs, executors, administrators, successors, and assigns to the Owner in the **PENAL SUM of five percent (5%) of the amount of the Principal's bid, but in no event more than Ten-thousand Dollars (\$10,000.00).**

THE CONDITION OF THIS OBLIGATION is that the Principal has submitted to the Owner the attached bid, which is incorporated herein by reference, for the Project identified above.

NOW, THEREFORE, if, within the terms of the Bid Documents, the Owner accepts the Principal's bid and the Principal thereafter either:

- (a) executes and delivers a Construction Contract with the required Performance and Payment Bonds (each in the form contained in the Bid Documents and properly completed in accordance with the bid) and delivers evidence of insurance as prescribed in the Bid Documents, or
 - (b) fails to execute and deliver such Construction Contract with such Bonds and evidence of insurance, but pays the Owner the difference, not to exceed the Penal Sum of this Bond, between the amount of the Principal's Bid and the larger amount for which the Owner may award a Construction Contract for the same Work to another bidder,
- then**, this obligation shall be null and void, otherwise it shall remain in full force and effect.

The Surety, for value received, hereby stipulates and agrees that the obligation of the Surety under this Bond shall not in any manner be impaired or affected by any extension of the time within which the Owner may accept the Principal's bid, and the Surety does hereby waive notice of any such extension.

SIGNED AND SEALED this _____ day of _____, _____.

ATTEST:

PRINCIPAL:

By _____

Name and Title

SURETY:

ATTEST

By _____

Name and Title

SECTION 00 22 00

OWNER'S SUPPLEMENTARY INSTRUCTIONS TO BIDDERS

PART 1 GENERAL

1.01 SUPPLEMENTS

- A. The following instructions are in addition to State of Alabama Building Commission Instructions to Bidders - ABC Form C-2, dated August 2001, and the Advertisement for Bids - ABC Form C-1, dated August 2001.

1.02 TIME

- A. Perform the Work within the time stated in Section 01 10 00 - Summary. The bidder, in submitting an offer, accepts the contract time period stated for performing the Work.

1.03 INSTRUCTIONS

- A. All sealed bids containing two copies of the Proposal Form, two copies of the Bid Bond, and one copy of Supplement A - List of Subcontractors (Section 00 43 21) and Supplement C - List of Alternates (Section 00 43 23) will be received by 2:00 p.m. CDT on May 22, 2018. Upon receipt of these documents the bids will be publicly opened and read aloud. No changes to the base bid will be allowed after 2:00 p.m.
- B. Bids will be opened at the Decatur City Schools, located at 302 Fourth Avenue, Decatur, Alabama.
- C. Any parties other than General Contractors may obtain contract documents for the cost of reproduction and postage by depositing \$200.00 with Nola | VanPeursem Architects, PC for each set obtained. On return of such documents in good condition within 10 days after the bid opening, the cost of reproduction and postage and mailing will be deducted from the deposit and the balance will be refunded. No refund will be made if plans are not returned in good condition.
- D. General Contractors will be refunded in full on the first two (2) sets issued. Additional sets may be obtained under the conditions stated in the above Item C.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 00 43 21

SUPPLEMENT A - LIST OF SUBCONTRACTORS

PARTICULARS

1.01 HERewith IS THE LIST OF SUBCONTRACTORS REFERENCED IN THE BID SUBMITTED BY:

1.02 (BIDDER) _____

1.03 TO: DECATUR CITY SCHOOLS

1.04 DATED _____ AND WHICH IS AN INTEGRAL PART OF THE BID FORM.

1.05 THE FOLLOWING WORK WILL BE PERFORMED (OR PROVIDED) BY SUBCONTRACTORS
AND COORDINATED BY US:

LIST OF SUBCONTRACTORS

2.01 WORK SUBJECT.....SUBCONTRACTOR NAME

2.02 CONCRETE_____

2.03 MASONRY_____

2.04 STEEL ERECTION_____

2.05 ROOFING_____

2.06 DOOR FRAMES_____

2.07 DOORS_____

2.08 DOOR HARDWARE_____

2.09 ACOUSTICAL AND DRYWALL_____

2.10 CERAMIC TILE_____

2.11 FLOORING_____

2.12 PAINTING_____

2.13 PLUMBING_____

2.14 MECHANICAL_____

2.15 ELECTRICAL_____

END OF SUPPLEMENT A

SECTION 00 43 23

SUPPLEMENT C - LIST OF ALTERNATES

PARTICULARS

1.01 THE FOLLOWING IS THE LIST OF ALTERNATES REFERENCED IN THE BID SUBMITTED BY:

1.02 (BIDDER) _____

1.03 TO: DECATUR CITY SCHOOLS

1.04 DATED _____ AND WHICH IS AN INTEGRAL PART OF THE BID FORM.

LIST OF ALTERNATES

2.01 THE FOLLOWING AMOUNTS SHALL BE ADDED TO OR DEDUCTED FROM THE BID AMOUNT. REFER TO SECTION 01 23 00 - ALTERNATES: SCHEDULE OF ALTERNATES.

2.02 ALTERNATE # 1: (ADD) (DEDUCT) \$ _____ (ELECTRICAL SERVICE)

2.03 ALTERNATE # 2: (ADD) (DEDUCT) \$ _____ (IF REQUIRED)

END OF SUPPLEMENT C

SECTION 00 50 00

CONSTRUCTION DOCUMENTS AND FORMS

PART 1 GENERAL

1.01 DOCUMENTS

- A. Construction Contract - ABC Form C-5, dated August 2001.
- B. Performance Bond - ABC Form C-6, dated August 2001.
- C. Payment Bond - ABC Form C-7, dated August 2001.
- D. General Conditions of the Contract - ABC Form C-8, dated August 2001.
- E. Supplementary Conditions of the Contract.
 - 1. Supplement to the General Conditions of the Contract, ABC Form C-8 Supplement, dated August 2009.
 - 2. Appendix A.
 - 3. Appendix B.
 - 4. ABC Form C-8 Attachment B, dated October 2012
 - 5. Appendix C.
 - 6. Appendix D.
 - 7. Appendix E.
 - a. Procurement Agreement.
 - 8. Permit Fee Calculation Worksheet
- F. Application and Certificate for Payment, ABC Form C-10ST, dated July 2004.
- G. Inventory of Stored Materials, ABC Form C-10SM, dated August 2001.
- H. Progress Schedule and Report, ABC Form C-11, dated August 2001.
- I. Contract Change Order, ABC Form C-12, dated August 2001.
- J. Certificate of Substantial Completion, ABC Form C-13, dated August 2001.
- K. Form of Advertisement of Completion, ABC Form C-14, dated August 2001.
- L. Detail of Project Sign, ABC Form C-15, dated August 2002.
- M. Material Invoice Summary, ABC Form MIS - Short, dated July 2004.
- N. Material Invoice Transmittal, ABC Form MIT, dated July 2004.
- O. Alabama State Disclosure Statement.

1.02 DOCUMENT AVAILABILITY

- A. A copy of the documents and forms noted above is attached hereto, as provided by the Alabama Building Commission.
- B. A copy of the "Alabama State Disclosure Statement" can be obtained from the Alabama Building Commission; www.bc.state.al.us.
- C. Additional copies may be obtained from the office of the Alabama Building Commission, RSA Plaza, 770 Washington Avenue, Suite 444, Montgomery, Alabama 36130, Phone (334)242-4082.

Austin High School
Career Tech Center
Project No. 17922

00 50 00 - 2
CONSTRUCTION DOCUMENTS AND FORMS

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

BC Project No.

CONSTRUCTION CONTRACT

- (1)
- (2) This Construction Contract is entered into this day of in the year of
- (3) between the **OWNER(s)**,
- (4) and the **CONTRACTOR**,
- (5) for the **WORK** of the Project, identified as:
- (6) The **CONTRACT DOCUMENTS** are dated and have been amended by
- (7) **ADDENDA**
- (8) The **ARCHITECT** is
- (9) The **CONTRACT SUM** is Dollars
(\$) and is the sum of the Contractor's Base Bid for the Work and the following
- (10) **BID ALTERNATE PRICES:**
- (11) The **CONTRACT TIME** is () calendar days.
- THE OWNER AND THE CONTRACTOR AGREE AS FOLLOWS:**
- The Contract Documents, as defined in the General Conditions of the Contract (ABC Form C-8), are incorporated herein by reference. The Contractor shall perform the Work in accordance with the Contract Documents. The Owner will pay and the Contractor will accept as full compensation for such performance of the Work, the Contract Sum subject to additions and deductions (including liquidated damages) as provided in the Contract Documents. The Work shall be commenced on a date to be specified in a Notice to Proceed issued by the Owner or the Director, Technical Staff, Alabama Building Commission, and shall then be substantially completed within the Contract Time.
- (12) **LIQUIDATED DAMAGES** for which the Contractor and its Surety (if any) shall be liable and may be required to pay the Owner in accordance with the Contract Documents shall be equal to six percent interest per annum on the total Contract Sum unless a dollar amount is stipulated in the following space, in which case liquidated damages shall be determined at _____ dollars (\$_____) per calendar day.

Numbers in margin correspond to "Checklist", ABC Form B-7

(13) **SPECIAL PROVISIONS** *(Special Provisions may be inserted here, such as Acceptance or Rejection of Unit Prices.)*

By signing this contract, the contracting parties affirm, for the duration of the agreement, that they will not violate federal immigration law or knowingly employ, hire for employment, or continue to employ an unauthorized alien within the state of Alabama. Furthermore, a contracting party found to be in violation of this provision shall be deemed in breach of the agreement and shall be responsible for all damages resulting therefrom.

(14) **STATE GENERAL CONTRACTOR'S LICENSE:** The Contractor does hereby certify that Contractor is currently licensed by the Alabama State Licensing Board for General Contractors and that the certificate for such license bears the following:

License No. Bid Limit: Classification:

The Owner and Contractor have entered into this Construction Contract as of the date first written above and have executed this Construction Contract in sufficient counterparts to enable each contracting party to have an originally executed Construction Contract each of which shall, without proof or accounting for the other counterparts, be deemed an original thereof.

The Owner does hereby certify that this Construction Contract was let in accordance with the provisions of Title 39, Code of Alabama 1975, as amended, and all other applicable provisions of law, and that the terms and commitments of this Construction Contract do not constitute a debt of the State of Alabama in violation of Article 11, Section 213 of the Constitution of Alabama, 1901, as amended by Amendment Number 26.

APPROVALS	CONTRACTING PARTIES
<p>By _____</p>	<p>Contractor</p>
<p>STATE OF ALABAMA BUILDING COMMISSION <i>(Not required for locally-funded, SDE projects.)</i></p>	<p>By _____ Name & Title _____</p>
<p>By _____ Director, Technical Staff</p>	<p>Owner</p>
	<p>By _____ Name & Title _____</p>

PERFORMANCE BOND

USE BLACK INK ONLY

SURETY'S BOND NUMBER

Numbers in margin correspond to "Checklist", ABC Form B-7

- (1) **PERFORMANCE BOND**
USE BLACK INK ONLY
- (2) The **PRINCIPAL** (Name and address of Contractor as appear in the Construction Contract)
- (3) The **SURETY** (Name and Principal Place of Business)
- (4) The **OWNER** (Name and address, same as appears in the Construction Contract)
- (5) The **PENAL SUM** of this Bond (the Contract Sum)
Dollars (\$)).
- (6) **DATE** of the Construction Contract :
- (7) The **PROJECT**: (Same as appears in the Construction Contract)

1. **WE, THE PRINCIPAL (hereinafter "Contractor") AND THE SURETY**, jointly and severally, hereby bind ourselves, our heirs, executors, administrators, successors, and assigns to the Owner in the Penal Sum stated above for the performance of the Contract, and Contract Change Orders, in accord with the requirements of the Contract Documents, which are incorporated herein by reference. If the Contractor performs the Contract, and Contract Change Orders, in accordance with the Contract Documents, then this obligation shall be null and void; otherwise it shall remain in full force and effect.
2. The Penal Sum shall remain equal to the Contract Sum as the Contract Sum is adjusted by Contract Change Orders. All Contract Change Orders involving an increase in the Contract Sum will require consent of Surety by endorsement of the Contract Change Order form. The Surety waives notification of any Contract Change Orders involving only extension of the Contract Time.

Numbers in margin correspond to "Checklist", ABC Form B-7

3. Whenever the Architect gives the Contractor and the Surety, at their addresses stated above, a written Notice to Cure a condition for which the Contract may be terminated in accordance with the Contract Documents, the Surety may, within the time stated in the notice, cure or provide the Architect with written verification that satisfactory positive action is in process to cure the condition.
4. The Surety's obligation under this Bond becomes effective after the Contractor fails to satisfy a Notice to Cure and the Owner:
 - (a) gives the Contractor and the Surety, at their addresses stated above, a written Notice of Termination declaring the Contractor to be in default under the Contract and stating that the Contractor's right to complete the Work, or a designated portion of the Work, shall terminate seven days after the Contractor's receipt of the notice; and
 - (b) gives the Surety a written demand that, upon the effective date of the Notice of Termination, the Surety promptly fulfill its obligation under this Bond.
5. In the presence of the conditions described in Paragraph 4, the Surety shall, at its expense:
 - (a) On the effective date of the Notice of Termination, take charge of the Work and be responsible for the safety, security, and protection of the Work, including materials and equipment stored on and off the Project site, and
 - (b) Within twenty-one days after the effective date of the Notice of Termination, proceed, or provide the Owner with written verification that satisfactory positive action is in process to facilitate proceeding promptly, to complete the Work in accordance with the Contract Documents, either with the Surety's resources or through a contract between the Surety and a qualified contractor to whom the Owner has no reasonable objection.
6. As conditions precedent to taking charge of and completing the Work pursuant to Paragraph 5, the Surety shall neither require, nor be entitled to, any agreements or conditions other than those of this Bond and the Contract Documents. In taking charge of and completing the Work, the Surety shall assume all rights and obligations of the Contractor under the Contract Documents; however, the Surety shall also have the right to assert "Surety Claims" to the Owner in accordance with the Contract Documents. The presence or possibility of a Surety Claim shall not be just cause for the Surety to fail or refuse to promptly take charge of and complete the Work or for the Owner to fail or refuse to continue to make payments in accordance with the Contract Documents.
7. By accepting this Bond as a condition of executing the Construction Contract, and by taking the actions described in Paragraph 4, the Owner agrees that:
 - (a) the Owner shall promptly advise the Surety of the unpaid balance of the Contract Sum and, upon request, shall make available or furnish to the Surety, at the cost of reproduction, any portions of the Project Record, and
 - (b) as the Surety completes the Work, or has it completed by a qualified contractor, the Owner shall pay the Surety, in accordance with terms of payment of the Contract Documents, the unpaid balance of the Contract Sum, less any amounts that may be or become due the Owner from the Contractor under the Construction Contract or from the Contractor or the Surety under this Bond.
8. In the presence of the conditions described in Paragraph 4, the Surety's obligation includes responsibility for the correction of Defective Work, liquidated damages, and reimbursement of any reasonable expenses incurred by the Owner as a result of the Contractor's default under the Contract, including architectural, engineering, administrative, and legal services.

Numbers in margin correspond to "Checklist", ABC Form B-7

9. Nothing contained in this Bond shall be construed to mean that the Surety shall be liable to the Owner for an amount exceeding the Penal Sum of this Bond, except in the event that the Surety should be in default under the Bond by failing or refusing to take charge of and complete the Work pursuant to Paragraph 5. If the Surety should fail or refuse to take charge of and complete the Work, the Owner shall have the authority to take charge of and complete the Work, or have it completed, and the following costs to the Owner, less the unpaid balance of the Contract Sum, shall be recoverable under this Bond:
- (a) the cost of completing the Contractor's responsibilities under the Contract, including correction of Defective Work;
 - (b) additional architectural, engineering, managerial, and administrative services, and reasonable attorneys' fees incident to completing the Work;
 - (c) interest on, and the cost of obtaining, funds to supplement the unpaid balance of the Contract Sum as may be necessary to cover the foregoing costs;
 - (d) the fair market value of any reductions in the scope of the Work necessitated by insufficiency of the unpaid balance of the Contract Sum and available supplemental funds to cover the foregoing costs; and
 - (f) additional architectural, engineering, managerial, and administrative services, and reasonable attorneys' fees incident to ascertaining and collecting the Owner's losses under the Bond.
10. All claims and disputes arising out of or related to this bond, or its breach, shall be resolved in accordance with Article 24, General Conditions of the Contract.

(8) **SIGNED AND SEALED** this _____ day of _____, _____.

(9) **ATTEST:**

CONTRACTOR as PRINCIPAL:

By _____

Name and Title

(10) Countersigned by
Alabama Resident Agent for Surety:

SURETY:

By _____

By _____

Name

Address

Name and Title

(11) **NOTE:** Power of attorney for the Surety's signatory shall be furnished with the original and five copies of the bond.

PAYMENT BOND

USE BLACK INK ONLY

SURETY'S BOND NUMBER

Numbers in margin correspond to "Checklist", ABC Form B-7

(2) The **PRINCIPAL** (Name and address of Contractor, same as appears in the Construction Contract)

(3) The **SURETY** (Name and Principal Place of Business)

(4) The **OWNER(s)** (Name and address, same as appears in the Construction Contract)

(5) The **PENAL SUM** of this Bond (the Contract Sum)

Dollars (\$)).

(6) **DATE** of the Construction Contract :

(7) The **PROJECT:** (Same as appears in the Construction Contract)

1. **WE, THE PRINCIPAL (hereinafter "Contractor") AND THE SURETY**, jointly and severally, hereby bind ourselves, our heirs, executors, administrators, successors, and assigns to the Owner in the Penal Sum stated above to promptly pay all persons supplying labor, materials, or supplies for or in the prosecution of the Contract, which is incorporated herein by reference, and any modifications thereof by Contract Change Orders. If the Contractor and its Subcontractors promptly pay all persons supplying labor, materials, or supplies for or in the prosecution of the Contract and Contract Change Orders, then this obligation shall be null and void; otherwise to remain and be in full force and effect.
2. The Penal Sum shall remain equal to the Contract Sum as the Contract Sum is adjusted by Contract Change Orders. All Contract Change Orders involving an increase in the Contract Sum will require consent of Surety by endorsement of the Contract Change Order form. The Surety waives notification of any Contract Change Orders involving only extension of the Contract Time.

Numbers in margin correspond to "Checklist", ABC Form B-7

3. Any person that has furnished labor, materials, or supplies for or in the prosecution of the Contract and Contract Change Orders for which payment has not been timely made may institute a civil action upon this Bond and have their rights and claims adjudicated in a civil action and judgment entered thereon. Notwithstanding the foregoing, a civil action may not be instituted on this bond until 45 days after written notice to the Surety of the amount claimed to be due and the nature of the claim. The civil action must commence not later than one year from the date of final settlement of the Contract. The giving of notice by registered or certified mail, postage prepaid, addressed to the Surety at any of its places of business or offices shall be deemed sufficient. In the event the Surety or Contractor fails to pay the claim in full within 45 days from the mailing of the notice, then the person or persons may recover from the Contractor and Surety, in addition to the amount of the claim, a reasonable attorney's fee based on the result, together with interest on the claim from the date of the notice.
4. Every person having a right of action on this bond shall, upon written application to the Owner indicating that labor, material, or supplies for the Work have been supplied and that payment has not been made, be promptly furnished a certified copy of this bond and the Construction Contract. The claimant may bring a civil action in the claimant's name on this Bond against the Contractor and the Surety, or either of them, in the county in which the Work is to be or has been performed or in any other county where venue is otherwise allowed by law.
5. This bond is furnished to comply with Code of Alabama, §39-1-1, and all provisions thereof shall be applicable to civil actions upon this bond.
6. All claims and disputes between Owner and either the Contractor or Surety arising out of or related to this bond, or its breach, shall be resolved in accordance with Article 24, General Conditions of the Contract

(8) **SIGNED AND SEALED** this _____ day of _____, _____.

(9) **ATTEST:**

CONTRACTOR as PRINCIPAL:

By _____

Name and Title

(10) Countersigned by
Alabama Resident Agent for Surety:

SURETY:

By _____

Name

By _____

Address

Name and Title

(11) **NOTE:** Power of attorney for the Surety's signatory shall be furnished with the original and five copies of the bond.

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| | 51. Sign |

ARTICLE 1 DEFINITIONS

Whenever the following terms, or pronouns in place of them, are used in the Contract Documents, the intent and meaning shall be interpreted as follows:

- A. ALABAMA BUILDING COMMISSION:** The Technical Staff of the Alabama Building Commission.
- B. ARCHITECT:** The Architect is the person or entity lawfully licensed to practice architecture in the State of Alabama, who is under contract with the Owner as the primary design professional for the Project and identified as the Architect in the Construction Contract. The term "Architect" means the Architect or the Architect's authorized representative. If the employment of the Architect is terminated, the Owner shall employ a new Architect whose status under the Contract Documents shall be that of the former Architect. If the primary design professional for the Project is a Professional Engineer, the term "Engineer" shall be substituted for the term "Architect" wherever it appears in this document.
- C. BC PROJECT INSPECTOR:** The member of the Technical Staff of the Alabama Building

Commission to whom the Project is assigned relative to executing the respective inspections and authorities described in Article 16, Inspection of the Work.

- D. COMMISSION:** The Alabama Building Commission, or any agency that may be designated by the Legislature as its successor.
- E. CONTRACT:** The Contract is the embodiment of the Contract Documents. The Contract represents the entire and integrated agreement between the Owner and Contractor and supersedes any prior written or oral negotiations, representations or agreements that are not incorporated into the Contract Documents. The Contract may be amended only by a Contract Change Order or a Modification to the Construction Contract. The contractual relationship which the Contract creates between the Owner and the Contractor extends to no other persons or entities. The Contract consists of the following Contract Documents, including all additions, deletions, and modifications incorporated therein before the execution of the Construction Contract:
- (1) Construction Contract
 - (2) Performance and Payment Bonds
 - (3) Conditions of the Contract (General, Supplemental, and other Conditions)
 - (4) Specifications
 - (5) Drawings
 - (6) Contract Change Orders
 - (7) Modifications to the Construction Contract (applicable to PSCA Projects)
- F. CONTRACT SUM:** The Contract Sum is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents. The term "Contract Sum" means the Contract Sum stated in the Construction Contract as may have been increased or decreased by Change Order(s) in accordance with the Contract Documents.
- G. CONTRACT TIME:** The Contract Time is the period of time in which the Contractor must achieve Substantial Completion of the Work. The date on which the Contract Time begins is specified in the written Notice To Proceed issued to the Contractor by the Owner or Director. The Date of Substantial Completion is the date established in accordance with Article 32. The term "Contract Time" means the Contract Time stated in the Construction Contract as may have been extended by Change Order(s) in accordance with the Contract Documents. The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.
- H. CONTRACTOR:** The Contractor is the person or persons, firm, partnership, joint venture, association, corporation, cooperative, limited liability company, or other legal entity, identified as such in the Construction Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative.
- I. DEFECTIVE WORK:** The term "Defective Work" shall apply to: (1) any product, material, system, equipment, or service, or its installation or performance, which does not conform to the requirements of the Contract Documents, (2) in-progress or completed Work the workmanship of which does not conform to the quality specified or, if not specified, to the quality produced by skilled workers performing work of a similar nature on similar projects in the state, (3) substitutions and deviations not properly submitted and approved or otherwise authorized, (4) temporary supports, structures, or construction which will not produce the results required by the Contract Documents, and (5) materials or equipment rendered unsuitable for incorporation into the Work due

to improper storage or protection.

- J. DIRECTOR:** The Director of the Technical Staff of the Alabama Building Commission.
- K. DRAWINGS:** The Drawings are the portions of the Contract Documents showing graphically the design, location, layout, and dimensions of the Work, in the form of plans, elevations, sections, details, schedules, and diagrams.
- L. NOTICE TO PROCEED:** A proceed order issued by the Owner or Director, as applicable, fixing the date on which the Contractor shall begin the prosecution of the Work, which is also the date on which the Contract Time shall begin.
- M. OWNER:** The Owner is the entity or entities identified as such in the Construction Contract and is referred to throughout the Contract Documents as if singular in number. The term "Owner" means the Owner or the Owner's authorized representative. The term "Owner" as used herein shall be synonymous with the term "Awarding Authority" as defined and used in Title 39 - Public Works, Code of Alabama, 1975, as amended.
- N. THE PROJECT:** The Project is the total construction of which the Work required by these Contract Documents may be the entirety or only a part with other portions to be constructed by the Owner or separate contractors.
- O. PROJECT MANUAL:** The Project Manual is the volume usually assembled for the Work which may include the Advertisement for Bids, Instructions to Bidders, sample forms, General Conditions of the Contract, Supplementary Conditions, and Specifications of the Work.
- P. SPECIFICATIONS:** The Specifications are that portion of the Contract Documents which set forth in writing the standards of quality and performance of products, equipment, materials, systems, and services and workmanship required for acceptable performance of the Work.
- Q. SUBCONTRACTOR:** A Subcontractor is a person or entity who is undertaking the performance of any part of the Work by virtue of a contract with the Contractor. The term "Subcontractor" means a Subcontractor or its authorized representatives.
- R. THE WORK:** The Work is the construction and services required by the Contract Documents and includes all labor, materials, supplies, equipment, and other items and services as are necessary to produce the required construction and to fulfill the Contractor's obligations under the Contract. The Work may constitute the entire Project or only a portion of it.

ARTICLE 2

INTENT and INTERPRETATION of the CONTRACT DOCUMENTS

A. INTENT

It is the intent of the Contract Documents that the Contractor shall properly execute and complete the Work described by the Contract Documents, and unless otherwise provided in the Contract, the Contractor shall provide all labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services, whether temporary

or permanent and whether or not incorporated or to be incorporated in the Work, in full accordance with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

B. COMPLEMENTARY DOCUMENTS

The Contract Documents are complementary. If Work is required by one Contract Document, the Contractor shall perform the Work as if it were required by all of the Contract Documents. However, the Contractor shall be required to perform Work only to the extent that is consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

C. ORDER of PRECEDENCE

Should any discrepancy arise between the various elements of the Contract Documents, precedence shall be given to them in the following order unless to do so would contravene the apparent Intent of the Contract Documents stated in preceding Paragraph A:

- (1) The Construction Contract.
- (2) Addenda, with those of later date having precedence over those of earlier date.
- (3) Supplementary Conditions (or other Conditions which modify the General Conditions of the Contract).
- (4) General Conditions of the Contract.
- (5) The Specifications.
- (6) Details appearing on the Drawings; large scale details shall take precedence over smaller scale details.
- (7) The Drawings; large scale drawings shall take precedence over smaller scale drawings.

D. ORGANIZATION

Except as may be specifically stated within the technical specifications, neither the organization of the Specifications into divisions, sections, or otherwise, nor any arrangement of the Drawings shall control how the Contractor subcontracts portions of the Work or assigns Work to any trade.

E. INTERPRETATION

(1) The Contract Documents shall be interpreted collectively, each part complementing the others and consistent with the Intent of the Contract Documents stated in preceding Paragraph A. Unless an item shown or described in the Contract Documents is specifically identified to be furnished or installed by the Owner or others or is identified as "Not In Contract" ("N.I.C."), the Contractor's obligation relative to that item shall be interpreted to include furnishing, assembling, installing, finishing, and/or connecting the item at the Contractor's expense to produce a product or system that is complete, appropriately tested, and in operative condition ready for use or subsequent construction or operation of the Owner or separate contractors. The omission of words or phrases for brevity of the Contract Documents, the inadvertent omission of words or phrases, or obvious typographical or written errors shall not defeat such interpretation as long as it is reasonably inferable from the Contract Documents as a whole.

(2) Words or phrases used in the Contract Documents which have well-known technical or construction industry meanings are to be interpreted consistent with such recognized meanings

unless otherwise indicated.

(3) Except as noted otherwise, references to standard specifications or publications of associations, bureaus, or organizations shall mean the latest edition of the referenced standard specification or publication as of the date of the Advertisement for Bids.

(4) In the case of inconsistency between Drawings and Specifications or within either document not clarified by addendum, the better quality or greater quantity of Work shall be provided in accordance with the Architect's interpretation.

(5) Generally, portions of the Contract Documents written in longhand take precedence over typed portions, and typed portions take precedence over printed portions.

(6) Any doubt as to the meaning of the Contract Documents or any obscurity as to the wording of them, shall be promptly submitted in writing to the Architect for written interpretation, explanation, or clarification.

F. SEVERABILITY.

The partial or complete invalidity of any one or more provision of this Contract shall not affect the validity or continuing force and effect of any other provision.

ARTICLE 3
CONTRACTOR'S REPRESENTATIONS

By executing the Construction Contract the Contractor represents to the Owner:

- A. The Contractor has visited the site of the Work to become familiar with local conditions under which the Work is to be performed and to evaluate reasonably observable conditions as compared with requirements of the Contract Documents.
- B. The Contractor shall use its best skill and attention to perform the Work in an expeditious manner consistent with the Contract Documents.
- C. The Contractor is an independent contractor and in performance of the Contract remains and shall act as an independent contractor having no authority to represent or obligate the Owner in any manner unless authorized by the Owner in writing.

ARTICLE 4
DOCUMENTS FURNISHED to CONTRACTOR

Unless otherwise provided in the Contract Documents, twenty sets of Drawings and Project Manuals will be furnished to the Contractor by the Architect without charge. Other copies requested will be furnished at reproduction cost.

ARTICLE 5
OWNERSHIP of DRAWINGS

All original or duplicated Drawings, Specifications, and other documents prepared by the Architect, and furnished to the Contractor are the property of the Architect and are to be used solely for this Project and not to be used in any manner for other work. Upon completion of the Work, all copies of Drawings and Specifications, with the exception of the Contractor's record set, shall be returned or accounted for by the Contractor to the Architect, on request.

ARTICLE 6

SUPERVISION, SUPERINTENDENT, and EMPLOYEES

A. SUPERVISION and CONSTRUCTION METHODS

(1) The term "Construction Methods" means the construction means, methods, techniques, sequences, and procedures utilized by the Contractor in performing the Work. The Contractor is solely responsible for supervising and coordinating the performance of the Work, including the selection of Construction Methods, unless the Contract Documents give other specific instructions concerning these matters.

(2) The Contractor is solely and completely responsible for job site safety, including the protection of persons and property in accordance with Article 14.

(3) The Contractor shall be responsible to the Owner for acts and omissions of not only the Contractor and its agents and employees, but all persons and entities, and their agents and employees, who are performing portions of the Work for or on behalf of the Contractor or any of its Subcontractors.

(4) The Contractor shall be responsible to inspect the in-progress and completed Work to verify its compliance with the Contract Documents and to insure that any element or portion of the Work upon which subsequent Work is to be applied or performed is in proper condition to receive the subsequent Work.

B. SUPERINTENDENT

(1) The Contractor shall employ and maintain a competent level of supervision for the performance of the Work at the Project site, including a superintendent who shall: (a) have full authority to receive instructions from the Architect or Owner and to act on those instructions and (b) be present at the Project site at all times during which Work is being performed.

(2) Before beginning performance of the Work, the Contractor shall notify the Architect in writing of the name and qualifications of its proposed superintendent so that the Owner may review the individual's qualifications. If, for reasonable cause, the Owner refuses to approve the individual, or withdraws its approval after once giving it, the Contractor shall name a different superintendent for the Owner's review and approval. Any disapproved superintendent will not perform in that capacity thereafter at the Project site.

C. EMPLOYEES

The Contractor shall permit only fit and skilled persons to perform the Work. The Contractor shall

enforce safety procedures, strict discipline, and good order among persons performing the Work. The Contractor will remove from its employment on the Project any person who deliberately or persistently produces non-conforming Work or who fails or refuses to conform to reasonable rules of personal conduct contained in the Contract Documents or implemented by the Owner and delivered to the Contractor in writing during the course of the Work.

ARTICLE 7

REVIEW of CONTRACT DOCUMENTS and FIELD CONDITIONS by CONTRACTOR

- A. In order to facilitate assembly and installation of the Work in accordance with the Contract Documents, before starting each portion of the Work, the Contractor shall examine and compare the relevant Contract Documents, and compare them to relevant field measurements made by the Contractor and any conditions at the site affecting that portion of the Work.
- B. If the Contractor discovers any errors, omissions, or inconsistencies in the Contract Documents, the Contractor shall promptly report them to the Architect as a written request for information that includes a detailed statement identifying the specific Drawings or Specifications that are in need of clarification and the error, omission, or inconsistency discovered in them.
 - (1) The Contractor shall not be expected to act as a licensed design professional and ascertain whether the Contract Documents comply with applicable laws, statutes, ordinances, building codes, and rules and regulations, but the Contractor shall be obligated to promptly notify the Architect of any such noncompliance discovered by or made known to the Contractor. If the Contractor performs Work without fulfilling this notification obligation, the Contractor shall pay the resulting costs and damages that would have been avoided by such notification.
 - (2) The Contractor shall not be liable to the Owner for errors, omissions, or inconsistencies that may exist in the Contract Documents, or between the Contract Documents and conditions at the site, unless the Contractor knowingly fails to report a discovered error, omission, or inconsistency to the Architect, in which case the Contractor shall pay the resulting costs and damages that would have been avoided by such notification.
- C. If the Contractor considers the Architect's response to a request for information to constitute a change to the Contract Documents involving additional costs and/or time, the Contractor shall follow the procedures of Article 20, Claims for Extra Cost or Extra Work.
- D. If, with undue frequency, the Contractor requests information that is obtainable through reasonable examination and comparison of the Contract Documents, site conditions, and previous correspondence, interpretations, or clarifications, the Contractor shall be liable to the Owner for reasonable charges from the Architect for the additional services required to review, research, and respond to such requests for information.

ARTICLE 8

SURVEYS by CONTRACTOR

- A. The Contractor shall provide competent engineering services to assure accurate execution of the Work in accordance with the Contract Documents. The Contractor shall verify the figures given for

the contours, approaches and locations shown on the Drawings before starting any Work and be responsible for the accuracy of the finished Work. Without extra cost to the Owner, the Contractor shall engage a licensed surveyor if necessary to verify boundary lines, keep within property lines, and shall be responsible for encroachments on rights or property of public or surrounding property owners.

- B.** The Contractor shall establish all base lines for the location of the principal components of the Work and make all detail surveys necessary for construction, including grade stakes, batter boards and other working points, lines and elevations. If the Work involves alteration of or addition to existing structures or improvements, the Contractor shall locate and measure elements of the existing conditions as is necessary to facilitate accurate fabrication, assembly, and installation of new Work in the relationship, alignment, and/or connection to the existing structure or improvement as is shown in the Contract Documents.

ARTICLE 9

SUBMITTALS

- A.** Where required by the Contract Documents, the Contractor shall submit shop drawings, product data, samples and other information (hereinafter referred to as Submittals) to the Architect for the purpose of demonstrating the way by which the Contractor proposes to conform to the requirements of the Contract Documents. Submittals which are not required by the Contract Documents may be returned by the Architect without action.
- B.** The Contractor shall be responsible to the Owner for the accuracy of its Submittals and the conformity of its submitted information to the requirements of the Contract Documents. Each Submittal shall bear the Contractor's approval, evidencing that the Contractor has reviewed and found the information to be in compliance with the requirements of the Contract Documents. Submittals which are not marked as reviewed and approved by the Contractor may be returned by the Architect without action.
- C.** The Contractor shall prepare and deliver its submittals to the Architect sufficiently in advance of construction requirements and in a sequence as to cause no delay in the Work or in the activities of the Owner or of separate contractors. In coordinating the Submittal process with its construction schedule, the Contractor shall allow sufficient time to permit adequate review by the Architect.
- D.** By approving a Submittal the Contractor represents not only that the element of Work presented in the Submittal complies with the requirements of the Contract Documents, but also that the Contractor has:
- (1) found the layout and/or dimensions in the Submittal to be comparable with those in the Contract Documents and other relevant Submittals and has made field measurements as necessary to verify their accuracy, and
 - (2) determined that products, materials, systems, equipment and/or procedures presented in the Submittal are compatible with those presented, or being presented, in other relevant Submittals and with the Contractor's intended Construction Methods.
- E.** The Contractor shall not fabricate or perform any portion of the Work for which the Contract Documents require Submittals until the respective Submittals have been approved by the Architect.

- F. In the case of a resubmission, the Contractor shall direct specific attention to all revisions in a Submittal. The Architect's approval of a resubmission shall not apply to any revisions that were not brought to the Architect's attention.
- G. If the Contract Documents specify that a Submittal is to be prepared and sealed by a registered architect or licensed engineer retained by the Contractor, all drawings, calculations, specifications, and certifications of the Submittal shall bear the Alabama seal of registration and signature of the registered/licensed design professional who prepared them or under whose supervision they were prepared. The Owner and the Architect shall be entitled to rely upon the adequacy, accuracy and completeness of such a Submittal, provided that all performance and design criteria that such Submittal must satisfy are sufficiently specified in the Contract Documents. The Architect will review, approve or take other appropriate action on such a Submittal only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Contractor shall not be responsible for the adequacy of the performance or design criteria specified in the Contract Documents.

H. **DEVIATIONS**

(1) The Architect is authorized by the Owner to approve "minor" deviations from the requirements of the Contract Documents. "Minor" deviations are defined as those which are in the interest of the Owner, do not materially alter the quality or performance of the finished Work, and do not affect the cost or time of performance of the Work. Deviations which are not "minor" may be authorized only by the Owner through the Change Order procedures of Article 19.

(2) Any deviation from the requirements of the Contract Documents contained in a Submittal shall be clearly identified as a "Deviation from Contract Requirements" (or by similar language) within the Submittal and, in a letter transmitting the Submittal to the Architect, the Contractor shall direct the Architect's attention to, and request specific approval of, the deviation. Otherwise, the Architect's approval of a Submittal does not constitute approval of deviations from the requirements of the Contract Documents contained in the Submittal.

(3) The Contractor shall bear all costs and expenses of any changes to the Work, changes to work performed by the Owner or separate contractors, or additional services by the Architect required to accommodate an approved deviation unless the Contractor has specifically informed the Architect in writing of the required changes and a Change Order has been issued authorizing the deviation and accounting for such resulting changes and costs.

I. **ARCHITECT'S REVIEW and APPROVAL**

(1) The Architect will review the Contractor's Submittals for conformance with requirements of, and the design concept expressed in, the Contract Documents and will approve or take other appropriate action upon them. This review is not intended to verify the accuracy and completeness of details such as dimensions and quantities nor to substantiate installation instructions or performance of equipment or systems, all of which remain the responsibility of the Contractor. However, the Architect shall advise the Contractor of any errors or omissions which the Architect may detect during this review. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

(2) The Architect will review and respond to all Submittals with reasonable promptness to avoid delay in the Work or in the activities of the Owner, Contractor or separate contractors, while allowing sufficient time to permit adequate review.

(3) No corrections or changes to Submittals indicated by the Architect will be considered as authorizations to perform Extra Work. If the Contractor considers such correction or change of a Submittal to require Work which differs from the requirements of the Contract Documents, the Contractor shall promptly notify the Architect in writing in accordance with Article 20, Claims for Extra Cost or Extra Work.

J. CONFORMANCE with SUBMITTALS

The Work shall be constructed in accordance with approved Submittals.

ARTICLE 10
DOCUMENTS and SAMPLES at the SITE

A. "AS ISSUED" SET

The Contractor shall maintain at the Project site, in good order, at least one copy of all Addenda, Change Orders, supplemental drawings, written directives and clarifications, and approved Submittals intact as issued, and an updated construction schedule.

B. "POSTED" SET

The Contractor shall maintain at the Project site, in good order, at least one set of the Drawings and Project Manual into which the Contractor has "posted"(incorporated) all Addenda, Change Orders, supplemental drawings, clarifications, and other information pertinent to the proper performance of the Work. The Contractor shall assure that all sets of the Drawings and Project Manuals being used by the Contractor, Subcontractors, and suppliers are "posted" with the current information to insure that updated Contract Documents are used for performance of the Work.

C. RECORD SET

One set of the Drawings and Project Manual described in Paragraph B shall be the Contractor's record set in which the Contractor shall record all field changes, corrections, selections, final locations, and other information as will be duplicated on the "As-built" documents required under Article 11. The Contractor shall record such "as-built" information in its record set as it becomes available through progress of the Work. The Contractor's performance of this requirement shall be subject to confirmation by the Architect at any time as a prerequisite to approval of Progress Payments.

D. The documents and samples required by this Article to be maintained at the Project site shall be readily available to the Architect, Owner, BC Project Inspector, and their representatives.

ARTICLE 11
"AS-BUILT" DOCUMENTS

- A. Unless otherwise provided in the Contract Documents, the Contractor shall deliver two (2) sets of "As-built" documents, as described herein, to the Architect for submission to the Owner upon completion of the Work. Each set of "As-built" documents shall consist of a copy of the Drawings and Project Manual, in like-new condition, into which the Contractor has neatly incorporated all Addenda, Change Orders, supplemental drawings, clarifications, field changes, corrections, selections, actual locations of underground utilities, and other information as required herein or specified elsewhere in the Contract Documents.
- B. The Contractor shall use the following methods for incorporating information into the "As-built" documents:
- (1) **Drawings**
- (a) To the greatest extent practicable, information shall be carefully drawn and lettered, in ink, on the Drawings in the form of sketches, details, plans, notes, and dimensions as required to provide a fully dimensioned record of the Work. When required for clarity, sketches, details, or partial plans shall be drawn on supplemental sheets and bound into the Drawings and referenced on the drawing being revised.
- (b) Where a revised drawing has been furnished by the Architect, the drawing of latest date shall be bound into the Drawings in the place of the superseded drawing.
- (c) Where a supplemental drawing has been furnished by the Architect, the supplemental drawing shall be bound into the Drawings in an appropriate location and referred to by notes added to the drawing being supplemented.
- (d) Where the Architect has furnished details, partial plans, or lengthy notes of which it would be impractical for the Contractor to redraw or letter on a drawing, such information may be affixed to the appropriate drawing with transparent tape if space is available on the drawing.
- (e) Any entry of information made in the Drawings that is the result of an Addendum or Change Order, shall identify the Addendum or Change Order from which it originated.
- (2) **Project Manual**
- (a) A copy of all Addenda and Change Orders, excluding drawings thereof, shall be bound in the front of the Project Manual.
- (b) Where a document, form, or entire specification section is revised, the latest issue shall be bound into the Project Manual in the place of the superseded issue.
- (c) Where information within a specification section is revised, the deleted or revised information shall be drawn through in ink and an adjacent note added identifying the Addendum or Change Order containing the revised information.
- C. Within ten days after the Date of Substantial Completion of the Work, or the last completed portion of the Work, the Contractor shall submit the "As-built" documents to the Architect for approval. If the Architect requires that any corrections be made, the documents will be returned in a reasonable time for correction and resubmission.

ARTICLE 12
PROGRESS SCHEDULE

(Not applicable if the Contract Time is 60 days or less.)

- A. The Contractor shall within fifteen days after the date of commencement stated in the Notice to Proceed, or such other time as may be provided in the Contract Documents, prepare and submit to

the Architect for review and approval a practicable construction schedule informing the Architect and Owner of the order in which the Contractor plans to carry on the Work within the Contract Time. The Architect's review and approval of the Contractor's construction schedule shall be only for compliance with the specified format, Contract Time, and suitability for monitoring progress of the Work and shall not be construed as a representation that the Architect has analyzed the schedule to form opinions of sequences or durations of time represented in the schedule.

- B. If a schedule format is not specified elsewhere in the Contract Documents, the construction schedule shall be prepared using ABC Form C-11, "Progress Schedule and Report", (contained in the Project Manual) or similar format of suitable scale and detail to indicate the percentage of Work scheduled to be completed at the end of each month. At the end of each month the Contractor shall enter the actual percentage of completion on the construction schedule submit two copies to the Architect, and attach one copy to each copy of the monthly Application for Payment. The construction schedule shall be revised to reflect any agreed extensions of the Contract Time or as required by conditions of the Work.
- C. If a more comprehensive schedule format is specified elsewhere in the Contract Documents or voluntarily employed by the Contractor, ABC Form C-11 shall also be prepared, updated, and submitted as described in preceding Paragraph B.
- D. The Contractor's construction schedule shall be used by the Contractor, Architect, and Owner to determine the adequacy of the Contractor's progress. The Contractor shall be responsible for maintaining progress in accordance with the currently approved construction schedule and shall increase the number of shifts, and/or overtime operations, days of work, and/or the amount of construction plant and equipment as may be necessary to do so. If the Contractor's progress falls materially behind the currently approved construction schedule and, in the opinion of the Architect or Owner, the Contractor is not taking sufficient steps to regain schedule, the Architect may, with the Owner's concurrence, issue the Contractor a Notice to Cure pursuant to Article 27. In such a Notice to Cure the Architect may require the Contractor to submit such supplementary or revised construction schedules as may be deemed necessary to demonstrate the manner in which schedule will be regained.

ARTICLE 13

EQUIPMENT, MATERIALS, and SUBSTITUTIONS

- A. Every part of the Work shall be executed in a workmanlike manner in accordance with the Contract Documents and approved Submittals. All materials used in the Work shall be furnished in sufficient quantities to facilitate the proper and expeditious execution of the Work and shall be new except such materials as may be expressly provided or allowed in the Contract Documents to be otherwise.
- B. Whenever a product, material, system, item of equipment, or service is identified in the Contract Documents by reference to a trade name, manufacturer's name, model number, etc.(hereinafter referred to as "source"), and only one or two sources are listed, or three or more sources are listed and followed by "or approved equal" or similar wording, it is intended to establish a required standard of performance, design, and quality, and the Contractor may submit, for the Architect's approval, products, materials, systems, equipment, or services of other sources which the Contractor can prove to the Architect's satisfaction are equal to, or exceed, the standard of

performance, design and quality specified, unless the provisions of Paragraph D below apply. Such proposed substitutions are not to be purchased or installed without the Architect's written approval of the substitution.

- C. If the Contract Documents identify three or more sources for a product, material, system, item of equipment or service to be used and the list of sources is not followed by "or approved equal" or similar wording, the Contractor may make substitution only after evaluation by the Architect and execution of an appropriate Contract Change Order.
- D. If the Contract Documents identify only one source and expressly provide that it is an approved sole source for the product, material, system, item of equipment, or service, the Contractor must furnish the identified sole source.

ARTICLE 14

SAFETY and PROTECTION of PERSONS and PROPERTY

- A. The Contractor shall be solely and completely responsible for conditions at the Project site, including safety of all persons (including employees) and property. The Contractor shall create, maintain, and supervise conditions and programs to facilitate and promote safe execution of the Work, and shall supervise the Work with the attention and skill required to assure its safe performance. Safety provisions shall conform to OSHA requirements and all other federal, state, county, and local laws, ordinances, codes, and regulations. Where any of these are in conflict, the more stringent requirement shall be followed. Nothing contained in this Contract shall be construed to mean that the Owner has employed the Architect nor has the Architect employed its consultants to administer, supervise, inspect, or take action regarding safety programs or conditions at the Project site.
- B. The Contractor shall employ Construction Methods, safety precautions, and protective measures that will reasonably prevent damage, injury or loss to:
 - (1) workers and other persons on the Project site and in adjacent and other areas that may be affected by the Contractor's operations;
 - (2) the Work and materials and equipment to be incorporated into the Work and stored by the Contractor on or off the Project site; and
 - (3) other property on, or adjacent to, the Project site, including trees, shrubs, lawns, walks, pavements, roadways, structures, utilities, and other improvements not designated in the Contract Documents to be removed, relocated, or replaced.
- C. The Contractor shall be responsible for the prompt remedy of damage and loss to property, including the filing of appropriate insurance claims, caused in whole or in part by the fault or negligence of the Contractor, a Subcontractor, or anyone for whose acts they may be liable.
- D. The Contractor shall comply with and give notices required by applicable laws, ordinances, rules, regulations and lawful orders of public authorities bearing on safety and protection of persons or property, including without limitation notices to adjoining property owners of excavation or other construction activities that potentially could cause damage or injury to adjoining property or persons thereon.

- E. The Contractor shall erect and maintain barriers, danger signs, and any other reasonable safeguards and warnings against hazards as may be required for safety and protection during performance of the Contract and shall notify owners and users of adjacent sites and utilities of conditions that may exist or arise which may jeopardize their safety.
- F. If use or storage of explosives or other hazardous materials or equipment or unusual Construction Methods are necessary for execution of the Work, the Contractor shall exercise commensurate care and employ supervisors and workers properly qualified to perform such activity.
- G. The Contractor shall furnish a qualified safety representative at the Project site whose duties shall include the prevention of accidents. The safety representative shall be the Contractor's superintendent, unless the Contractor assigns this duty to another responsible member of its on-site staff and notifies the Owner and Architect in writing of such assignment.
- H. The Contractor shall not permit a load to be applied, or forces introduced, to any part of the construction or site that may cause damage to the construction or site or endanger safety of the construction, site, or persons on or near the site.
- I. The Contractor shall have the right to act as it deems appropriate in emergency situations jeopardizing life or property. The Contractor shall be entitled to equitable adjustment of the Contract Sum or Contract Time for its efforts expended for the sole benefit of the Owner in an emergency. Such adjustment shall be determined as provided in Articles 19 and 20.
- J. The duty of the Architect and the Architect's consultants to visit the Project site to conduct periodic inspections of the Work or for other purposes shall not give rise to a duty to review or approve the adequacy of the Contractor's safety program, safety supervisor, or any safety measure which Contractor takes or fails to take in, on, or near the Project site.

ARTICLE 15

HAZARDOUS MATERIALS

- A. A Hazardous Material is any substance or material identified as hazardous under any federal, state, or local law or regulation, or any other substance or material which may be considered hazardous or otherwise subject to statutory or regulatory requirements governing its handling, disposal, and/or clean-up. Existing Hazardous Materials are Hazardous Materials discovered at the Project site and not introduced to the Project site by the Contractor, a Subcontractor, or anyone for whose acts they may be liable.
- B. If, during the performance of the Work, the Contractor encounters a suspected Existing Hazardous Material, the Contractor shall immediately stop work in the affected area, take measures appropriate to the condition to keep people away from the suspected Existing Hazardous Material, and immediately notify the Architect and Owner of the condition in writing.
- C. The Owner shall obtain the services of an independent laboratory or professional consultant, appropriately licensed and qualified, to determine whether the suspected material is a Hazardous Material requiring abatement and, if so, to certify after its abatement that it has been rendered harmless. Any abatement of Existing Hazardous Materials will be the responsibility of the Owner. The Owner will advise the Contractor in writing of the persons or entities who will determine the

nature of the suspected material and those who will, if necessary, perform the abatement. The Owner will not employ persons or entities to perform these services to whom the Contractor or Architect has reasonable objection.

- D. After certification by the Owner's independent laboratory or professional consultant that the material is harmless or has been rendered harmless, work in the affected area shall resume upon written agreement between the Owner and Contractor. If the material is found to be an Existing Hazardous Material and the Contractor incurs additional cost or delay due to the presence and abatement of the material, the Contract Sum and/or Contract Time shall be appropriately adjusted by a Contract Change Order pursuant to Article 19.
- E. The Owner shall not be responsible for Hazardous Materials introduced to the Project site by the Contractor, a Subcontractor, or anyone for whose acts they may be liable unless such Hazardous Materials were required by the Contract Documents.

ARTICLE 16

INSPECTION of the WORK

A. GENERAL

(1) The Contractor is solely responsible for the Work's compliance with the Contract Documents; therefore, the Contractor shall be responsible to inspect in-progress and completed Work, and shall verify its compliance with the Contract Documents and that any element or portion of the Work upon which subsequent Work is to be applied or performed is in proper condition to receive the subsequent Work. Neither the presence nor absence of inspections by the Architect, Owner, Director, BC Project Inspector, any public authority having jurisdiction, or their representatives shall relieve the Contractor of responsibility to inspect the Work, for responsibility for Construction Methods and safety precautions and programs in connection with the Work, or from any other requirement of the Contract Documents.

(2) The Architect, Owner, Director, BC Project Inspector, any public authority having jurisdiction, and their representatives shall have access at all times to the Work for inspection whenever it is in preparation or progress, and the Contractor shall provide proper facilities for such access and inspection. All materials, workmanship, processes of manufacture, and methods of construction, if not otherwise stipulated in the Contract Documents, shall be subject to inspection, examination, and test at any and all places where such manufacture and/or construction are being carried on. Such inspections will not unreasonably interfere with the Contractor's operations.

(3) The Architect will inspect the Work as a representative of the Owner. The Architect's inspections may be supplemented by inspections by the BC Project Inspector as a representative of the Alabama Building Commission.

(4) The Contractor may be charged by the Owner for any extra cost of inspection incurred by the Owner or Architect on account of material and workmanship not being ready at the time of inspection set by the Contractor.

B. TYPES of INSPECTIONS

(1) SCHEDULED INSPECTIONS and CONFERENCES. Scheduled Inspections and Conferences are conducted by the Architect, scheduled by the Architect in coordination with the Contractor and BC Project Inspector, and are attended by the Contractor and applicable Subcontractors, suppliers and manufacturers, and the BC Project Inspector. Scheduled Inspections and Conferences of this Contract include:

(a) Pre-construction Conference.

(b) Pre-roofing Conference (not applicable if the Contract involves no roofing work)

(c) Above Ceiling Inspection(s): An above ceiling inspection of all spaces in the building is required before the ceiling material is installed. Above ceiling inspections are to be conducted at a time when all above ceiling systems are complete and tested to the greatest extent reasonable pending installation of the ceiling material. System identifications and markings are to be complete. All fire-rated construction including fire-stopping of penetrations and specified identification above the ceiling shall be complete. Ceiling framing and suspension systems shall be complete with lights, grilles and diffusers, access panels, fire protection drops for sprinkler heads, etc., installed in their final locations to the greatest extent reasonable. Above ceiling framing to support ceiling mounted equipment shall be complete. The above ceiling construction shall be complete to the extent that after the inspection the ceiling material can be installed without disturbance.

(d) Final Inspection(s): A Final Inspection shall establish that the Work, or a designated portion of the Work, is Substantially Complete in accordance with Article 32 and is accepted by the Architect, Owner, and BC Project Inspector as being ready for the Owner's occupancy or use. At the conclusion of this inspection, items requiring correction or completion ("punch list" items) shall be minimal and require only a short period of time for accomplishment to establish Final Acceptance of the Work. If the Work, or designated portion of the Work, includes the installation, or modification, of a fire alarm system or other life safety systems essential to occupancy, such systems shall have been tested and appropriately certified before the Final Inspection.

(e) Year-end Inspection(s): An inspection of the Work, or each separately completed portion thereof, is required near the end of the Contractor's one year warranty period(s). The subsequent delivery of the Architect's report of this inspection will serve as confirmation that the Contractor was notified of Defective Work found within the warranty period in accordance with Article 35.

(2) PERIODIC INSPECTIONS. Periodic Inspections are conducted throughout the course of the Work by the Architect, the Architect's consultants, their representatives, and the BC Project Inspector, jointly or independently, with or without advance notice to the Contractor.

(3) SPECIFIED INSPECTIONS and TESTS. Specified Inspections and Tests include inspections, tests, demonstrations, and approvals that are either specified in the Contract Documents or required by laws, ordinances, rules, regulations, or orders of public authorities having jurisdiction, to be performed by the Contractor, one of its Subcontractors, or an independent testing laboratory or firm (whether paid for by the Contractor or Owner).

C. INSPECTIONS by the ARCHITECT

(1) The Architect is not authorized to revoke, alter, relax, or waive any requirements of the Contract Documents (other than "minor" deviations as defined in Article 9 and "minor" changes as defined in Article 19), to finally approve or accept any portion of the Work or to issue instructions contrary to the Contract Documents without concurrence of the Owner.

(2) The Architect will visit the site at intervals appropriate to the stage of the Contractor's operations and as otherwise necessary to:

- (a) become generally familiar with the in-progress and completed Work and the quality of the Work,
- (b) determine whether the Work is progressing in general accordance with the Contractor's schedule and is likely to be completed within the Contract Time,
- (c) visually compare readily accessible elements of the Work to the requirements of the Contract Documents to determine, in general, if the Contractor's performance of the Work indicates that the Work will conform to the requirements of the Contract Documents when completed,
- (d) endeavor to guard the Owner against Defective Work,
- (e) review and address with the Contractor any problems in implementing the requirements of the Contract Documents that the Contractor may have encountered, and
- (f) keep the Owner fully informed about the Project.

(3) The Architect shall have the authority to reject Defective Work or require its correction, but shall not be required to make exhaustive investigations or examinations of the in-progress or completed portions of the Work to expose the presence of Defective Work. However, it shall be an obligation of the Architect to report in writing, to the Owner, Contractor, and BC Project Inspector, any Defective Work recognized by the Architect.

(4) The Architect shall have the authority to require the Contractor to stop work only when, in the Architect's reasonable opinion, such stoppage is necessary to avoid Defective Work. The Architect shall not be liable to the Contractor or Owner for the consequences of any decisions made by the Architect in good faith either to exercise or not to exercise this authority.

(5) "Inspections by the Architect" includes appropriate inspections by the Architect's consultants as dictated by their respective disciplines of design and the stage of the Contractor's operations.

D. INSPECTIONS by the BC PROJECT INSPECTOR

(1) The BC Project Inspector will:

- (a) participate in scheduled inspections and conferences as practicable,
- (b) perform periodic inspections of in-progress and completed Work to ensure code compliance of the Project and general conformance of the Work with the Contract Documents, and
- (c) monitor the Contractor's progress and performance of the Work.

(2) The BC Project Inspector shall have the authority to:

- (a) reject Work that is not in compliance with the State Building Code adopted by the Commission, unless the Work is in accordance with the Contract Documents in which case the BC Project Inspector will advise the Architect to initiate appropriate corrective action, and
- (b) notify the Architect, Owner, and Contractor of Defective Work recognized by the BC Project Inspector.

(3) The BC Project Inspector's periodic inspections will usually be scheduled around key stages of construction based upon information reported by the Architect. As the Architect or Owner deems appropriate, the BC Project Inspector, as well as other members of the Technical Staff, can

be requested to schedule special inspections or meetings to address specific matters. The written findings of BC Project Inspector will be transmitted to the Owner, Contractor, and Architect.

(4) The BC Project Inspector is not authorized to revoke, alter, relax, or waive any requirements of the Contract Documents, to finally approve or accept any portion of the Work or to issue instructions contrary to the Contract Documents without concurrence of the Owner. The Contractor shall not proceed with Work as a result of instructions or findings of the BC Project Inspector which the Contractor considers to be a change to the requirements of the Contract Documents without written authorization of the Owner through the Architect.

E. UNCOVERING WORK

(1) If the Contractor covers a portion of the Work before it is examined by the Architect and this is contrary to the Architect's request or specific requirements in the Contract Documents, then, upon written request of the Architect, the Work must be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

(2) Without a prior request or specific requirement that Work be examined by the Architect before it is covered, the Architect may request that Work be uncovered for examination and the Contractor shall uncover it. If the Work is in accordance with the Contract Documents, the Contract Sum shall be equitably adjusted under Article 19 to compensate the Contractor for the costs of uncovering and replacement. If the Work is not in accordance with the Contract Documents, uncovering, correction, and replacement shall be at the Contractor's expense unless the condition was caused by the Owner or a separate contractor in which event the Owner shall be responsible for payment of such costs.

F. SPECIFIED INSPECTIONS and TESTS

(1) The Contractor shall schedule and coordinate Specified Inspections and Tests to be made at appropriate times so as not to delay the progress of the Work or the work of the Owner or separate contractors. If the Contract Documents require that a Specified Inspection or Test be witnessed or attended by the Architect or Architect's consultant, the Contractor shall give the Architect timely notice of the time and place of the Specified Inspection or Test. If a Specified Inspection or Test reveals that Work is not in compliance with requirements of the Contract Documents, the Contractor shall bear the costs of correction, repeating the Specified Inspection or Test, and any related costs incurred by the Owner, including reasonable charges, if any, by the Architect for additional services. Through appropriate Contract Change Order the Owner shall bear costs of tests, inspections or approvals which become Contract requirements subsequent to the receipt of bids.

(2) If the Architect, Owner, or public authority having jurisdiction determines that inspections, tests, demonstrations, or approvals in addition to Specified Inspections and Tests are required, the Contractor shall, upon written instruction from the Architect, arrange for their performance by an entity acceptable to the Owner, giving timely notice to the architect of the time and place of their performance. Related costs shall be borne by the Owner unless the procedures reveal that Work is not in compliance with requirements of the Contract Documents, in which case the Contractor shall bear the costs of correction, repeating the procedures, and any related costs incurred by the Owner, including reasonable charges, if any, by the Architect for additional services.

(3) Unless otherwise required by the Contract Documents, required certificates of Specified Inspections and Tests shall be secured by the Contractor and promptly delivered to the Architect.

(4) Failure of any materials to pass Specified Inspections and Tests will be sufficient cause for refusal to consider any further samples of the same brand or make of that material for use in the Work.

ARTICLE 17

CORRECTION of DEFECTIVE WORK

- A. The Contractor shall, at the Contractor's expense, promptly correct Defective Work rejected by the Architect or which otherwise becomes known to the Contractor, removing the rejected or nonconforming materials and construction from the project site.
- B. Correction of Defective Work shall be performed in such a timely manner as will avoid delay of completion, use, or occupancy of the Work and the work of the Owner and separate contractors.
- C. The Contractor shall bear all expenses related to the correction of Defective Work, including but not limited to: (1) additional testing and inspections, including repeating Specified Inspections and Tests, (2) reasonable services and expenses of the Architect, and (3) the expense of making good all work of the Contractor, Owner, or separate contractors destroyed or damaged by the correction of Defective Work.

ARTICLE 18

DEDUCTIONS for UNCORRECTED WORK

If the Owner deems it advisable and in the Owner's interest to accept Defective Work, the Owner may allow part or all of such Work to remain in place, provided an equitable deduction from the Contract Sum, acceptable to the Owner, is offered by the Contractor.

ARTICLE 19

CHANGES in the WORK

A. GENERAL

(1) The Owner may at any time direct the Contractor to make changes in the Work which are within the general scope of the Contract, including changes in the Drawings, Specifications, or other portions of the Contract Documents to add, delete, or otherwise revise portions of the Work. The Architect is authorized by the Owner to direct "minor" changes in the Work by written order to the Contractor. "Minor" changes in the Work are defined as those which are in the interest of the Owner, do not materially alter the quality or performance of the finished Work, and do not affect the cost or time of performance of the Work. Changes in the Work which are not "minor" may be authorized only by the Owner.

(2) If the Owner directs a change in the Work, the change shall be incorporated into the Contract by a Contract Change Order prepared by the Architect and signed by the Contractor, Owner, and other signatories to the Construction Contract, stating their agreement upon the change or changes in the Work and the adjustments, if any, in the Contract Sum and the Contract Time.

(3) Subject to compliance with Alabama's Public Works Law, the Owner may, upon agreement by the Contractor, incorporate previously unawarded bid alternates into the Contract.

(4) In the event of a claim or dispute as to the appropriate adjustment to the Contract Sum or Contract Time due to a directive to make changes in the Work, the Work shall proceed as provided in this article subject to subsequent agreement of the parties or final resolution of the dispute pursuant to Article 24.

(5) Consent of surety will be obtained for all Contract Change Orders involving an increase in the Contract Sum.

(6) Changes in the Work shall be performed under applicable provisions of the Contract Documents and the Contractor shall proceed promptly to perform changes in the Work, unless otherwise directed by the Owner through the Architect.

B. DETERMINATION of ADJUSTMENT of the CONTRACT SUM

The adjustment of the Contract Sum resulting from a change in the Work shall be determined by one of the following methods, or a combination thereof, as selected by the Owner:

(1) **Lump Sum.** By mutual agreement to a lump sum based on or negotiated from an itemized cost proposal from the Contractor. Additions to the Contract Sum shall include the Contractor's direct costs plus a maximum 15% markup for overhead and profit. Where subcontract work is involved the total mark-up for the Contractor and a Subcontractor shall not exceed 25%. No allowance for overhead and profit shall be figured on a change which involves a net credit to the Owner. For the purposes of this method of determining an adjustment of the Contract Sum, "overhead" shall cover the Contractor's indirect costs of the change, such as the cost of bonds, superintendent and other job office personnel, watchman, job office, job office supplies and expenses, temporary facilities and utilities, and home office expenses.

(2) **Unit Price.** By application of Unit Prices included in the Contract or subsequently agreed to by the parties. However, if the character or quantity originally contemplated is materially changed so that application of such unit price to quantities of Work proposed will cause substantial inequity to either party, the applicable unit price shall be equitably adjusted.

(3) **Force Account.** By directing the Contractor to proceed with the change in the Work on a "force account" basis under which the Contractor shall be reimbursed for reasonable expenditures incurred by the Contractor and its Subcontractors in performing added Work and the Owner shall receive reasonable credit for any deleted Work. The Contractor shall keep and present, in such form as the Owner may prescribe, an itemized accounting of the cost of the change together with sufficient supporting data. Unless otherwise stated in the directive, the adjustment of the Contract Sum shall be limited to the following:

(a) costs of labor and supervision, including employee benefits, social security, retirement, unemployment and workers' compensation insurance required by law, agreement, or under Contractor's or Subcontractor's standard personnel policy;

- (b) cost of materials, supplies and equipment, including cost of delivery, whether incorporated or consumed;
- (c) rental cost of machinery and equipment, not to exceed prevailing local rates if contractor-owned;
- (d) costs of premiums for insurance required by the Contract Documents, permit fees, and sales, use or similar taxes related to the change in the Work;
- (e) reasonable credits to the Owner for the value of deleted Work, without Contractor or Subcontractor mark-ups; and
- (f) for additions to the Contract Sum, mark-up of the Contractor's direct costs for overhead and profit not exceeding 15% on Contractor's work nor exceeding 25% for Contractor and Subcontractor on a Subcontractor's work. No allowance for overhead and profit shall be figured on a change which involves a net credit to the Owner. For the purposes of this method of determining an adjustment of the Contract Sum, "overhead" shall cover the Contractor's indirect costs of the change, such as the cost of insurance other than mentioned above, bonds, superintendent and other job office personnel, watchman, use and rental of small tools, job office, job office supplies and expenses, temporary facilities and utilities, and home office expenses.

C. ADJUSTMENT of the CONTRACT TIME due to CHANGES

- (1) Unless otherwise provided in the Contract Documents, the Contract Time shall be equitably adjusted for the performance of a change provided that the Contractor notifies the Architect in writing that the change will increase the time required to complete the Work. Such notice shall be provided no later than:
 - (a) with the Contractor's cost proposal stating the number of days of extension requested, or
 - (b) within ten days after the Contractor receives a directive to proceed with a change in advance of submitting a cost proposal, in which case the notice should provide an estimated number of days of extension to be requested, which may be subject to adjustment in the cost proposal.
- (2) The Contract Time shall be extended only to the extent that the change affects the time required to complete the entire Work of the Contract, taking into account the concurrent performance of the changed and unchanged Work.

D. CHANGE ORDER PROCEDURES

- (1) If the Owner proposes to make a change in the Work, the Architect will request that the Contractor provide a cost proposal for making the change to the Work. The request shall be in writing and shall adequately describe the proposed change using drawings, specifications, narrative, or a combination thereof. Within 21 days after receiving such a request, or such other time as may be stated in the request, the Contractor shall prepare and submit to the Architect a written proposal, properly itemized and supported by sufficient substantiating data to facilitate evaluation. The stated time within which the Contractor must submit a proposal may be extended if, within that time, the Contractor makes a written request with reasonable justification thereof.
- (2) The Contractor may voluntarily offer a change proposal which, in the Contractor's opinion, will reduce the cost of construction, maintenance, or operation or will improve the cost-effective performance of an element of the Project, in which case the Owner, through the Architect, will accept, reject, or respond otherwise within 21 days after receipt of the proposal, or such other

reasonable time as the Contractor may state in the proposal.

(3) If the Contractor's proposal is acceptable to the Owner, or is negotiated to the mutual agreement of the Contractor and Owner, the Architect will prepare an appropriate Contract Change Order for execution. Upon receipt of the fully executed Contract Change Order, the Contractor shall proceed with the change.

(4) In advance of delivery of a fully executed Contract Change Order, the Architect may furnish to the Contractor a written authorization to proceed with an agreed change. However, such an authorization shall be effective only if it:

- (a) identifies the Contractor's accepted or negotiated proposal for the change,
- (b) states the agreed adjustments, if any, in Contract Sum and Contract Time,
- (c) states that funds are available to pay for the change, and
- (d) is signed by the Owner.

(5) If the Contractor and Owner cannot agree on the amount of the adjustment in the Contract Sum for a change, the Owner, through the Architect, may order the Contractor to proceed with the change on a Force Account basis, but the net cost to the Owner shall not exceed the amount quoted in the Contractor's proposal. Such order shall state that funds are available to pay for the change.

(6) If the Contractor does not promptly respond to a request for a proposal, or the Owner determines that the change is essential to the final product of the Work and that the change must be effected immediately to avoid delay of the Project, the Owner may:

- (a) determine with the Contractor a sufficient maximum amount to be authorized for the change and
- (b) direct the Contractor to proceed with the change on a Force Account basis pending delivery of the Contractor's proposal, stating the maximum increase in the Contract Sum that is authorized for the change.

(7) Pending agreement of the parties or final resolution of any dispute of the total amount due the Contractor for a change in the Work, amounts not in dispute for such changes in the Work may be included in Applications for Payment accompanied by an interim Change Order indicating the parties' agreement with part of all of such costs or time extension. Once a dispute is resolved, it shall be implemented by preparation and execution of an appropriate Change Order.

ARTICLE 20

CLAIMS for EXTRA COST or EXTRA WORK

- A. If the Contractor considers any instructions by the Architect, Owner, BC Project Inspector, or public authority having jurisdiction to be contrary to the requirements of the Contract Documents and will involve extra work and/or cost under the Contract, the Contractor shall give the Architect written notice thereof within ten days after receipt of such instructions, and in any event before proceeding to execute such work. As used in this Article, "instructions" shall include written or oral clarifications, directions, instructions, interpretations, or determinations.
- B. The Contractor's notification pursuant to Paragraph 20.A shall state: (1) the date, circumstances, and source of the instructions, (2) that the Contractor considers the instructions to constitute a

change to the Contract Documents and why, and (3) an estimate of extra cost and time that may be involved to the extent an estimate may be reasonably made at that time.

- C. Except for claims relating to an emergency endangering life or property, no claim for extra cost or extra work shall be considered in the absence of prior notice required under Paragraph 20.A.
- D. Within ten days of receipt of a notice pursuant to Paragraph 20.A, the Architect will respond in writing to the Contractor, stating one of the following:
 - (1) The cited instruction is rescinded.
 - (2) The cited instruction is a change in the Work and in which manner the Contractor is to proceed with procedures of Article 19, Changes in the Work.
 - (3) The cited instruction is reconfirmed, is not considered by the Architect to be a change in the Contract Documents, and the Contractor is to proceed with Work as instructed.
- E. If the Architect's response to the Contractor is as in Paragraph 20.D(3), the Contractor shall proceed with the Work as instructed. If the Contractor continues to consider the instructions to constitute a change in the Contract Documents, the Contractor shall, within ten days after receiving the Architect's response, notify the Architect in writing that the Contractor intends to submit a claim pursuant to Article 24, Resolution of Claims and Disputes

ARTICLE 21

DIFFERING SITE CONDITIONS

A. DEFINITION

"Differing Site Conditions" are:

- (1) subsurface or otherwise concealed physical conditions at the Project site which differ materially from those indicated in the Contract Documents, or
- (2) unknown physical conditions at the Project site which are of an unusual nature, differing materially from conditions ordinarily encountered and generally recognized as inherent in construction activities of the character required by the Contract Documents.

B. PROCEDURES

If Differing Site Conditions are encountered, then the party discovering the condition shall promptly notify the other party before the condition is disturbed and in no event later than ten days after discovering the condition. Upon such notice and verification that a Differing Site Condition exists, the Architect will, with reasonable promptness and with the Owner's concurrence, make changes in the Drawings and/or Specifications as are deemed necessary to conform to the Differing Site Condition. Any increase or decrease in the Contract Sum or Contract Time that is warranted by the changes will be made as provided under Article 19, Changes in the Work. If the Architect determines a Differing Site Condition has not been encountered, the Architect shall notify the Owner and Contractor in writing, stating the reason for that determination.

ARTICLE 22
CLAIMS for DAMAGES

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

ARTICLE 23
DELAYS

- A. A delay beyond the Contractor's control at any time in the commencement or progress of Work by an act or omission of the Owner, Architect, or any separate contractor or by labor disputes, unusual delay in deliveries, unavoidable casualties, fires, abnormal floods, tornadoes, or other cataclysmic events of nature, may entitle the Contractor to an extension of the Contract Time provided, however, that the Contractor shall, within ten days after the delay first occurs, give written notice to the Architect of the cause of the delay and its probable effect on progress of the entire Work.
- B. Adverse weather conditions that are more severe than anticipated for the locality of the Work during any given month may entitle the Contractor to an extension of Contract Time provided, however;
- (1) the weather conditions had an adverse effect on construction scheduled to be performed during the period in which the adverse weather occurred, which in reasonable sequence would have an effect on completion of the entire Work,
 - (2) the Contractor shall, within twenty-one days after the end of the month in which the delay occurs, give the Architect written notice of the delay that occurred during that month and its probable effect on progress of the Work, and
 - (3) within a reasonable time after giving notice of the delay, the Contractor provides the Architect with sufficient data to document that the weather conditions experienced were unusually severe for the locality of the Work during the month in question. Unless otherwise provided in the Contract Documents, data documenting unusually severe weather conditions shall compare actual weather conditions to the average weather conditions for the month in question during the previous five years as recorded by the National Oceanic and Atmospheric Administration (NOAA) or similar record-keeping entities.
- C. Adjustments, if any, of the Contract Time pursuant to this Article shall be incorporated into the Contract by a Contract Change Order prepared by the Architect and signed by the Contractor, Owner, and other signatories to the Construction Contract or, at closeout of the Contract, by mutual written agreement between the Contractor and Owner. The adjustment of the Contract Time shall not exceed the extent to which the delay extends the time required to complete the entire Work of the Contract.
- D. The Contractor shall not be entitled to any adjustment of the Contract Sum for damage due to delays claimed pursuant to this Article unless the delay was caused by the Owner or Architect and

was either:

- (1) the result of bad faith or active interference or
- (2) beyond the contemplation of the parties and not remedied within a reasonable time after notification by the Contractor of its presence.

ARTICLE 24

RESOLUTION of CLAIMS and DISPUTES

A. APPLICABILITY of ARTICLE

(1) As used in this Article, "Claims and Disputes" include claims or disputes asserted by the Contractor, its Surety, or Owner arising out of or related to the Contract, or its breach, including without limitation claims seeking, under the provisions of the Contract, equitable adjustment of the Contract Sum or Contract Time and claims and disputes arising between the Contractor (or its Surety) and Owner regarding interpretation of the Contract Documents, performance of the Work, or breach of or compliance with the terms of the Contract.

(2) "Resolution" addressed in this Article applies only to Claims and Disputes arising between the Contractor (or its Surety) and Owner and asserted after execution of the Construction Contract and prior to the date upon which final payment is made. Upon making application for final payment the Contractor may reserve the right to subsequent Resolution of existing Claims by including a list of all Claims, in stated amounts, which remain to be resolved and specifically excluding them from any release of claims executed by the Contractor, and in that event Resolution may occur after final payment is made.

B. CONTINUANCE of PERFORMANCE

An unresolved Claim or Dispute shall not be just cause for the Contractor to fail or refuse to proceed diligently with performance of the Contract or for the Owner to fail or refuse to continue to make payments in accordance with the Contract Documents.

C. GOOD FAITH EFFORT to SETTLE

The Contractor and Owner agree that, upon the assertion of a Claim by the other, they will make a good faith effort, with the Architect's assistance and advice, to achieve mutual resolution of the Claim. If mutually agreed, the Contractor and Owner may endeavor to resolve a Claim through mediation. If efforts to settle are not successful, the Claim shall be resolved in accordance with paragraph D or E below, whichever applies.

D. FINAL RESOLUTION for STATE-FUNDED CONTRACTS

(1) If the Contract is funded in whole or in part with state funds, the final Resolution of Claims and Disputes which cannot be resolved by the Contractor (or its Surety) and Owner shall be by the Director, whose decision shall be final, binding, and conclusive upon the Contractor, its Surety, and the Owner.

(2) When it becomes apparent to the party asserting a Claim (the Claimant) that an impasse to mutual resolution has been reached, the Claimant may request in writing to the Director that the

Claim be resolved by decision of the Director. Such request by the Contractor (or its Surety) shall be submitted through the Owner. Should the Owner fail or refuse to submit the Contractor's request within ten days of receipt of same, the Contractor may forward such request directly to the Director. Upon receipt of a request to resolve a Claim, the Director will instruct the parties as to procedures to be initiated and followed.

(3) If the respondent to a Claim fails or refuses to participate or cooperate in the Resolution procedures to the extent that the Claimant is compelled to initiate legal proceedings to induce the Respondent to participate or cooperate, the Claimant will be entitled to recover, and may amend its Claim to include, the expense of reasonable attorney's fees so incurred.

E. FINAL RESOLUTION for LOCALLY-FUNDED CONTRACTS

If the Contract is funded in whole with funds provided by a city or county board of education or other local governmental authority and the Contract Documents do not stipulate a binding alternative dispute resolution method, the final resolution of Claims and Disputes which cannot be resolved by the Contractor (or its Surety) and Owner may be by any legal remedy available to the parties. Alternatively, upon the written agreement of the Contractor (or its Surety) and the Owner, final Resolution of Claims and Disputes may be by submission to binding arbitration before a neutral arbitrator or panel or by submission to the Director in accordance with preceding Paragraph D.

ARTICLE 25
OWNER'S RIGHT to CORRECT DEFECTIVE WORK

If the Contractor fails or refuses to correct Defective Work in a timely manner that will avoid delay of completion, use, or occupancy of the Work or work by the Owner or separate contractors, the Architect may give the Contractor written Notice to Cure the Defective Work within a reasonable, stated time. If within ten days after receipt of the Notice to Cure the Contractor has not proceeded and satisfactorily continued to cure the Defective Work or provided the Architect with written verification that satisfactory positive action is in process to cure the Defective Work, the Owner may, without prejudice to any other remedy available to the Owner, correct the Defective Work and deduct the actual cost of the correction from payment then or thereafter due to the Contractor.

ARTICLE 26
OWNER'S RIGHT to STOP or SUSPEND the WORK

A. STOPPING the WORK for CAUSE

If the Contractor fails to correct Defective Work or persistently fails to carry out Work in accordance with the Contract Documents, the Owner may direct the Contractor in writing to stop the Work, or any part of the Work, until the cause for the Owner's directive has been eliminated; however, the Owner's right to stop the Work shall not be construed as a duty of the Owner to be exercised for the benefit of the Contractor or any other person or entity.

B. SUSPENSION by the OWNER for CONVENIENCE

(1) The Owner may, at any time and without cause, direct the Contractor in writing to suspend, delay or interrupt the Work, or any part of the Work, for a period of time as the Owner may determine.

(2) The Contract Sum and Contract Time shall be adjusted, pursuant to Article 19, for reasonable increases in the cost and time caused by an Owner-directed suspension, delay or interruption of Work for the Owner's convenience. However, no adjustment to the Contract Sum shall be made to the extent that the same or concurrent Work is, was or would have been likewise suspended, delayed or interrupted for other reasons not caused by the Owner.

ARTICLE 27

OWNER'S RIGHT to TERMINATE CONTRACT

A. TERMINATION by the OWNER for CAUSE

(1) **Causes:** The Owner may terminate the Contractor's right to complete the Work, or any designated portion of the Work, if the Contractor:

- (a) should be adjudged bankrupt, or should make a general assignment for the benefit of the Contractor's creditors, or if a receiver should be appointed on account of the Contractor's insolvency to the extent termination for these reasons is permissible under applicable law;
- (b) refuses or fails to prosecute the Work, or any part of the Work, with the diligence that will insure its completion within the Contract Time, including any extensions, or fails to complete the Work within the Contract Time;
- (c) refuses or fails to perform the Work, including prompt correction of Defective Work, in a manner that will insure that the Work, when fully completed, will be in accordance with the Contract Documents;
- (d) fails to pay for labor or materials supplied for the Work or to pay Subcontractors in accordance with the respective Subcontract;
- (e) persistently disregards laws, ordinances, or rules, regulations or orders of a public authority having jurisdiction, or the instructions of the Architect or Owner; or
- (f) is otherwise guilty of a substantial breach of the Contract.

(2) **Procedure for Unbonded Construction Contracts (Generally, contracts less than \$50,000):**

- (a) **Notice to Cure:** In the presence of any of the above conditions the Architect may give the Contractor written notice to cure the condition within a reasonable, stated time, but not less than ten days after the Contractor receives the notice.
- (b) **Notice of Termination:** If, at the expiration of the time stated in the Notice to Cure, the Contractor has not proceeded and satisfactorily continued to cure the condition or provided the Architect with written verification that satisfactory positive action is in process to cure the condition, the Owner may, without prejudice to any other rights or remedies of the Owner, give the Contractor written notice that the Contractor's right to complete the Work, or a designated portion of the Work, shall terminate seven days after the Contractor's receipt of the written Notice of Termination.
- (c) If the Contractor satisfies a Notice to Cure, but the condition for which the notice was first given reoccurs, the Owner may give the Contractor a seven day Notice of Termination without giving the Contractor another Notice to Cure.

- (d) At the expiration of the seven days of the termination notice, the Owner may:
 - .1 take possession of the site, of all materials and equipment stored on and off site, and of all Contractor-owned tools, construction equipment and machinery, and facilities located at the site, and
 - .2 finish the Work by whatever reasonable method the Owner may deem expedient.
 - (e) The Contractor shall not be entitled to receive further payment under the Contract until the Work is completed.
 - (f) If the Owner's cost of completing the Work, including correction of Defective Work, compensation for additional architectural, engineering, managerial, and administrative services, and reasonable attorneys' fees due to the default and termination, is less than the unpaid balance of the Contract Sum, the excess balance less liquidated damages for delay shall be paid to the Contractor. If such cost to the Owner including attorney's fees, plus liquidated damages, exceeds the unpaid balance of the Contract Sum, the Contractor shall pay the difference to the Owner. Final Resolution of any claim or Dispute involving the termination or any amount due any party as a result of the termination shall be pursuant to Article 24.
 - (g) Upon the Contractor's request, the Owner shall furnish to the Contractor a detailed accounting of the Owner's cost of completing the Work.
- (3) **Procedure for Bonded Construction Contracts (Generally, contracts over \$50,000):**
- (a) **Notice to Cure:** In the presence of any of the above conditions the Architect may give the Contractor and its Surety written Notice to Cure the condition within a reasonable, stated time, but not less than ten days after the Contractor receives the notice.
 - (b) **Notice of Termination:** If, at the expiration of the time stated in the Notice to Cure, the Contractor has not proceeded and satisfactorily continued to cure the condition or provided the Architect with written verification that satisfactory positive action is in process to cure the condition, the Owner may, without prejudice to any other rights or remedies of the Owner, give the Contractor and its Surety written notice declaring the Contractor to be in default under the Contract and stating that the Contractor's right to complete the Work, or a designated portion of the Work, shall terminate seven days after the Contractor's receipt of the written Notice of Termination.
 - (c) If the Contractor satisfies a Notice to Cure, but the condition for which the notice was first given reoccurs, the Owner may give the Contractor a Notice of Termination without giving the Contractor another Notice to Cure.
 - (d) **Demand on the Performance Bond:** With the Notice of Termination the Owner shall give the Surety a written demand that, upon the effective date of the Notice of Termination, the Surety promptly fulfill its obligation to take charge of and complete the Work in accordance with the terms of the Performance Bond.
 - (e) **Surety Claims:** Upon receiving the Owner's demand on the Performance Bond, the Surety shall assume all rights and obligations of the Contractor under the Contract. However, the Surety shall also have the right to assert "Surety Claims" to the Owner, which are defined as claims relating to acts or omissions of the Owner or Architect prior to termination of the Contractor which may have prejudiced its rights as Surety or its interest in the unpaid balance of the Contract Sum. If the Surety wishes to assert a Surety Claim, it shall give the Owner, through the Architect, written notice within twenty-one days after first recognizing the condition giving rise to the Surety Claim. The Surety Claim shall then be submitted to the Owner, through the Architect, no later than sixty days after giving notice thereof, but no such Surety Claims shall be considered if submitted after the date upon which final payment becomes due. Final resolution of Surety Claims shall be pursuant to Article 24, Resolution of

Claims and Disputes. The presence or possibility of a Surety Claim shall not be just cause for the Surety to fail or refuse to take charge of and complete the Work or for the Owner to fail or refuse to continue to make payments in accordance with the Contract Documents.

(f) Payments to Surety: The Surety shall be paid for completing the Work in accordance with the Contract Documents as if the Surety were the Contractor. The Owner shall have the right to deduct from payments to the Surety any reasonable costs incurred by the Owner, including compensation for additional architectural, engineering, managerial, and administrative services, and attorneys' fees as necessitated by termination of the Contractor and completion of the Work by the Surety. No further payments shall be made to the Contractor by the Owner. The Surety shall be solely responsible for any accounting to the Contractor for the portion of the Contract Sum paid to Surety by Owner or for the costs and expenses of completing the Work.

(4) Wrongful Termination: If any notice of termination by the Owner for cause, made in good faith, is determined to have been wrongly given, such termination shall be effective and compensation therefore determined as if it had been a termination for convenience pursuant to Paragraph B below.

B. TERMINATION by the OWNER for CONVENIENCE

(1) The Owner may, without cause and at any time, terminate the performance of Work under the Contract in whole, or in part, upon determination by the Owner that such termination is in the Owner's best interest. Such termination is referred to herein as Termination for Convenience.

(2) Upon receipt of a written notice of Termination for Convenience from the Owner, the Contractor shall:

- (a)** stop Work as specified in the notice;
- (b)** enter into no further subcontracts or purchase orders for materials, services, or facilities, except as may be necessary for Work directed to be performed prior to the effective date of the termination or to complete Work that is not terminated;
- (c)** terminate all existing subcontracts and purchase orders to the extent they relate to the terminated Work;
- (d)** take such actions as are necessary, or directed by the Architect or Owner, to protect, preserve, and make safe the terminated Work; and
- (e)** complete performance of the Work that is not terminated.

(3) In the event of Termination for Convenience, the Contractor shall be entitled to receive payment for the Work performed prior to its termination, including materials and equipment purchased and delivered for incorporation into the terminated Work, and any reasonable costs incurred because of the termination. Such payment shall include reasonable mark-up of costs for overhead and profit, not to exceed the limits stated in Article 19, Changes in the Work. The Contractor shall be entitled to receive payment for reasonable anticipated overhead ("home office") and shall not be entitled to receive payment for any profits anticipated to have been gained from the terminated Work. A proposal for decreasing the Contract Sum shall be submitted to the Architect by the Contractor in such time and detail, and with such supporting documentation, as is reasonably directed by the Owner. Final modification of the Contract shall be by Contract Change Order pursuant to Article 19. Any Claim or Dispute involving the termination or any amount due a party as a result shall be resolved pursuant to Article 24.

ARTICLE 28
CONTRACTOR'S RIGHT to SUSPEND or TERMINATE the CONTRACT

A. SUSPENSION by the OWNER

If all of the Work is suspended or delayed for the Owner's convenience or under an order of any court, or other public authority, for a period of sixty days, through no act or fault of the Contractor or a Subcontractor, or anyone for whose acts they may be liable, then the Contractor may give the Owner a written Notice of Termination which allows the Owner fourteen days after receiving the Notice in which to give the Contractor appropriate written authorization to resume the Work. Absent the Contractor's receipt of such authorization to resume the Work, the Contract shall terminate upon expiration of this fourteen day period and the Contractor will be compensated by the Owner as if the termination had been for the Owner's convenience pursuant to Article 27.B.

B. NONPAYMENT

The Owner's failure to pay the undisputed amount of an Application for Payment within sixty days after receiving it from the Architect (Certified pursuant to Article 30) shall be just cause for the Contractor to give the Owner fourteen days' written notice that the Work will be suspended pending receipt of payment but that the Contract shall terminate if payment is not received within fourteen days (or a longer period stated by the Contractor) of the expiration of the fourteen day notice period.

(1) If the Work is then suspended for nonpayment, but resumed upon receipt of payment, the Contractor will be entitled to compensation as if the suspension had been by the Owner pursuant to Article 26, Paragraph B.

(2) If the Contract is then terminated for nonpayment, the Contractor will be entitled to compensation as if the termination had been by the Owner pursuant to Article 27, Paragraph B.

ARTICLE 29
PROGRESS PAYMENTS

A. FREQUENCY of PROGRESS PAYMENTS

Unless otherwise provided in the Contract Documents, the Owner will make payments to the Contractor as the Work progresses based on monthly estimates prepared and certified by the Contractor, approved and certified by the Architect, and approved by the Owner and other authorities whose approval is required.

B. SCHEDULE of VALUES

Within ten days after receiving the Notice to Proceed the Contractor shall submit to the Architect a Schedule of Values, which is a breakdown of the Contract Sum showing the value of the various parts of the Work for billing purposes. The Schedule of Values shall be prepared on 8 1/2" x 11"

paper in a format that is acceptable to the Architect and Owner and shall divide the Contract Sum into as many parts ("line items") as the Architect and Owner determine necessary to permit evaluation and to show amounts attributable to Subcontractors. The Contractor's overhead and profit are to be proportionately distributed throughout the line items of the Schedule of Values. Upon approval, the Schedule of Values shall be used as a basis for monthly Applications for Payment, unless it is later found to be in error. Approved change order amounts shall be added to or incorporated into the Schedule of Values as mutually agreed by the Contractor and Architect.

C. APPLICATIONS for PAYMENTS

(1) Based on the approved Schedule of Values, each monthly Application for Payment shall show the Contractor's estimate of the value of Work performed in each line item as of the end of the billing period. The Contractor's cost of materials and equipment not yet incorporated into the Work, but delivered and suitably stored on the site, may be considered in monthly Applications for Payment.

(2) The Contractor's estimate of the value of Work performed and stored materials must represent such reasonableness as to warrant certification by the Architect to the Owner in accordance with Article 30. Each monthly Application for Payment shall be supported by such data as will substantiate the Contractor's right to payment, including without limitation copies of requisitions from subcontractors and material suppliers.

(3) If no other date is stated in the Contract Documents or agreed upon by the parties, each monthly Application for Payment shall be submitted to the Architect on or about the first day of each month and payment shall be issued to the Contractor within thirty days after an Application for Payment is Certified pursuant to Article 30 and delivered to the Owner

D. MATERIALS STORED OFF SITE

Unless otherwise provided in the Contract Documents, the Contractor's cost of materials and equipment to be incorporated into the Work, which are stored off the site, may also be considered in monthly Applications for Payment under the following conditions:

- (1) the contractor has received written approval from the Architect and Owner to store the materials or equipment off site in advance of delivering the materials to the off site location;
- (2) a Certificate of Insurance is furnished to the Architect evidencing that a special insurance policy, or rider to an existing policy, has been obtained by the Contractor providing all-risk property insurance coverage, specifically naming the materials or equipment stored, and naming the Owner as an additionally insured party;
- (3) the Architect is provided with a detailed inventory of the stored materials or equipment and the materials or equipment are clearly marked in correlation to the inventory to facilitate inspection and verification of the presence of the materials or equipment by the Architect or Owner;
- (4) the materials or equipment are properly and safely stored in a bonded warehouse, or a facility otherwise approved in advance by the Architect and Owner; and
- (5) 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.

E. RETAINAGE

(1) "Retainage" is defined as the money earned and, therefore, belonging to the Contractor (subject to final settlement of the Contract) which has been retained by the Owner conditioned on final completion and acceptance of all Work required by the Contract Documents. Retainage shall not be relied upon by Contractor (or Surety) to cover or off-set unearned monies attributable to uncompleted or uncorrected Work.

(2) In making progress payments the Owner shall retain five percent of the estimated value of Work performed and the value of the materials stored for the Work; but after retainage has been held upon fifty percent of the Contract Sum, no additional retainage will be withheld.

F. CONTRACTOR'S CERTIFICATION

(1) Each Application for Payment shall bear the Contractor's notarized certification that, to the best of the Contractor's knowledge, information, and belief, the Work covered by the Application for Payment has been completed in accordance with the Contract Documents, that all amounts have been paid by the Contractor for Work for which previous Certificates for Payments were issued and payments received from the Owner and that the current payment shown in the Application for Payment has not yet been received.

(2) By making this certification the Contractor represents to the Architect and Owner that, upon receipt of previous progress payments from the Owner, the Contractor has promptly paid each Subcontractor, in accordance with the terms of its agreement with the Subcontractor, the amount due the Subcontractor from the amount included in the progress payment on account of the Subcontractor's Work and stored materials. The Architect and Owner may advise Subcontractors and suppliers regarding percentages of completion or amounts requested and/or approved in an Application for Payment on account of the Subcontractor's Work and stored materials.

G. PAYMENT ESTABLISHES OWNERSHIP

All material and Work covered by progress payments shall become the sole property of the Owner, but the Contractor shall not be relieved from the sole responsibility for the care and protection of material and Work upon which payments have been made and for the restoration of any damaged material and Work.

ARTICLE 30
CERTIFICATION and APPROVALS for PAYMENT

- A. The Architect's review, approval, and certification of Applications for Payment shall be based on the Architect's general knowledge of the Work obtained through site visits and the information provided by the Contractor with the Application. The Architect shall not be required to perform exhaustive examinations, evaluations, or estimates of the cost of completed or uncompleted Work or stored materials to verify the accuracy of amounts requested by the Contractor, but the Architect shall have the authority to adjust the Contractor's estimate when, in the Architect's reasonable opinion, such estimates are overstated or understated.
- B. Within seven days after receiving the Contractor's monthly Application for Payment, or such other time as may be stated in the Contract Documents, the Architect will take one of the following

actions:

- (1) The Architect will approve and certify the Application as submitted and forward it as a Certification for Payment for approval by the Owner (and other approving authorities, if any) and payment.
 - (2) If the Architect takes exception to any amounts claimed by the Contractor and the Contractor and Architect cannot agree on revised amounts, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to certify to the Owner, transmitting a copy of same to the Contractor.
 - (3) To the extent the Architect determines may be necessary to protect the Owner from loss on account of any of the causes stated in Article 31, the Architect may subtract from the Contractor's estimates and will issue a Certificate for Payment to the Owner, with a copy to the Contractor, for such amount as the Architect determines is properly due and notify the Contractor and Owner in writing of the Architect's reasons for withholding payment in whole or in part.
- C. Neither the Architect's issuance of a Certificate for Payment nor the Owner's resulting progress payment shall be a representation to the Contractor that the Work in progress or completed at that time is accepted or deemed to be in conformance with the Contract Documents.
- D. The Architect shall not be required to determine that the Contractor has promptly or fully paid Subcontractors and suppliers or how or for what purpose the Contractor has used monies paid under the Construction Contract. However, the Architect may, upon request and if practical, inform any Subcontractor or supplier of the amount, or percentage of completion, approved or paid to the Contractor on account of the materials supplied or the Work performed by the Subcontractor.

ARTICLE 31 **PAYMENTS WITHHELD**

- A. The Architect may nullify or revise a previously issued Certificate for Payment prior to Owner's payment thereunder to the extent as may be necessary in the Architect's opinion to protect the Owner from loss on account of any of the following causes not discovered or fully accounted for at the time of the certification or approval of the Application for Payment:
- (1) Defective Work;
 - (2) filed, or reasonable evidence indicating probable filing of, claims arising out of the Contract by other parties against the Contractor;
 - (3) the Contractor's failure to pay for labor, materials or equipment or to pay Subcontractors;
 - (4) reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
 - (5) damage suffered by the Owner or another contractor caused by the Contractor, a Subcontractor, or anyone for whose acts they may be liable;
 - (6) reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance is insufficient to cover applicable liquidated damages; or
 - (7) the Contractor's persistent failure to conform to the requirements of the Contract Documents.
- B. If the Owner deems it necessary to withhold payment pursuant to preceding Paragraph A, the Owner will notify the Contractor and Architect in writing of the amount to be withheld and the

reason for same.

- C. The Architect shall not be required to withhold payment for completed or partially completed Work for which compliance with the Contract Documents remains to be determined by Specified Inspections or Final Inspections to be performed in their proper sequence. However, if Work for which payment has been approved, certified, or made under an Application for Payment is subsequently determined to be Defective Work, the Architect shall determine an appropriate amount that will protect the Owner's interest against the Defective Work.
- (1) If payment has not been made against the Application for Payment first including the Defective Work, the Architect will notify the Owner and Contractor of the amount to be withheld from the payment until the Defective Work is brought into compliance with the Contract Documents.
- (2) If payment has been made against the Application for Payment first including the Defective Work, the Architect will withhold the appropriate amount from the next Application for Payment submitted after the determination of noncompliance, such amount to then be withheld until the Defective Work is brought into compliance with the Contract Documents.
- D. The amount withheld will be paid with the next Application for Payment certified and approved after the condition for which the Owner has withheld payment is removed or otherwise resolved to the Owner's satisfaction.
- E. The Owner shall have the right to withhold from payments due the Contractor under this Contract an amount equal to any amount which the Contractor owes the Owner under another contract.

ARTICLE 32

SUBSTANTIAL COMPLETION

- A. Substantial Completion is the stage in the progress of the Work when the Work or designated portion of the Work is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use without disruption or interference by the Contractor in completing or correcting any remaining unfinished Work ("punch list" items). Substantial Completion of the Work, or a designated portion of the Work, is not achieved until so agreed in a Certificate of Substantial Completion signed by the Contractor, Architect, Owner, and Technical Staff of the Alabama Building Commission.
- B. The Contractor shall notify the Architect in writing when it considers the Work, or a portion of the Work which the Owner has agreed to accept separately, to be substantially complete and ready for a Final Inspection pursuant to Article 16. In this notification the Contractor shall identify any items remaining to be completed or corrected for Final Acceptance prior to final payment.
- C. Substantial Completion is achieved and a Final Inspection is appropriate only when a minimal number of punch list items exists and only a short period of time will be required to correct or complete them. Upon receipt of the Contractor's notice for a Final Inspection, the Architect will advise the Contractor in writing of any conditions of the Work which the Architect or Owner is aware do not constitute Substantial Completion, otherwise, a Final Inspection will proceed within a reasonable time after the Contractor's notice is given. However, the Architect will not be required

to prepare lengthy listings of punch list items; therefore, if the Final Inspection discloses that Substantial Completion has not been achieved, the Architect may discontinue or suspend the inspection until the Contractor does achieve Substantial Completion.

D. CERTIFICATE of SUBSTANTIAL COMPLETION

(1) When the Work or a designated portion of the Work is substantially complete, the Architect will prepare and sign a Certificate of Substantial Completion to be signed in order by the Contractor, Owner, and Alabama Building Commission.

(2) When signed by all parties, the Certificate of Substantial Completion shall establish the Date of Substantial Completion which is the date upon which:

- (a) the Work, or designated portion of the Work, is accepted by the Architect, Owner, and Alabama Building Commission as being ready for occupancy,
- (b) the Contractor's one-year and special warranties for the Work covered by the Certificate commence, unless stated otherwise in the Certificate (the one-year warranty for punch list items completed or corrected after the period allowed in the Certificate shall commence on the date of their Final Acceptance) , and
- (c) Owner becomes responsible for building security, maintenance, utility services, and insurance, unless stated otherwise in the Certificate.

(3) The Certificate of Substantial Completion shall set the time within which the Contractor shall finish all items on the "punch list" accompanying the Certificate. The completion of punch list items shall be a condition precedent to Final Payment.

(4) If the Work or designated portion covered by a Certificate of Substantial Completion includes roofing work, the General Contractor's (5-year) Roofing Guarantee, ABC Form C-9, must be executed by the Contractor and attached to the Certificate of Substantial Completion. If the Contract Documents specify any other roofing warranties to be provided by the roofing manufacturer, Subcontractor, or Contractor, they must also be attached to the Certificate of Substantial Completion. The Alabama Building Commission will not sign the Certificate of Substantial Completion in the absence of the roofing guarantees.

E. The Date of Substantial Completion of the Work, as set in the Certificate of Substantial Completion of the Work or of the last completed portion of the Work, establishes the extent to which the Contractor is liable for Liquidated Damages, if any; however, should the Contractor fail to complete all punch list items within thirty days, or such other time as may be stated in the respective Certificate of Substantial Completion, the Contractor shall bear any expenses, including additional Architectural services and expenses, incurred by the Owner as a result of such failure to complete punch list items in a timely manner.

ARTICLE 33
OCCUPANCY or USE PRIOR to COMPLETION

A. UPON SUBSTANTIAL COMPLETION

Prior to completion of the entire Work, the Owner may occupy or begin utilizing any designated portion of the Work on the agreed Date of Substantial Completion of that portion of the Work.

B. BEFORE SUBSTANTIAL COMPLETION

- (1) The Owner shall not occupy or utilize any portion of the Work before Substantial Completion of that portion has been achieved.
- (2) The Owner may deliver furniture and equipment and store, or install it in place ready for occupancy and use, in any designated portion of the Work before it is substantially completed under the following conditions:
 - (a) The Owner's storage or installation of furniture and equipment will not unreasonably disrupt or interfere with the Contractor's completion of the designated portion of the Work.
 - (b) The Contractor consents to the Owner's planned action (such consent shall not be unreasonably withheld).
 - (c) The Owner shall be responsible for insurance coverage of the Owner's furniture and equipment, and the Contractor's liability shall not be increased.
 - (d) The Contractor, Architect, and Owner will jointly inspect and record the condition of the Work in the area before the Owner delivers and stores or installs furniture and equipment; the Owner will equitably compensate the Contractor for making any repairs to the Work that may subsequently be required due to the Owner's delivery and storage or installation of furniture and equipment.
 - (e) The Owner's delivery and storage or installation of furniture and equipment shall not be deemed an acceptance of any Work not completed in accordance with the requirements of the Contract Documents.

**ARTICLE 34
FINAL PAYMENT**

A. PREREQUISITES to FINAL PAYMENT

The following conditions are prerequisites to Final Payment becoming due the Contractor:

- (1) Full execution of a Certificate of Substantial Completion for the Work, or each designated portion of the Work.
- (2) Final Acceptance of the Work.
- (3) The Contractor's completion, to the satisfaction of the Architect and Owner, of all documentary requirements of the Contract Documents; such as delivery of "as-built" documents, operating and maintenance manuals, warranties, etc.
- (4) Delivery to the Owner of a final Application for Payment, prepared by the Contractor and approved and certified by the Architect.
- (5) Completion of an Advertisement for Completion pursuant to Paragraph C below.
- (6) Delivery by the Contractor to the Owner through the Architect of a Release of Claims and such other documents as may be required by Owner, satisfactory in form to the Owner pursuant to Paragraph D below.
- (7) Consent of Surety, if any, to Final Payment to Contractor.
- (8) Delivery by the Contractor to the Architect and Owner of other documents, if any, required by the Contract Documents as prerequisites to Final Payment.

B. FINAL ACCEPTANCE of the WORK

“Final Acceptance of the Work” shall be achieved when all “punch list” items recorded with the Certificate(s) of Substantial Completion are accounted for by either: (1) their completion or correction by the Contractor and acceptance by the Architect, Owner, and BC Project Inspector, or (2) their resolution under Article 18, Deductions for Uncorrected Work.

C. ADVERTISEMENT for COMPLETION

(1) **If the Contract Sum is less than \$50,000:** The Owner, immediately after being notified by the Architect that all other requirements of the Contract have been completed, shall give public notice of completion of the Contract by having an Advertisement for Completion published one time in a newspaper of general circulation, published in the county in which the Owner is located and shall post notice of completion of the Contract on the Owner’s bulletin board for one week, and shall require the Contractor to certify under oath that all bills have been paid in full. Final payment may be made at any time after the notice has been posted for one entire week.

(2) **If the Contract Sum is more than \$50,000:** The Contractor, immediately after being notified by the Architect that all other requirements of the Contract have been completed, shall give public notice of completion of the Contract by having an Advertisement for Completion, similar to the sample contained in the Project Manual, published for a period of four successive weeks in some newspaper of general circulation published within the city or county where the Work was performed. Proof of publication of the Advertisement for Completion, in duplicate, shall be made by the Contractor to the Architect by affidavit of the publisher and a printed copy of the Advertisement for Completion published, in duplicate. If no newspaper is published in the county where the work was done, the notice may be given by posting at the Court House for thirty days and proof of same made by Probate Judge or Sheriff and the Contractor. Final payment shall not be due until thirty days after this public notice is completed.

D. RELEASE of CLAIMS

The Release of Claims and other documents referenced in Paragraph A(6) above are as follows:

(1) A release executed by Contractor of all claims and claims of lien against the Owner arising under and by virtue of the Contract, other than such claims of the Contractor, if any, as may have been previously made in writing and as may be specifically excepted by the Contractor from the operation of the release in stated amounts to be set forth therein.

(2) An affidavit under oath, if required, stating that so far as the Contractor has knowledge or information, there are no claims or claims of lien which have been or will be filed by any Subcontractor, Supplier or other party for labor or material for which a claim or claim of lien could be filed.

(3) A release, if required, of all claims and claims of lien made by any Subcontractor, Supplier or other party against the Owner or unpaid Contract funds held by the Owner arising under or related to the Work on the Project; provided, however, that if any Subcontractor, Supplier or others refuse to furnish a release of such claims or claims of lien, the Contractor may furnish a bond executed by Contractor and its Surety to the Owner to provide an unconditional obligation to defend, indemnify and hold harmless the Owner against any loss, cost or expense, including attorney’s fees, arising

out of or as a result of such claims, or claims of lien, in which event Owner may make Final Payment notwithstanding such claims or claims of lien. If Contractor and Surety fail to fulfill their obligations to Owner under the bond, the Owner shall be entitled to recover damages as a result of such failure, including all costs and reasonable attorney's fees incurred to recover such damages.

E. EFFECT of FINAL PAYMENT

(1) The making of Final Payment shall constitute a waiver of Claims by the Owner except those arising from:

- (a) liens, claims, security interests or encumbrances arising out of the Contract and unsettled;
- (b) failure of the Work to comply with the requirements of the Contract Documents;
- (c) terms of warranties or indemnities required by the Contract Documents, or
- (d) latent defects.

(2) Acceptance of Final Payment by the Contractor shall constitute a waiver of claims by Contractor except those previously made in writing, identified by Contractor as unsettled at the time of final Application for Payment, and specifically excepted from the release provided for in Paragraph D(1), above.

ARTICLE 35
CONTRACTOR'S WARRANTY

A. GENERAL WARRANTY

The Contractor warrants to the Owner and Architect that all materials and equipment furnished under the Contract will be of good quality and new, except such materials as may be expressly provided or allowed in the Contract Documents to be otherwise, and that none of the Work will be Defective Work as defined in Article 1.

B. ONE-YEAR WARRANTY

(1) If, within one year after the date of Substantial Completion of the Work or each designated portion of the Work (or otherwise as agreed upon in a mutually-executed Certificate of Substantial Completion), any of the Work is found to be Defective Work, the Contractor shall promptly upon receipt of written notice from the Owner or Architect, and without expense to either, replace or correct the Defective Work to conform to the requirements of the Contract Documents, and repair all damage to the site, the building and its contents which is the result of Defective Work or its replacement or correction.

(2) The one-year warranty for punch list items shall begin on the Date of Substantial Completion if they are completed or corrected within the time period allowed in the Certificate of Substantial Completion in which they are recorded. The one-year warranty for punch list items that are not completed or corrected within the time period allowed in the Certificate of Substantial Completion, and other Work performed after Substantial Completion, shall begin on the date of Final Acceptance of the Work. The Contractor's correction of Work pursuant to this warranty does not

extend the period of the warranty. The Contractor's one-year warranty does not apply to defects or damages due to improper or insufficient maintenance, improper operation, or wear and tear during normal usage.

(3) Upon recognizing a condition of Defective Work, the Owner shall promptly notify the Contractor of the condition. If the condition is causing damage to the building, its contents, equipment, or site, the Owner shall take reasonable actions to mitigate the damage or its continuation, if practical. If the Contractor fails to proceed promptly to comply with the terms of the warranty, or to provide the Owner with satisfactory written verification that positive action is in process, the Owner may have the Defective Work replaced or corrected and the Contractor and the Contractor's Surety shall be liable for all expense incurred.

(4) **Year-end Inspection(s):** An inspection of the Work, or each separately completed portion thereof, is required near the end of the Contractor's one-year warranty period(s). The subsequent delivery of the Architect's report of a Year-end Inspection will serve as confirmation that the Contractor was notified of Defective Work found within the warranty period.

(5) The Contractor's warranty of one year is in addition to, and not a limitation of, any other remedy stated herein or available to the Owner under applicable law.

C. GENERAL CONTRACTOR'S ROOFING GUARANTEE

(1) In addition to any other roof related warranties or guarantees that may be specified in the Contract Documents, the roof and associated work shall be guaranteed by the General Contractor against leaks and defects of materials and workmanship for a period of five (5) years, starting on the Date of Substantial Completion of the Project as stated in the Certificate of Substantial Completion. This guarantee for punch list items shall begin on the Date of Substantial Completion if they are completed or corrected within the time period allowed in the Certificate of Substantial Completion in which they are recorded. The guarantee for punch list items that are not completed or corrected within the time period allowed in the Certificate of Substantial Completion shall begin on the date of Final Acceptance of the Work.

(2) The "General Contractor's Roofing Guarantee" (ABC Form C-9), included in the Project Manual, shall be executed in triplicate, signed by the appropriate party and submitted to the Architect for submission with the Certificate of Substantial Completion to the Owner and the Building Commission.

(3) This guarantee does not include costs which might be incurred by the General Contractor in making visits to the site requested by the Owner regarding roof problems that are due to lack of proper maintenance (keeping roof drains and/or gutters clear of debris that cause a stoppage of drainage which results in water ponding, overflowing of flashing, etc.), or damages caused by vandalism or misuse of roof areas. Should the contractor be required to return to the job to correct problems of this nature that are determined not to be related to faulty workmanship and materials in the installation of the roof, payment for actions taken by the Contractor in response to such request will be the responsibility of the Owner. A detailed written report shall be made by the General Contractor on each of these 'Service Calls' with copies to the Architect, Owner and Building Commission.

D. SPECIAL WARRANTIES

(1) The Contractor shall deliver to the Owner through the Architect all special or extended warranties required by the Contract Documents from the Contractor, Subcontractors, and suppliers.

(2) The Contractor and the Contractor's Surety shall be liable to the Owner for such special warranties during the Contractor's one-year warranty; thereafter, the Contractor's obligations relative to such special warranties shall be to provide reasonable assistance to the Owner in their enforcement.

E. ASSUMPTION of GUARANTEES of OTHERS

If the Contractor disturbs, alters, or damages any work guaranteed under a separate contract, thereby voiding the guarantee of that work, the Contractor shall restore the work to a condition satisfactory to the Owner and shall also guarantee it to the same extent that it was guaranteed under the separate contract.

**ARTICLE 36
INDEMNIFICATION AGREEMENT**

To the fullest extent permitted by law, the Contractor shall defend, indemnify, and hold harmless the Owner, Architect, Architect's consultants, Alabama Building Commission, State Department of Education (if applicable), and their agents, employees, and consultants (hereinafter collectively referred to as the "Indemnitees") from and against all claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of, related to, 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, including loss of use resulting therefrom, and is caused in whole or in part by negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, regardless of whether such claim, damage, loss or expense is caused in part, or is alleged but not legally established to have been caused in whole or in part by the negligence or other fault of a party indemnified hereunder.

- A. This indemnification shall extend to all claims, damages, losses and expenses for injury or damage to adjacent or neighboring property, or persons injured thereon, that arise out of, relate to, or result from performance of the Work.
- B. This indemnification does not extend to the liability of the Architect, or the Architect's Consultants, agents, or employees, arising out of (1) the preparation or approval of maps, shop drawings, opinions, reports, surveys, field orders, Change Orders, drawings or specifications, or (2) the giving of or the failure to give directions or instructions, provided such giving or failure to give instructions is the primary cause of the injury or damage.
- C. This indemnification does not apply to the extent of the sole negligence of the Indemnitees.

ARTICLE 37
CONTRACTOR'S and SUBCONTRACTORS' INSURANCE

A. GENERAL

(1) **RESPONSIBILITY.** The Contractor shall be responsible to the Owner from the time of the signing of the Construction Contract or from the beginning of the first work, whichever shall be earlier, for all injury or damage of any kind resulting from any negligent act or omission or breach, failure or other default regarding the work by the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, regardless of who may be the owner of the property.

(2) **INSURANCE PROVIDERS.** Each of the insurance coverages required below shall be issued by an insurer licensed by the Insurance Commissioner to transact the business of insurance in the State of Alabama for the applicable line of insurance, and such insurer (or, for qualified self-insureds or group self-insureds, a specific excess insurer providing statutory limits) must have a Best Policyholders Rating of "A-" or better and a financial size rating of Class V or larger.

(3) **NOTIFICATION ENDORSEMENT.** Each policy shall be endorsed to provide that the insurance company agrees that the policy shall not be canceled, changed, allowed to lapse or allowed to expire for any reason until thirty days after the Owner has received written notice by certified mail as evidenced by return receipt or until such time as other insurance coverage providing protection equal to protection called for in the Contract Documents shall have been received, accepted and acknowledged by the Owner. Such notice shall be valid only as to the Project as shall have been designated by Project Name and Number in said notice.

(4) **INSURANCE CERTIFICATES.** The Contractor shall procure the insurance coverages identified below, or as otherwise required in the Contract Documents, at the Contractor's own expense, and to evidence that such insurance coverages are in effect, the Contractor shall furnish the Owner an insurance certificate(s) acceptable to the Owner and listing the Owner as the certificate holder. The insurance certificate(s) must be delivered to the Owner with the Construction Contract and Bonds for final approval and execution of the Construction Contract. The insurance certificate must provide the following:

- (a) Name and address of authorized agent of the insurance company
- (b) Name and address of insured
- (c) Name of insurance company or companies
- (d) Description of policies
- (e) Policy Number(s)
- (f) Policy Period(s)
- (g) Limits of liability
- (h) Name and address of Owner as certificate holder
- (i) Project Name and Number, if any
- (j) Signature of authorized agent of the insurance company
- (k) Telephone number of authorized agent of the insurance company
- (l) Mandatory thirty day notice of cancellation / non-renewal / change

(5) **MAXIMUM DEDUCTIBLE.** Self-insured retention, except for qualified self-insurers or group self-insurers, in any policy shall not exceed \$25,000.00.

B. INSURANCE COVERAGES

Unless otherwise provided in the Contract Documents, the Contractor shall purchase the types of insurance coverages with liability limits not less than as follows:

(1) WORKERS' COMPENSATION and EMPLOYER'S LIABILITY INSURANCE

(a) Workers' Compensation coverage shall be provided in accordance with the statutory coverage required in Alabama. A group insurer must submit a certificate of authority from the Alabama Department of Industrial Relations approving the group insurance plan. A self-insurer must submit a certificate from the Alabama Department of Industrial Relations stating the Contractor qualifies to pay its own workers' compensation claims.

(b) Employer's Liability Insurance limits shall be at least:

- .1 Bodily Injury by Accident - \$1,000,000 each accident
- .2 Bodily Injury by Disease - \$1,000,000 each employee

(2) COMMERCIAL GENERAL LIABILITY INSURANCE

(a) Commercial General Liability Insurance, written on an ISO Occurrence Form (current edition as of the date of Advertisement for Bids) or equivalent, shall include, but need not be limited to, coverage for bodily injury and property damage arising from premises and operations liability, products and completed operations liability, blasting and explosion, collapse of structures, underground damage, personal injury liability and contractual liability. The Commercial General Liability Insurance shall provide at minimum the following limits:

<u>Coverage</u>	<u>Limit</u>
.1 General Aggregate	\$ 2,000,000.00 per Project
.2 Products, Completed Operations Aggregate	\$ 2,000,000.00 per Project
.3 Personal and Advertising Injury	\$ 1,000,000.00 per Occurrence
.4 Each Occurrence	\$ 1,000,000.00

(b) Additional Requirements for Commercial General Liability Insurance:

- .1 The policy shall name the Owner, Architect, Alabama Building Commission, State Department of Education (if applicable), and their agents, consultants and employees as additional insureds, state that this coverage shall be primary insurance for the additional insureds; and contain no exclusions of the additional insureds relative to job accidents.
- .2 The policy must include separate per project aggregate limits.

(3) COMMERCIAL BUSINESS AUTOMOBILE LIABILITY INSURANCE

(a) Commercial Business Automobile Liability Insurance which shall include coverage for bodily injury and property damage arising from the operation of any owned, non-owned or hired automobile. The Commercial Business Automobile Liability Insurance Policy shall provide not less than \$1,000,000 Combined Single Limits for each occurrence.

(b) The policy shall name the Owner, Architect, Alabama Building Commission, State Department of Education (if applicable), and their agents, consultants, and employees as additional insureds.

(4) COMMERCIAL UMBRELLA LIABILITY INSURANCE

(a) Commercial Umbrella Liability Insurance to provide excess coverage above the Commercial General Liability, Commercial Business Automobile Liability and the Workers' Compensation and Employer's Liability to satisfy the minimum limits set forth herein.

(b) Minimum Combined Primary Commercial General Liability and Commercial/Excess Umbrella Limits of:

.1 \$ 5,000,000 per Occurrence

.2 \$ 5,000,000 Aggregate

(c) Additional Requirements for Commercial Umbrella Liability Insurance:

.1 The policy shall name the Owner, Architect, Alabama Building Commission, State Department of Education (if applicable), and their agents, consultants, and employees as additional insureds.

.2 The policy must be on an "occurrence" basis.

(5) BUILDER'S RISK INSURANCE

(a) The Builder's Risk Policy shall be made payable to the Owner and Contractor, as their interests may appear. The policy amount shall be equal to 100% of the Contract Sum, written on a Causes of Loss - Special Form (current edition as of the date of Advertisement for Bids), or its equivalent. All deductibles shall be the sole responsibility of the Contractor.

(b) The policy shall be endorsed as follows:

"The following may occur without diminishing, changing, altering or otherwise affecting the coverage and protection afforded the insured under this policy:

(i) Furniture and equipment may be delivered to the insured premises and installed in place ready for use; or

(ii) Partial or complete occupancy by Owner; or

(iii) Performance of work in connection with construction operations insured by the Owner, by agents or lessees or other contractors of the Owner, or by contractors of the lessee of the Owner."

C. SUBCONTRACTORS' INSURANCE

(1) WORKERS' COMPENSATION and EMPLOYER'S LIABILITY INSURANCE. The Contractor shall require each Subcontractor to obtain and maintain Workers' Compensation and Employer's Liability Insurance coverages as described in preceding Paragraph B, or to be covered by the Contractor's Workers' Compensation and Employer's Liability Insurance while performing Work under the Contract.

(2) LIABILITY INSURANCE. The Contractor shall require each Subcontractor to obtain and maintain adequate General Liability, Automobile Liability, and Umbrella Liability Insurance coverages similar to those described in preceding Paragraph B. Such coverage shall be in effect at all times that a Subcontractor is performing Work under the Contract.

(3) ENFORCEMENT RESPONSIBILITY. The Contractor shall have responsibility to enforce its Subcontractors' compliance with these or similar insurance requirements; however, the Contractor shall, upon request, provide the Architect or Owner acceptable evidence of insurance for any Subcontractor.

D. TERMINATION of OBLIGATION to INSURE

Unless otherwise expressly provided in the Contract Documents, the obligation to insure as provided herein shall continue as follows:

(1) BUILDER'S RISK INSURANCE. The obligation to insure under Subparagraph B(5) shall remain in effect until the Date of Substantial Completion as shall be established in the Certificate of Substantial Completion. In the event that multiple Certificates of Substantial Completion covering designated portions of the Work are issued, Builder's Risk coverage shall remain in effect until the Date of Substantial Completion as shall be established in the last issued Certificate of Substantial Completion. However, in the case that the Work involves separate buildings, Builder's Risk coverage of each separate building may terminate on the Date of Substantial Completion as established in the Certificate of Substantial Completion issued for each building.

(2) PRODUCTS and COMPLETED OPERATIONS. The obligation to carry Products and Completed Operations coverage specified under Subparagraph B(2) shall remain in effect for two years after the Date(s) of Substantial Completion.

(3) ALL OTHER INSURANCE. The obligation to carry other insurance coverages specified under Subparagraphs B(1) through B(4) and Paragraph C shall remain in effect after the Date(s) of Substantial Completion until such time as all Work required by the Contract Documents is completed. Equal or similar insurance coverages shall remain in effect if, after completion of the Work, the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, returns to the Project to perform warranty or maintenance work pursuant to the terms of the Contract Documents.

E. WAIVERS of SUBROGATION

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, and (2) the Architect, Architect's consultants, separate contractors performing construction or operations related to the Project, if any, and any of their subcontractors, sub-subcontractors, agents and employees, for damages caused by fire or other causes of loss to the extent covered by builder's risk insurance or other property insurance applicable to the Work or to other property located within or adjacent to the Project, except such rights as they may have to proceeds of such insurance held by the Owner or Contractor as fiduciary. The Owner or Contractor, as appropriate, shall require of the Architect, Architect's consultants, separate contractors, if any, and the subcontractor, sub-subcontractors, suppliers, agents and employees of any of them, by appropriate agreements, written where legally required for validity, similar waivers each in favor of other parties enumerated herein. The Policies shall provide such waivers of subrogation by endorsement or otherwise. A waiver of subrogation shall be effective as to the person or entity even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, did not pay the insurance premium directly or indirectly, and whether or not the person or entity had an insurable interest in the property damaged. The waivers provided for in this paragraph shall survive final acceptance and continue to apply to insured losses to the Work or other property on or adjacent to the Project.

ARTICLE 38
PERFORMANCE and PAYMENT BONDS

A. GENERAL

Upon signing and returning the Construction Contract to the Owner for final approval and execution, the Contractor shall, at the Contractor's expense, furnish to the Owner a Performance Bond and a Payment Bond, each in a penal sum equal to 100% of the Contract Sum. Each bond shall be on the form contained in the Project Manual, shall be executed by a surety company (Surety) acceptable to the Owner and duly authorized and qualified to make such bonds in the State of Alabama in the required amounts, shall be countersigned by an authorized, Alabama resident agent of the Surety who is qualified to execute such instruments, and shall have attached thereto a power of attorney of the signing official.

The provisions of this Article are not applicable to this Contract if the Contract Sum is less than \$50,000, unless bonds are required for this Contract in the Supplemental General Conditions.

B. PERFORMANCE BOND

Through the Performance Bond, the Surety's obligation to the Owner shall be to assure the prompt and faithful performance of the Contract and Contract Change Orders. The Penal Sum shall remain equal to the Contract Sum as the Contract Sum is adjusted by Contract Change Orders. In case of default on the part of the Contractor, the Surety shall take charge of and complete the Work in accordance with the terms of the Performance Bond. Any reasonable expenses incurred by the Owner as a result of default on the part of the Contractor, including architectural, engineering, administrative, and legal services, shall be recoverable under the Performance Bond.

C. PAYMENT BOND

Through the Payment Bond the Surety's obligation to the Owner shall be to guarantee that the Contractor and its Subcontractors shall promptly make payment to all persons supplying labor, materials, or supplies for, or in, the prosecution of the Work, including the payment of reasonable attorneys fees incurred by successful claimants or plaintiffs in civil actions on the Bond. Any person or entity indicating that they have a claim of nonpayment under the Bond shall, upon written request, be promptly furnished a certified copy of the Bond and Construction Contract by the Contractor, Architect, Owner, or Alabama Building Commission, whomever is recipient of the request.

D. CHANGE ORDERS

The Penal Sum shall remain equal to the Contract Sum as the Contract Sum is adjusted by Contract Change Orders. All Contract Change Orders involving an increase in the Contract Sum will require consent of Surety by endorsement of the Contract Change Order form. The Surety waives notification of any Contract Change Orders involving only extension of the Contract Time.

E. EXPIRATION

The obligations of the Contractor's performance bond surety shall be coextensive with the contractor's performance obligations under the Contract Documents; provided, however, that the surety's obligation shall expire at the end of the one-year warranty period(s) of Article 35.

ARTICLE 39 **ASSIGNMENT**

The Contractor shall not assign the Contract or sublet it as a whole nor assign any moneys due or to become due to the Contractor thereunder without the previous written consent of the Owner (and of the Surety, in the case of a bonded Construction Contract). As prescribed by the Public Works Law, the Contract shall in no event be assigned to an unsuccessful bidder for the Contract whose bid was rejected because the bidder was not a responsible or responsive bidder.

ARTICLE 40 **CONSTRUCTION by OWNER or SEPARATE CONTRACTORS**

A. OWNER'S RESERVATION of RIGHT

(1) The Owner reserves the right to self-perform, or to award separate contracts for, other portions of the Project and other Project related construction and operations on the site. The contractual conditions of such separate contracts shall be substantially similar to those of this Contract, including insurance requirements and the provisions of this Article. If the Contractor considers such actions to involve delay or additional cost under this Contract, notifications and assertion of claims shall be as provided in Article 20 and Article 23.

(2) When separate contracts are awarded, the term "Contractor" in the separate Contract Documents shall mean the Contractor who executes the respective Construction Contract.

B. COORDINATION

Unless otherwise provided in the Contract Documents, the Owner shall be responsible for coordinating the activities of the Owner's forces and separate contractors with the Work of the Contractor. The Contractor shall cooperate with the Owner and separate contractors, shall participate in reviewing and comparing their construction schedules relative to that of the Contractor when directed to do so, and shall make and adhere to any revisions to the construction schedule resulting from a joint review and mutual agreement.

C. CONDITIONS APPLICABLE to WORK PERFORMED by OWNER

Unless otherwise provided in the Contract Documents, when the Owner self-performs construction or operations related to the Project, the Owner shall be subject to the same obligations to Contractor as Contractor would have to a separate contractor under the provision of this Article 40.

D. MUTUAL RESPONSIBILITY

(1) The Contractor shall reasonably accommodate the required introduction and storage of materials and equipment and performance of activities by the Owner and separate contractors and shall connect and coordinate the Contractor's Work with theirs as required by the Contract Documents.

(2) By proceeding with an element or portion of the Work that is applied to or performed on

construction by the Owner or a separate contractor, or which relies upon their operations, the Contractor accepts the condition of such construction or operations as being suitable for the Contractor's Work, except for conditions that are not reasonably discoverable by the Contractor. If the Contractor discovers any condition in such construction or operations that is not suitable for the proper performance of the Work, the Contractor shall not proceed, but shall instead promptly notify the Architect in writing of the condition discovered.

(3) The Contractor shall reimburse the Owner for any costs incurred by a separate contractor and payable by the Owner because of acts or omissions of the Contractor. Likewise, the Owner shall be responsible to the Contractor for any costs incurred by the Contractor because of the acts or omissions of a separate contractor.

(4) The Contractor shall not cut or otherwise alter construction by the Owner or a separate contractor without the written consent of the Owner and separate contractor; such consent shall not be unreasonably withheld. Likewise, the Contractor shall not unreasonably withhold its consent allowing the Owner or a separate contractor to cut or otherwise alter the Work.

(5) The Contractor shall promptly remedy any damage caused by the Contractor to the construction or property of the Owner or separate contractors.

ARTICLE 41 **SUBCONTRACTS**

A. AWARD of SUBCONTRACTS and OTHER CONTRACTS for PORTIONS of the WORK

(1) Unless otherwise provided in the Contract Documents, when delivering the executed Construction Contract, bonds, and evidence of insurance to the Architect, the Contractor shall also submit a listing of Subcontractors proposed for each principal portion of the Work and fabricators or suppliers proposed for furnishing materials or equipment fabricated to the design of the Contract Documents. This listing shall be in addition to any naming of Subcontractors, fabricators, or suppliers that may have been required in the bid process. The Architect will promptly reply to the Contractor in writing stating whether or not the Owner, after due investigation, has reasonable objection to any Subcontractor, fabricator, or supplier proposed by the Contractor. The issuance of the Notice to Proceed in the absence of such objection by the Owner shall constitute notice that no reasonable objection to them is made.

(2) The Contractor shall not contract with a proposed Subcontractor, fabricator, or supplier to whom the Owner has made reasonable and timely objection. Except in accordance with prequalification procedures as may be contained in the Contract Documents, through specified qualifications, or on the grounds of reasonable objection, the Owner may not restrict the Contractor's selection of Subcontractors, fabricators, or suppliers.

(3) Upon the Owner's reasonable objection to a proposed Subcontractor, fabricator, or supplier, the Contractor shall promptly propose another to whom the Owner has no reasonable objection. If the proposed Subcontractor, fabricator, or supplier to whom the Owner made reasonable objection was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be equitably adjusted by Contract Change Order for any resulting difference if the Contractor has acted promptly and responsively in this procedure.

(4) The Contractor shall not change previously selected Subcontractors, fabricators, or suppliers without notifying the Architect and Owner in writing of proposed substitute Subcontractors, fabricators, or suppliers. If the Owner does not make a reasonable objection to a proposed substitute within three working days, the substitute shall be deemed approved.

B. SUBCONTRACTUAL RELATIONS

(1) The Contractor agrees to bind every Subcontractor and material supplier (and require every Subcontractor to so bind its subcontractors and material suppliers) to all the provisions of the Contract Documents as they apply to the Subcontractor's and material supplier's portion of the Work.

(2) Nothing contained in the Contract Documents shall be construed as creating any contractual relationship between any Subcontractor and the Owner, nor to create a duty of the Architect, Owner, or Director to resolve disputes between or among the Contractor or its Subcontractors and suppliers or any other duty to such Subcontractors or suppliers.

ARTICLE 42
ARCHITECT'S STATUS

- A. The Architect is an independent contractor performing, with respect to this Contract, pursuant to an agreement executed between the Owner and the Architect. The Architect has prepared the Drawings and Specifications and assembled the Contract Document and is, therefore, charged with their interpretation and clarification as described in the Contract Documents. As a representative of the Owner, the Architect will endeavor to guard the Owner against variances from the requirements of the Contract Documents by the Contractor. On behalf of the Owner, the Architect will administer the Contract as described in the Contract Documents during construction and the Contractor's one-year warranty.
- B. So as to maintain continuity in administration of the Contract and performance of the Work, and to facilitate complete documentation of the project record, all communications between the Contractor and Owner regarding matters of or related to the Contract shall be directed through the Architect, unless direct communication is otherwise required to provide a legal notification. Unless otherwise authorized by the Architect, communications by and with the Architect's consultants shall be through the Architect. Unless otherwise authorized by the Contractor, communications by and with Subcontractors and material suppliers shall be through the Contractor.

C. ARCHITECT'S AUTHORITY

Subject to other provisions of the Contract Documents, the following summarizes some of the authority vested in the Architect by the Owner with respect to the Construction Contract and as further described or conditioned in other Articles of these General Conditions of the Contract.

- (1) **The Architect is authorized to:**
- (a) approve "minor" deviations as defined in Article 9, Submittals,
 - (b) make "minor" changes in the Work as defined in Article 19, Changes in the Work,
 - (c) reject or require the correction of Defective Work,
 - (d) require the Contractor to stop the performance of Defective Work,
 - (e) adjust an Application for Payment by the Contractor pursuant to Article 30, Certification and Approval of payments, and

(f) issue Notices to Cure pursuant to Article 27.

(2) The Architect is not authorized to:

- (a) revoke, alter, relax, or waive any requirements of the Contract Documents (other than "minor" deviations and changes) without concurrence of the Owner,
- (b) finally approve or accept any portion of the Work without concurrence of the Owner,
- (c) issue instructions contrary to the Contract Documents,
- (d) issue Notice of Termination or otherwise terminate the Contract, or
- (e) require the Contractor to stop the Work except only to avoid the performance of Defective Work.

D. LIMITATIONS of RESPONSIBILITIES

(1) The Architect shall not be responsible to Contractors or to others for supervising or coordinating the performance of the Work or for the Construction Methods or safety of the Work, unless the Contract Documents give other specific instructions concerning these matters.

(2) The Architect will not be responsible to the Contractor (nor the Owner) for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents or for acts or omissions of the Contractor, a Subcontractor, or anyone for whose acts they may be liable. However, the Architect will report to the Owner and Contractor any Defective Work recognized by the Architect.

(3) The Architect will endeavor to secure faithful performance by Owner and Contractor, and the Architect will not show partiality to either or be liable to either for results of interpretations or decisions rendered in good faith.

(4) The Contractor's remedies for additional time or expense arising out of or related to this Contract, or the breach thereof, shall be solely as provided for in the Contract Documents. The Contractor shall have no claim or cause of action against the Owner, Architect, or its consultants for any actions or failures to act, whether such claim may be in contract, tort, strict liability, or otherwise, it being the agreement of the parties that the Contractor shall make no claim against the Owner or any agents of the Owner, including the Architect or its consultants, except as may be provided for claims or disputes submitted in accordance with Article 24. The Architect and Architect's consultants shall be considered third party beneficiaries of this provision of the Contract and entitled to enforce same.

E. ARCHITECT'S DECISIONS

Decisions by the Architect shall be in writing. The Architect's decisions on matters relating to aesthetic effect will be final and binding if consistent with the intent expressed in the Contract Documents. The Architect's decisions regarding disputes arising between the Contractor and Owner shall be advisory.

**ARTICLE 43
CASH ALLOWANCES**

- A. All allowances stated in the Contract Documents shall be included in the Contract Sum. Items covered by allowances shall be supplied by the Contractor as directed by the Architect or Owner

and the Contractor shall afford the Owner the economy of obtaining competitive pricing from responsible bidders for allowance items unless other purchasing procedures are specified in the Contract Documents.

- B.** Unless otherwise provided in the Contract Documents:
- (1) allowances shall cover the cost to the Contractor of materials and equipment delivered to the Project site and all applicable taxes, less applicable trade discounts;
 - (2) the Contractor's costs for unloading, storing, protecting, and handling at the site, labor, installation, overhead, profit and other expenses related to materials or equipment covered by an allowance shall be included in the Contract Sum but not in the allowances;
 - (3) if required, the Contract Sum shall be adjusted by Change Order to reflect the actual costs of an allowance.
- C.** Any selections of materials or equipment required of the Architect or Owner under an allowance shall be made in sufficient time to avoid delay of the Work.

ARTICLE 44 **PERMITS, LAWS, and REGULATIONS**

A. PERMITS, FEES AND NOTICES

- (1) Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit and other permits and governmental fees, licenses, and inspections necessary for proper execution and completion of the Work which are customarily secured after award of the Construction Contract and which are in effect on the date of receipt of bids.
- (2) The Contractor shall comply with and give notices required by all laws, ordinances, rules, regulations, and lawful orders of public authorities applicable to performance of the Work.

B. TAXES

Unless stated otherwise in the Contract Documents, materials incorporated into the Work are exempt from sales and use tax pursuant to Section 40-9-33, Code of Alabama, 1975 as amended. The Contractor and its subcontractors shall be responsible for complying with rules and regulations of the Sales, Use, & Business Tax Division of the Alabama Department of Revenue regarding certificates and other qualifications necessary to claim such exemption when making qualifying purchases from vendors. The Contractor shall pay all applicable taxes that are not covered by the exemption of Section 40-9-33 and which are imposed as of the date of receipt of bids, including those imposed as of the date of receipt of bids but scheduled to go into effect after that date.

C. COMPENSATION for INCREASES

The Contractor shall be compensated for additional costs incurred because of increases in tax rates imposed after the date of receipt of bids.

ARTICLE 45 **ROYALTIES, PATENTS, and COPYRIGHTS**

The Contractor shall pay all royalties and license fees. The Contractor shall defend, indemnify and hold harmless the Owner, Architect, Architect's consultants, Alabama Building Commission, State Department of Education (if applicable), and their agents, employees, and consultants from and against all claims, damages, losses and expenses, including but not limited to attorney's fees, arising out of, related to, or resulting from all suits or claims for infringement of any patent rights or copyrights arising out of the inclusion of any patented or copyrighted materials, methods, or systems selected by the Contractor and used during the execution of or incorporated into the Work. This indemnification does not apply to any suits or claims of infringement of any patent rights or copyrights arising out of any patented or copyrighted materials, methods, or systems specified in the Contract Documents. However, if the Contractor has information that a specified material, method, or system is or may constitute an infringement of a patent or copyright, the Contractor shall be responsible for any resulting loss unless such information is promptly furnished to the Architect.

ARTICLE 46
USE of the SITE

- A. The Contractor shall confine its operations at the Project site to areas permitted by the Owner and by law, ordinances, permits and the Contract Documents and shall not unreasonably encumber the site with materials, equipment, employees' vehicles, or debris. The Contractor's operations at the site shall be restricted to the sole purpose of constructing the Work, use of the site as a staging, assembly, or storage area for other business which the Contractor may undertake shall not be permitted.
- B. Unless otherwise provided in the Contract Documents, temporary facilities, such as storage sheds, shops, and offices may be erected on the Project site with the approval of the Architect and Owner. Such temporary buildings and/or utilities shall remain the property of the Contractor, and be removed at the Contractor's expense upon completion of the Work, unless the Owner authorizes their abandonment without removal.

ARTICLE 47
CUTTING and PATCHING

- A. The Contractor shall be responsible for all cutting, fitting, or patching that may be required to execute the Work to the results indicated in the Contract Documents or to make its parts fit together properly.
- B. Any cutting, patching, or excavation by the Contractor shall be supervised and performed in a manner that will not endanger persons nor damage or endanger the Work or any fully or partially completed construction of the Owner or separate contractors.

ARTICLE 48
IN-PROGRESS and FINAL CLEANUP

A. IN-PROGRESS CLEAN-UP

- (1) The Contractor shall at all times during the progress of the Work keep the premises and

surrounding area free from rubbish, scrap materials and debris resulting from the Work. Trash and combustible materials shall not be allowed to accumulate inside buildings or elsewhere on the premises. At no time shall any rubbish be thrown from window openings. Burning of trash and debris on site is not permitted.

(2) The Contractor shall make provisions to minimize and confine dust and debris resulting from construction activities.

B. FINAL CLEAN-UP

(1) Before Substantial Completion or Final Acceptance is achieved, the Contractor shall have removed from the Owner's property all construction equipment, tools, and machinery; temporary structures and/or utilities including the foundations thereof (except such as the Owner permits in writing to remain); rubbish, debris, and waste materials; and all surplus materials, leaving the site clean and true to line and grade, and the Work in a safe and clean condition, ready for use and operation.

(2) In addition to the above, and unless otherwise provided in the Contract Documents, the Contractor shall be responsible for the following special cleaning for all trades as the Work is completed:

(a) **Cleaning of all painted, enameled, stained, or baked enamel work:** Removal of all marks, stains, finger prints and splatters from such surfaces.

(b) **Cleaning of all glass:** Cleaning and removing of all stickers, labels, stains, and paint from all glass, and the washing and polishing of same on interior and exterior.

(c) **Cleaning or polishing of all hardware:** Cleaning and polishing of all hardware.

(d) **Cleaning all tile, floor finish of all kinds:** Removal of all splatters, stains, paint, dirt, and dust, the washing and polishing of all floors as recommended by the manufacturer or required by the Architect.

(e) **Cleaning of all manufactured articles, materials, fixtures, appliances, and equipment:** Removal of all stickers, rust stains, labels, and temporary covers, and cleaning and conditioning of all manufactured articles, material, fixtures, appliances, and electrical, heating, and air conditioning equipment as recommended or directed by the manufacturers, unless otherwise required by the Architect; blowing out or flushing out of all foreign matter from all equipment, piping, tanks, pumps, fans, motors, devices, switches, panels, fixtures, boilers, sanitizing potable water systems; and freeing identification plates on all equipment of excess paint and the polishing thereof.

C. OWNER'S RIGHT to CLEAN-UP

If the Contractor fails to comply with these clean-up requirements and then fails to comply with a written directive by the Architect to clean-up the premises within a specified time, the Architect or Owner may implement appropriate clean-up measures and the cost thereof shall be deducted from any amounts due or to become due the Contractor.

ARTICLE 49 LIQUIDATED DAMAGES

A. Time is the essence of the Contract. Any delay in the completion of the Work required by the

Contract Documents may cause inconvenience to the public and loss and damage to the Owner including but not limited to interest and additional administrative, architectural, inspection and supervision charges. By executing the Construction Contract, the Contractor agrees that the Contract Time is sufficient for the achievement of Substantial Completion.

- B. The Contract Documents may provide in the Construction Contract or elsewhere for a certain dollar amount for which the Contractor and its Surety (if any) will be liable to the Owner as liquidated damages for each calendar day after expiration of the Contract Time that the Contractor fails to achieve Substantial Completion of the Work. If such daily liquidated damages are provided for, Owner and Contractor, and its Surety, agree that such amount is reasonable and agree to be bound thereby.
- C. If a daily liquidated damage amount is not otherwise provided for in the Contract Documents, a time charge equal to six percent interest per annum on the total Contract Sum may be made against the Contractor for the entire period after expiration of the Contract Time that the Contractor fails to achieve Substantial Completion of the Work.
- D. The amount of liquidated damages due under either paragraph B or C, above, may be deducted by the Owner from the moneys otherwise due the Contractor in the Final Payment, not as a penalty, but as liquidated damages sustained, or the amount may be recovered from Contractor or its Surety. If part of the Work is substantially completed within the Contract Time and part is not, the stated charge for liquidated damages shall be equitably prorated to that portion of the Work that the Contractor fails to substantially complete within the Contract Time. It is mutually understood and agreed between the parties hereto that such amount is reasonable as liquidated damages.

ARTICLE 50

USE of FOREIGN MATERIALS

- A. In the performance of the Work the Contractor agrees to use materials, supplies, and products manufactured, mined, processed or otherwise produced in the United States or its territories, if same are available at reasonable and competitive prices and are not contrary to any sole source specification implemented under the Public Works Law.
- B. In the performance of the Work the Contractor agrees to use steel produced in the United States if the Contract Documents require the use of steel and do not limit its supply to a sole source pursuant to the Public Works Law. If the Owner decides that the procurement of domestic steel products becomes impractical as a result of national emergency, national strike, or other cause, the Owner shall waive this restriction.
- C. If domestic steel or other domestic materials, supplies, and products are not used in accordance with preceding Paragraphs A and B, the Contract Sum shall be reduced by an amount equal to any savings or benefits realized by the Contractor.
- D. This Article applies only to Public Works projects financed entirely by the State of Alabama or any political subdivision of the state.

ARTICLE 51

PROJECT SIGN

(Not required for locally-funded SDE projects.)

If the Contract Sum (as awarded) is \$100,000.00 or more, the Contractor shall furnish and erect a project sign as shown in "Detail of Project Sign" (ABC Form C-15) bound in the Project Manual. The project sign shall be erected in a prominent location selected by the Architect and Owner and shall be maintained in good condition until completion of Work. If the Contract involves Work on multiple sites, only one sign is required, which shall be erected on one of the sites in a location selected by the Architect and Owner.

END of
GENERAL CONDITIONS of the CONTRACT

SUPPLEMENTARY CONDITIONS OF THE CONTRACT

PART 1 GENERAL

1.01 PURPOSE

- A. The changes, deletions and omissions to ABC Form C-8, General Conditions of the Contract, relate to the limited contract period of the project.
 - 1. Article 16 - Inspection of the Work:
 - a. Add Paragraph G: Follow-up observations will be performed by the Architect or Architect's Consultant each time a punchlist is generated to ensure that punchlist items have been corrected. The cost of additional observations required due to incomplete correction of punchlist items will be the responsibility of the Contractor at the rate of \$150.00 per hour, including travel time.
Shop Drawings and/or submittals requiring resubmission to the Architect due to non-compliance with the Contract Documents and /or incompleteness shall be thoroughly reviewed by the Contractor prior to delivery to the Architect for review. The Contractor shall ensure the completeness and compliance of the submittal materials. Cost incurred by the Owner for review of submittals after the second submittal is rejected will be the responsibility of the Contractor at the rate indicated in the paragraph above.
 - b. Add Paragraph H - Punch List Expectations and its subparagraphs to read as follows:
 - H. Punch List Expectations:
The General Contractor is to generate a punch list; this list is to be sent to the Architect. After the Architect receives the General Contractors punch list, the Architect will generate a punch list, which will be distributed appropriately. The Architect will not recheck the punch list until the General Contractor notifies the Architect that all punch items are finished and all Subcontractors affected have signed off on. The General Contractor is responsible for getting the punch lists signed off of and send the signed lists to the Architect.
 - 2. Article 19 - Changes in the work:
 - a. See ABC form C-8 Supplement, dated August 2009 in section 00 50 00 - Construction Documents and Forms.
 - b. Paragraph B (3) (f) - add subparagraph 1 and its subparagraphs to read as follows:
 - 1. The following fees apply to changes in the Work:
 - a. 15 percent overhead and profit on the net cost of own Work;
 - b. 10 percent on the cost of Work done by any subcontractor.
 - c. The Agreement identifies the overhead and profit fees applicable for changes in the Work, whether additions to or deductions from the Work on which the Contract Sum is based and identifies the fees for subcontract work for changes (both additions and deductions in the Work. The Contractor shall apply fees as noted, to the Subcontractor's gross (net plus fee) costs on addition work.
- C. Paragraph D - add subparagraph (8) to read as follows:
 - (8). All deductive Change Orders are to include a minimum 2 percent return for profit and overhead.
- 3. Article 23 - Delays: Paragraph B (2) - delete in its entirety. Time extensions as they relate to weather are outlined in the appendix "WEATHER DELAYS" attached hereto.
- 4. Article 29 - Schedule of Values: Add Article 29 in "Appendix D" attached hereto.
- 5. Article 37 - Insurance(s):
 - a. Replace paragraphs A, B, C, D and their subparagraphs in their entirety with "Appendix B" attached hereto.
 - b. See ABC form C-8, Attachment B, dated October 2012 in section 00 50 00 - Construction Documents and Forms.

6. Article 44 - Permits, Laws, and Regulations,
 - a. Paragraph A – Add subparagraph (1) (a) to read as follows, “Public Works Projects Bidding After October 1, 2014, the General Contractor shall secure and pay for building permit fee required under Administrative Rule 170X-8 of The Alabama Building Commission. See attached Permit Fee Calculation Worksheet.”
 - b. Paragraph A - Add subparagraph (3) to read as follows, "Alabama laws require that, as a condition for the award of a contract by a school board to a business entity or employer with one or more employees working in Alabama, the business entity or employer must provide documentation of enrollment in the E-Verify program. During the performance of the contract, the business entity or employer shall participate in the E-Verify program and shall verify every employee that is required to be verified according to the applicable federal rules and regulations. The contractor's E-Verify Memorandum of Understanding must be included with the bid. If you do not believe these requirements are applicable to your entity, include an explanation justifying such exemption. An entity can obtain the E-Verify Memorandum of Understanding upon completion in the E-Verify enrollment process located at the federal web site www.uscis.gov/everify. The Alabama Department of Homeland Security (<http://immigration.alabama.gov>) has also established an E-Verify employer agent account for any business entity or employer with 25 or fewer employees that will provide a participating business entity or employer with the required documentation of enrollment in the E-Verify program. An Employer Identification Number (EIN), also known as a Federal Tax Identification Number, is required to enroll in E-Verify or to establish an E-Verify employer agent account."
 - c. Paragraph B - Taxes - delete in its entirety. Insert Article 44 - Paragraph B in "Appendix E".
7. Article 49 - Liquidated Damages: Add Article 49 in "Appendix C" attached hereto.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SUPPLEMENT to the GENERAL CONDITIONS of the CONTRACT

1. Article 19 "Changes in the Work", Paragraph B (1) is modified as follows:

(1) **Lump Sum.** By mutual agreement to a lump sum based on or negotiated from an itemized cost proposal from the Contractor. Additions to the Contract Sum shall include the Contractor's direct costs plus a maximum 15% markup for overhead and profit. Where subcontract work is involved the total mark-up for the Contractor and a Subcontractor shall not exceed 25%. ~~No allowance for overhead and profit shall be figured on a change which involves a net credit to the Owner.~~ **Changes which involve a net credit to the Owner shall include credits for overhead and profit on the deducted work. Changes involving a net credit that do not include overhead and profit shall be justified by the Architect, approved by the Owner, and must also be approved by the Director.** For the purposes of this method of determining an adjustment of the Contract Sum, "overhead" shall cover the Contractor's indirect costs of the change, such as the cost of bonds, superintendent and other job office personnel, watchman, job office, job office supplies and expenses, temporary facilities and utilities, and home office expenses.

2. Article 19 "Changes in the Work", Paragraph B (3) (f) is modified as follows:

(3) **Force Account.** By directing the Contractor to proceed with the change in the Work on a "force account" basis under which the Contractor shall be reimbursed for reasonable expenditures incurred by the Contractor and its Subcontractors in performing added Work and the Owner shall receive reasonable credit for any deleted Work. The Contractor shall keep and present, in such form as the Owner may prescribe, an itemized accounting of the cost of the change together with sufficient supporting data. Unless otherwise stated in the directive, the adjustment of the Contract Sum shall be limited to the following:

- (a) costs of labor and supervision, including employee benefits, social security, retirement, unemployment and workers' compensation insurance required by law, agreement, or under Contractor's or Subcontractor's standard personnel policy;
- (b) cost of materials, supplies and equipment, including cost of delivery, whether incorporated or consumed;
- (c) rental cost of machinery and equipment, not to exceed prevailing local rates if contractor-owned;
- (d) costs of premiums for insurance required by the Contract Documents, permit fees, and sales, use or similar taxes related to the change in the Work;
- (e) reasonable credits to the Owner for the value of deleted Work, without Contractor or Subcontractor mark-ups; and
- (f) for additions to the Contract Sum, mark-up of the Contractor's direct costs for overhead and profit not exceeding 15% on Contractor's work nor exceeding 25% for Contractor and Subcontractor on a Subcontractor's work. ~~No allowance for overhead and profit shall be figured on a change which involves a net credit to the Owner.~~ **Changes which involve a net credit to the Owner shall include credits for overhead and profit on the deducted work. Changes involving a net credit that do not include overhead and profit shall be justified by the Architect, approved by**

the Owner, and must also be approved by the Director. For the purposes of this method of determining an adjustment of the Contract Sum, “overhead” shall cover the Contractor’s indirect costs of the change, such as the cost of insurance other than mentioned above, bonds, superintendent and other job office personnel, watchman, use and rental of small tools, job office, job office supplies and expenses, temporary facilities and utilities, and home office expenses.

END of SUPPLEMENT to the
GENERAL CONDITIONS of the CONTRACT

APPENDIX A

SUPPLEMENTARY CONDITIONS OF THE CONTRACT - WEATHER DELAYS

EXTENSIONS OF CONTRACT TIME

Extension of time on the basis of weather may be granted only for the number of Weather Delay Days in excess of the number of days listed as the Standard baseline for the month.

STANDARD BASELINE FOR AVERAGE CLIMATIC RANGE

Based on weather data available from the National Oceanic and Atmospheric Administration a Standard Baseline of average climatic range for North Alabama has been determined.

Standard Baseline shall be regarded as the normal and anticipatable number of calendar days for each month during which construction activity shall be expected to be prevented and suspended by cause of adverse weather. Suspension of construction activity for the number of days each month as listed in the Standard Baseline is included in the Work and is not eligible for extension of Contract Time.

Standard Baseline is as follows:

Jan 12	Feb 11	Mar 08	Apr 07	May 07	Jun 06	Jul 07	Aug 05	Sep 04	Oct 05	Nov 06	Dec 11
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ADVERSE WEATHER AND WEATHER DELAY DAYS

Adverse Weather is defined as the occurrence of one or more of the following conditions which prevents exterior construction activity or access to the site within twenty-four (24) hours:

1. Precipitation (rain, snow, or ice) in excess of one-tenth (0.10") liquid measure.
2. Temperatures which do not rise above 32 degrees F by 10:00 a.m.
3. Temperatures which do not rise above that specified by day's construction activity by 10:00 a.m., if any is specified.
4. Sustained wind in excess of twenty-five (25) m.p.h.
5. Standing snow in excess of one inch (1.00")

Adverse Weather may include, if appropriate, "dry-out" or "mud" days when all the following conditions are met:

1. For rain days above the standard baseline.
2. Only if there is a hindrance to site access or sitework, such as excavation backfill, and footings.

3. At a rate no greater than 1 make-up day for each day or consecutive days or rain beyond the standard baseline that totals 1.0 inch or more, liquid measure, unless specifically recommended otherwise by the Designer.

A Weather Delay Day may be counted if adverse weather prevents work on the project for fifty percent (50%) or more of the contractor's scheduled work day, including a weekend day or holiday.

REPORTING OF WEATHER DELAYS

Contractor will provide written notice to the Architect, by fax or email, of a day claimed as a potential basis for delay. Notice of a potential basis for delay must be received by the Architect by 9:00 a.m. on the day immediately following the day claimed. At the end of the month the total days claimed will be compared to the Standard Baseline. Bad weather days exceeding the days indicated on the Standard Baseline will be granted as an extension of time.

END OF APPENDIX A

APPENDIX B

SUPPLEMENTARY CONDITIONS OF THE CONTRACT - ARTICLE 37

37. CONTRACTOR'S and SUBCONTRACTORS' INSURANCE

A. GENERAL

1. **RESPONSIBILITY.** The Contractor shall be responsible to the Owner from the time of the signing of the Construction Contract or from the beginning of the first work, whichever shall be earlier, for all injury or damage of any kind resulting from any negligent act or omission or breach, failure or other default regarding the work by the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, regardless of who may be the owner of the property.
2. **INSURANCE PROVIDERS.** Each of the insurance coverages required below shall be issued by an insurer licensed by the Insurance Commissioner to transact the business of insurance in the State of Alabama for the applicable line of insurance, and such insurer (or, for qualified self-insureds or group self-insureds, a specific excess insurer providing statutory limits) must have a Financial Strength Rating of "A-" or better and a financial size category (FSC) rating of Class V or larger.
3. **NOTIFICATION ENDORSEMENT.** Each policy shall be endorsed to provide that the insurance company agrees that the policy shall not be cancelled, changed, allowed to lapse or allowed to expire for any reason until thirty days after the Owner has received written notice by certified mail as evidenced by return receipt or until such time as other insurance coverage providing protection equal to protection called for in the Contract Documents shall have been received, accepted and acknowledged by the Owner. Such notice shall be valid only as to the Project as shall have been designated by Project Name and Number in said notice.
4. **INSURANCE CERTIFICATES.** The Contractor shall procure the insurance coverages identified below, or as otherwise required in the Contract Documents, at the Contractor's own expense, and to evidence that such insurance coverages are in effect, the Contractor shall furnish the Owner an insurance certificates(s) acceptable to the Owner and listing the Owner as the certificate holder. The insurance certificate(s) must be delivered to the Owner with the Construction Contract and Bonds for final approval and execution of the Construction Contract. The insurance certificate must provide the following:
 - a. Name and address of authorized agent of the insurance company
 - b. Name and address of insured
 - c. Name of insurance company of companies
 - d. Description of policies
 - e. Policy Number(s)
 - f. Policy Period(s)
 - g. Limits of liability
 - h. Name and address of Owner as certificate holder
 - i. Project Name and Number, if any
 - j. Signature of authorized agent of the insurance company
 - k. Telephone number of authorized agent of the insurance company
 - l. Mandatory thirty day notice of cancellation / non-renewal / change

5. **MAXIMUM DEDUCTIBLE.** Self-insured retention, except for qualified self-insurers or group self-insurers, in any policy shall not exceed \$25,000.00.

B. INSURANCE COVERAGES

Unless otherwise provided in the Contract Documents, the Contractor shall purchase the types of insurance coverages with liability limits not less than as follows:

1. **WORKERS' COMPENSATION AND EMPLOYER'S LIABILITY INSURANCE**
 - a. Workers' Compensation coverage shall be provided in accordance with the statutory coverage required in Alabama. A group insurer must submit a certificate of authority from the Alabama Department of Industrial Relations approving the group insurance plan. A self-insurer must submit a certificate from the Alabama Department of Industrial Relations stating the Contractor qualifies to pay its own workers' compensation claims.
 - b. Employer's Liability Insurance limits shall be at least:
 - 1.) Bodily Injury by Accident - \$1,000,000 each accident
 - 2.) Bodily Injury by Disease - \$1,000,000 each employee

2. **COMMERCIAL GENERAL LIABILITY INSURANCE**
 - a. Commercial General Liability Insurance, written on an ISO Occurrence Form (current edition as of the date of Advertisement for Bids) or equivalent, shall include, but not be limited to, coverage for bodily injury and property damage arising from premises and operations liability, products and completed operations liability, blasting and explosion, collapse of structures, underground damage, personal injury liability and contractual liability. The Commercial General Liability Insurance shall provide at minimum the following limits:

<u>Coverage</u>	<u>Limit</u>
1.) General Aggregate	\$ 2,000,000.00 per Project
2.) Products, Completed Operations Aggregate	\$ 2,000,000.00 per Project
3.) Personal and Advertising Injury	\$ 1,000,000.00 per Occurrence
4.) Each Occurrence	\$ 1,000,000.00

- b. Additional Requirements for Commercial General Liability Insurance:
 - 1.) The policy shall name the Owner, Architect, Alabama Building Commission, State Department of Education (if applicable), and their agents, consultants and employees as additional insureds, state that this coverage shall be primary insurance for the additional insureds; and contain no exclusions of the additional insureds relative to job accidents.
 - 2.) The policy must include separate per project aggregate limits.
3. **COMMERCIAL BUSINESS AUTOMOBILE LIABILITY INSURANCE**
 - a. Commercial Business Automobile Liability Insurance which shall include coverage for bodily injury and property damage arising from the operation of any owned, non-owned or hired automobile. The Commercial Business Automobile Liability Policy shall provide not less than \$1,000,000 Combined Single Limits for each occurrence.
 - b. The policy shall name the Owner, Architect, Alabama Building Commission, State Department of Education (if applicable), and their agents, consultants, and employees as additional insureds.
4. **COMMERCIAL UMBRELLA LIABILITY INSURANCE**

- a. Commercial Umbrella Liability Insurance to provide excess coverage above the Commercial General Liability, Commercial Business Automobile Liability and Workers' Compensation and Employer's Liability to satisfy the minimum limits set forth herein.
- b. Minimum Combined Primary Commercial General Liability and Commercial/Excess Umbrella Limits of:
 - 1.) \$ 5,000,000 per Occurrence
 - 2.) \$ 5,000,000 Aggregate
- c. Additional Requirements for Commercial Umbrella Liability Insurance:
 - 1.) The policy shall name the Owner, Architect, Alabama Building Commission, State Department of Education (if applicable), and their agents, consultants, and employees as additional insureds.
 - 2.) The policy must be on an "occurrence" basis.

5. BUILDER'S RISK INSURANCE

- a. The Builder's Risk Policy shall be made payable to the Owner and Contractor, as their interests may appear. The policy amount shall be equal to 100% of the Contract Sum, written on a Causes of Loss – Special Form (current edition as of the date of Advertisement for Bids), or its equivalent. All deductibles shall be the sole responsibility of the Contractor.
- b. The policy shall be endorsed as follows:

"The following may occur without diminishing, changing, altering or otherwise affecting the coverage and protection afforded the insured under this policy:

- 1.) Furniture and equipment may be delivered to the insured premises and install in place ready for use; or
- 2.) Partial or complete occupancy by Owner; or
- 3.) Performance of work in connection with construction operations insured by the Owner, by agents or lessees or other contractors of the Owner, or by contractors of the lessee of the Owner."

C. SUBCONTRACTORS' INSURANCE

1. WORKERS' COMPENSATION AND EMPLOYER'S LIABILITY INSURANCE. The Contractor shall require each Subcontractor to obtain and maintain Workers' Compensation and Employer's Liability Insurance coverages as described in preceding Paragraph B, or to be covered by the Contractor's Workers' Compensation and Employer's Liability Insurance while performing Work under the Contract.
2. LIABILITY INSURANCE. The Contractor shall require each Subcontractor to obtain and maintain adequate General Liability, Automobile Liability, and Umbrella Liability Insurance coverages similar to those described in preceding Paragraph B. Such coverage shall be in effect at all times that a Subcontractor is performing Work under the Contract.
3. ENFORCEMENT RESPONSIBILITY. The Contractor shall have responsibility to enforce its Subcontractors' compliance with these or similar insurance requirements; however, the Contractor shall, upon request, provide the Architect or Owner acceptable evidence of insurance for any Subcontractor.

D. TERMINATION OF OBLIGATION TO INSURE

Unless otherwise expressly provided in the Contract Documents, the obligation to insure as provided herein shall continue as follows:

1. **BUILDER'S RISK INSURANCE.** The obligation to insure under Subparagraph B(5) shall remain in effect until the Date of Substantial Completion as shall be established in the Certificate of Substantial Completion. In the event that multiple Certificates of Substantial Completion covering designated portions or the Work are issued, Builder's Risk coverage shall remain in effect until the Date of Substantial Completion. However, in the case that the Work involves separate buildings, Builder's Risk coverage of each separate building may terminate on the Date of Substantial Completion as established in the Certificate of Substantial Completion issued for each building.
2. **PRODUCTS AND COMPLETED OPERATIONS.** The obligation to carry Products and Completed Operations coverage specified under Subparagraph B(2) shall remain in effect for two years after the Date(s) of Substantial Completion.
3. **ALL OTHER INSURANCE.** The obligation to carry other insurance coverages specified under Subparagraphs B(1) through B(4) and Paragraph C shall remain in effect after the Date(s) of Substantial Completion until such time as all Work required by the Contract Documents is completed. Equal or similar insurance coverages shall remain in effect if, after completion of the Work, the Contractor, a Subcontractor, anyone directly employed by them or anyone for whose acts they may be liable, returns to the Project to perform warranty or maintenance work pursuant to the terms of the Contract Documents.

END OF APPENDIX B

ATTACHMENT B
to the
GENERAL CONDITIONS of the CONTRACT

(MANDATORY FOR PROJECTS COVERED THROUGH
THE STATE INSURANCE FUND (SIF))

1. Article 37 "Contractor's and Subcontractors' Insurance", Paragraph E is modified as follows:

E. WAIVERS of SUBROGATION

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, and (2) the Architect, Architect's consultants, separate contractors performing construction or operations related to the Project, if any, and any of their subcontractors, sub-subcontractors, agents and employees, for damages caused by fire or other causes of loss. But said waiver shall apply only to the extent the loss or damage is covered by builder's risk insurance or other property insurance applicable to the Work or to other property located within or adjacent to the Project, except such rights as they may have to proceeds of such insurance held by the Owner or Contractor as fiduciary. The Owner or Contractor, as appropriate, shall require of the Architect, Architect's consultants, separate contractors, if any, and the subcontractor, sub-subcontractors, suppliers, agents and employees of any of them, by appropriate agreements, written where legally required for validity, similar waivers each in favor of other parties enumerated herein. The Policies shall provide such waivers of subrogation by endorsement or otherwise. A waiver of subrogation shall be effective as to the person or entity even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, did not pay the insurance premium directly or indirectly, and whether or not the person or entity had an insurable interest in the property damaged. The waivers provided for in this paragraph shall survive not be applicable to loss or damage that occurs after final acceptance of the Work. ~~and continue to apply to insured losses to the Work or other property on or adjacent to the Project.~~

END of ATTACHMENT B to the
GENERAL CONDITIONS of the CONTRACT

APPENDIX C

SUPPLEMENTARY CONDITIONS OF THE CONTRACT - ARTICLE 49

49. LIQUIDATED DAMAGES:

- A. The Substantial Completion date of this project is critical due to owner occupancy. Delays in the completion of the work as provided for in the Contract Documents will cause undue expense and hardship for the Owner.
- B. Refer to Section 01 10 00 Summary for contract time.
- C. LIQUIDATED DAMAGES:
 - 1. A charge of \$1,000.00 per day will be made against the General Contractor for not meeting the Date of Substantial Completion.
 - 2. The amount of the total charges shall be deducted by the Owner from the Final estimate and shall be retained by the Owner out of moneys otherwise due the Contractor in the Final Payment, not as a penalty, but as liquidated damages sustained, it being mutually understood and agreed between the parties hereto that such amount is reasonable as liquidated damages.
- D. Liquidated damages will be processed by change order to the contract price.

END OF APPENDIX C

APPENDIX D

SUPPLEMENTARY CONDITIONS OF THE CONTRACT – ARTICLE 29

29. SCHEDULE OF VALUES:

- A. In accordance with the General Conditions of the Contract, Article 29, Paragraph B, the Contractor shall submit for approval a Schedule of Values as shown below.

No.	<i>Divisions of Work</i>
1	<i>Bonds, Insurance & Permits</i>
2	<i>General Conditions</i>
3	<i>Allowances</i>
4	<i>Contingencies</i>
5	<i>Conc. Walks / Pads / Aprons</i>
8	<i>Concrete Footings / Slabs</i>
7	<i>Masonry - Block</i>
8	<i>Struct. Steel / Misc. Metals</i>
9	<i>Rough & Finish Carpentry</i>
10	<i>Doors & Frames</i>
11	<i>Hardware</i>
12	<i>Drywall / Acoustical</i>
13	<i>Ceramic / Hard Tile</i>
14	<i>Painting</i>
15	<i>Specialties</i>
16	<i>Plumbing</i>
17	<i>HVAC</i>
18	<i>Electrical</i>
19	<i>Fire Alarm</i>
20	<i>Phone / Data / Security</i>

END OF SECTION

APPENDIX E

SUPPLEMENTARY CONDITIONS OF THE CONTRACT – ARTICLE 44, PARAGRAPH B

SALES AND USE TAXES

GENERAL DESCRIPTION

- A. **PURPOSE:** The Owner, Decatur City Schools, is a Tax Exempt Instrumentality of the State of Alabama. As such, it is authorized to and desires to enter into an Procurement Agreement with the Contractor whereby the Owner will purchase all, or a portion of, the materials, supplies, equipment, and other items (hereinafter referred to as “materials”) necessary for the performance of this Contract by the Contractor and its subcontractors and thereby save the amount of the sales and use tax thereon.
- B. **SALES AND USE TAXES ARE INCLUDED IN THE CONTRACT AMOUNT:** The Base Bid (and all Alternate Bids) submitted on the proposal form WILL INCLUDE the cost of all required taxes, including sales and use taxes; therefore, sales and use taxes will be included in the Contract amount.
- C. **ACTUAL SAVINGS WILL BE DEDUCTED FROM THE CONTRACT AMOUNT:** Prior to Final Payment the amount of sales and use taxes actually saved and 100 percent of any cash discounts earned pursuant to this Section shall be deducted from the Contract amount by change order.

GENERAL PROVISIONS

- A. **PRECEDENCE:** The provisions of this Section take precedence over the printed forms, “Instructions to Bidders”, “General Conditions of the Contract”, as modified and “Supplementary General Conditions”. Unaltered provisions of these documents remain intact.
- B. **BID PROPOSALS:** The Contractor shall submit its proposal for Base Bid and proposals for each Alternate Bid, if any, with the inclusion of all required taxed including sales and use taxes, the same as if sales and use taxes were to be paid in the normal manner. The sales and use tax savings will be effected by change order prior to closeout of the Construction Contract.
- C. **NOTICE OF INTENT:** The Contractor, its subcontractors, sub-subcontractors, and all material suppliers are hereby made aware of the Owner’s intent to reduce the Contract amount through the purchase of materials in the manner hereinafter described and the Contractor shall not arbitrarily withhold his consent to the arrangement.
- D. **ADMINISTRATION:** Purchases and the resulting sales and use tax savings effected pursuant to this Section will be administered by the Contractor in accordance with the procedures set forth herein and utilizing the Purchase Order and other forms bound herein. Under the Procurement Agreement, which is also bound herein, the Contractor will be appointed as agent of the Owner to purchase, for and in the name of the Owner, those materials that are necessary for the performance of the Work by the Contractor and its subcontractors. The Owner will render payment directly to vendors and materials suppliers.
- E. **CONTRACTOR’ ADMINISTRATIVE COSTS:** Any and all costs incurred by the Contractor's administration of purchases pursuant to the provisions of this Section shall be considered to be

included in the Contract Amount. No additional costs shall be added to the Contract amount because of the service provided by the Contractor in the purchase of materials for this project in the name of the Owner.

- F. EFFECT OF PAYMENTS:** The Owner's payments directly to vendors and suppliers pursuant to this Section shall also constitute payments against this Construction Contract. In preparing monthly requests for payment, the Contractor will determine the value of stored materials in accordance with the procedures and forms contained herein. The calculation of the amount to be retained from the contractor's monthly payments will be the percentage of retainage specified in the General Conditions of the Contract applied against the sum of the value of completed work plus the value of stored materials.
- G. SUBCONTRACTORS AND SUPPLIERS:** The Contractor shall include provisions in all subcontractors and purchase orders requiring subcontractors and suppliers and their sub-subcontractors and sub-suppliers to also effect the sales and use tax savings procedures set forth therein, fully utilizing the applicable forms bound herein.
- H. FAILURE TO ADMINISTER:** In the event that Contractor, or any of its subcontractors or suppliers at any tier, arbitrarily pays for materials that should have been purchased and/or paid for by the owner under this Section, the Owner may, at its discretion, reduce the amount to be paid. A decision by the Contractor to waive these procedures in order to expedite delivery of materials in emergency or critical situations will not be deemed a failure to administer.
- I. DISCOUNTS:** In the event there is entitlement to a discount because of timely payments for purchases made pursuant to this Section, such discount is the Owners in its entirety.
- J. RESPONSIBILITY FOR MATERIALS:** Notwithstanding this special purchase arrangement, the Contractor shall be responsible for all materials purchased hereunder, the same as would have been the case if these tax savings procedures were not implemented. Such responsibility of the Contractor shall include, but not be limited to, selecting, describing, ordering, obtaining approvals, submitting samples, coordinating, processing, preparing shop drawings, expediting deliveries, receiving and unloading, inspecting, properly storing and protecting, insuring, and guaranteeing the materials. The Contractor shall accept and sign for the materials as the Owner's agent and forward the materials invoices to the Owner for payment in accordance with the procedures for Processing of Invoices.
- K. WARRANTIES:** The purchase of materials pursuant to this Section shall not relieve the Contractor of its obligation to provide warranties specified elsewhere in these project specifications in full force and effect, the same as if these procedures were not implemented. If the purchase of an item in accordance with these procedures will invalidate the warranty offered and/or required for that item, the Contractor shall notify the Architect and Owner of the condition prior to purchasing the item so that the Owner may evaluate its option to waive these procedures for that purchase. If materials purchased pursuant to this Section fail to meet the requirements of the plans and specifications, the Contractor, as agent of the Owner or its assigns, will be responsible to enforce and pursue, at Contractor's cost and expense, including attorneys fees, all warranty actions against vendors or others responsible for the furnishing of such defective or non-complying materials to Owner.

PROCUREMENT AGREEMENT

To establish the agency relationship between the Contractor and Owner for the purposes of this Section, a Procurement Agreement will be executed by the two parties immediately after the Contract Bonds and Contract have been properly executed and approved. The form of Procurement Agreement to be utilized is bound in Section 00 50 00.

PROCEDURES

A. PURCHASE ORDERS

All purchases of materials must be made utilizing the Purchase Order form found in Section 00 50 00.

B. PROCESSING OF INVOICES

The Owner will render payments to Vendors upon receipt of invoices approved by the Contractor and transmitted to the Owner on a monthly basis as prescribed herein.

1. Invoices from each vendor must be tabulated on and attached to a MATERIAL INVOICE TRANSMITTAL, see Section 00 50 00 for this form. The original and one copy of the invoice are required. The set of original invoices are to be attached to the original MATERIAL INVOICE TRANSMITTAL and each set of invoice copies is to be attached to a copy of the MATERIAL INVOICE TRANSMITTAL. By signing the certification at the bottom of the MATERIAL INVOICE TRANSMITTAL the Contractor approves the invoices for payment, certifies that the materials or equipment covered by the invoices are to be incorporated into this project, and certifies that the invoices are true, correct, and unpaid.
2. The MATERIAL INVOICE SUMMARY, see Section 00 50 00 for this form, is to be used for summarizing and forwarding the MATERIAL INVOICE TRANSMITTALS with invoices to the Owner. The total amounts from each TRANSMITTAL and the resulting sales and use tax savings are to be tabulated on the SUMMARY. Each new SUMMARY is to be submitted to the Owner with the contractor's monthly APPLICATION AND CERTIFICATE FOR PAYMENT.

C. MONTHLY ACCOUNTING

The Contractor's monthly and final APPLICATION AND CERTIFICATE FOR PAYMENT shall account for the accumulated credit due the Owner for: (1) its portion of earned Cash Discounts, (2) payments for materials, and (3) actual sales and use tax savings realized from the Owner's payments for materials.

END OF SECTION

PROCUREMENT AGREEMENT

THIS PROCUREMENT AGREEMENT dated the ____ day of _____, 2018, by and between Decatur City Schools, a public corporation duly organized and existing under the laws of the State of Alabama (herein called "the Owner") and _____, a corporation organized and existing under the laws of the State of Alabama (herein called "the Contractor").

RECITALS:

Simultaneously with the execution and delivery of this Procurement Agreement, the Owner and the Contractor will enter into a Standard Form of Agreement Between the Owner and Contractor when the basis of payment is a Stipulated Sum dated the ____ day of _____, 2018, (herein called "the Construction Contract") pursuant to which the Contractor will agree to provide all labor necessary to construct the Austin High School, Career Tech Center, (herein called "the Project"), all as more fully described in the Construction Contract. Pursuant to the terms of the Construction Contract, all materials, equipment and other personal property incorporated or to be incorporated in the Project are to be purchased and paid for by the Owner.

The Owner, on its part, has requested that the Contractor undertake on behalf of the Owner certain procurement functions in connection with the acquisition of the materials, equipment and other personal property to be acquired by the Owner in connection with the construction of the Project and that the Contractor make certain warranties to the Owner with respect to such materials, equipment and other personal property. The Contractor, on its part, has agreed to accept the responsibility for performing on behalf of the Owner the procurement functions hereinafter set forth and to make the warranties herein contained in order to induce the Owner to enter into the Construction Contract.

NOW, THEREFORE, the consideration of the premises and of the respective agreement here in contained, it is hereby agreed between the Owner and the Contractor, as follows:

- Section 1. The Contractor agrees that it will prepare all purchase orders to be issued by the Owner in connection with the acquisition of the materials, equipment and other personal property necessary for the construction of the Project (herein called "the Materials"). The materials shall be solely for the Project and shall conform in all respects to the plans and specifications for the Project which are referred to in the construction Contract. Sales tax savings will not be permitted for items such as general supplies, tools, or equipment.
- Section 2. All purchase orders prepared by the contractor pursuant to this Procurement Agreement shall be prepared on the Owner's form of purchase order.
- Section 3. Upon execution of each purchase order prepared by the Contractor pursuant to this Procurement Agreement, the Contractor shall transmit the purchase order to the manufacturer or vendor of the property covered thereby and shall distribute such copies of each purchase order as required by the Owner.
- Section 4. The Contractor shall maintain such records of its procurement functions on behalf of the Owner as are required by the Owner.
- Section 5. The Contractor shall be responsible for the inspection of all Materials upon delivery and shall be responsible for preserving and protecting all Materials delivered to the site pursuant to the Construction Contract and this Procurement Agreement.
- Section 6. The Contractor warrants that all Materials covered by the purchase orders prepared by the Contractor pursuant to this Procurement Agreement shall be free of defects or imperfections and hereby agrees, immediately upon receiving notification from the Owner, to remedy, repair or replace, without cost to the Owner, all defects or imperfections which appear in any such Materials at any time or from time to time during a period beginning upon the date of commencement of construction of the Project and ending one (1) year after the date of actual acceptance of the Project. In addition, the Contractor shall use its best efforts to enforce for

and in the name and behalf of the Owner any manufacturer's or vendor's warranty and guarantee prior to final completion of the construction of the Project and for a period of one (1) year thereafter. Upon repair or replacement by the Contractor of any defective Materials and payment to the Owner of any costs or expenses incurred in connection therewith, the Contractor shall be subrogated to the rights of the Owner against the manufacturer or vendor of such defective material.

- Section 7. All Materials shall be of the kinds, qualities and sources specified in the Construction Contract, shall be new unless otherwise specified in the Construction Contract, and shall be suitable for the Project.
- Section 8. All invoices for items purchased by the Owner on purchase orders prepared by the Contractor pursuant to this Procurement Agreement shall be promptly presented to the Owner together with a payment request signed by the Contractor which shall approve the payment of such invoice and request that the Owner pay such invoice directly to the manufacturer or vendor.
- Section 9. The Construction Contract provides that the Contractor will perform the work under the Construction Contract for the Contract Sum of: _____ Dollars (\$_____). Said amount due Contractor under the Construction Contract shall be reduced by the sum of all amounts paid by the Owner for materials, supplies or other items purchased hereunder and plus any savings of sales and use tax on the purchase of such items. Any cash discounts taken for timely payment by the Owner will accrue to the benefit of the Owner by an additional reduction in the contract amount. Therefore it is a requirement that the Contractor submit all invoices in a timely manner so that the Owner may realize savings.
- Section 10. All actions required to be taken by the Contractor pursuant to this Procurement Agreement shall be as agent for the Owner and not as principal, and the Owner hereby constitutes and appoints the Contractor as its agent solely to the extent necessary to carry out the services which the Contractor has agreed to perform hereunder. The relationship of principal and agent created in this Procurement Agreement shall continue until final completion of the construction of the Project or such earlier time as the same may be terminated by the Owner.
- Section 11. Any costs of administration to be incurred by Contractor in conjunction with this Agency Agreement are included in the Contract sum cited in Section 9 above.
- Section 12. In the case of projects funded by the Alabama Public School and College Authority (PSCA), the Contractor will receive payment from PSCA for both material and labor. Upon receipt of payment from PSCA, the Contractor shall pay to the Owner an amount equal to the total amount received from PSCA for materials. Payment must be received by the Owner within seven calendar days of receipt of funds from PSCA.

IN WITNESS WHEREOF, the parties have executed this Procurement Agreement as of the day and year first above written.

DECATUR CITY SCHOOLS

By _____

CONTRACTOR

By _____

Dept Use Only
Invoice # _____
Date Paid _____
Confirmation # _____

PERMIT FEE CALCULATION WORKSHEET

BC # _____ DATE _____

PROJECT NAME _____

OWNER _____ ARCHITECT _____

CONTRACTOR _____

AWARDED CONTRACT AMOUNT _____

Calculation of Fee:

Less than \$1,000 N/A

\$1,001 - \$50,000

Cost of Work less \$ 1,000= _____ /1,000 x \$5.00= _____ +\$15.00= _____

\$50,000 - \$100,000

Cost of Work less \$50,000= _____ /1,000 x \$4.00= _____ +\$260.00= _____

\$100,000 - \$500,000

Cost of Work less \$100,000= _____ /1,000 x \$3.00= _____ +\$460.00= _____

\$500,001 and up

Cost of Work less \$500,000= _____ /1,000 x \$2.00= _____ +\$1,660.00= _____

The PERMIT FEE is to be paid before scheduling the Pre-Construction Conference. The PERMIT FEE is based on the awarded construction contract amount. A copy of the signed construction contract must be received prior to the Pre-Construction Conference.

The FINAL RECONCILIATION OF PERMIT FEE must be paid prior to the Year-End Inspection. The FINAL RECONCILIATION OF PERMIT FEE is based on the Contractor's Final Pay Application including all change orders and sales tax credits received by the Owner.

APPLICATION and CERTIFICATE for PAYMENT

Attach Schedule of Values

ESTIMATE No. _____

DATE: _____

B.C. No. _____

TO OWNER:	PROJECT:
FROM CONTRACTOR:	TO: ARCHITECT
FEIN _____	

TOTAL ORIGINAL CONTRACT
CHANGE ORDER(S)
TO CONTRACT TO DATE

Numbers _____ through _____

\$ _____
\$ _____
\$ _____

1.	Brought Forward: TOTAL CONTRACT TO DATE	\$ _____	\$ _____
	AMOUNT COMPLETE	% _____	\$ _____
2.	Stored Materials per the attached inventory of Stored Materials		\$ _____
3.	Total Completed Work and Stored Materials		\$ _____
4.	Less Retainage		\$ _____
5.	Total Completed Work and Stored Materials, less Retainage		\$ _____
6.	Less credits to Owner for the "Totals To Date" amounts in the referenced Columns of attached MATERIALS INVOICE SUMMARY NO. ____ :		\$ _____
	a. Owner's Cash Discounts: Column No. 4 (\$ _____)		\$ _____
	b. Owner's Payments for Materials: Column No. 5		\$ _____
	c. Sales & Use Tax Savings: Column No., 6		\$ _____
7.	Total Due		\$ _____
8.	Less Total Previous Payments to Contractor		\$ _____
9.	Balance Due This Estimate		\$ _____

CONTRACTOR'S CERTIFICATION

The undersigned Contractor certifies that to the best of his knowledge, information, and belief the Work covered by this Application for Payment has been completed in accordance with the Contract Documents, that all amounts have been paid by him for Work for which previous Certificates for Payments were issued and payments received from the Owner and that current payment shown herein has not yet been received.

By _____ Date _____

(Title)

Sworn and subscribed before me this _____ day of _____

L. S.

Notary Public

ARCHITECT'S CERTIFICATION

In accordance with the Contract Documents, the Architect certifies to the Owner that, to the best of the Architect's knowledge and belief, the Work has progressed to the point indicated herein, the quality of the Work is in accordance with the Contract Documents, and the Contractor is entitled to payment of the amount approved.

(Architect)

By _____

Date _____

REVIEW AND APPROVALS

Approved by _____
(Owner)

Signature

Date _____

Approved by _____

Signature

Date _____

INVENTORY OF STORED MATERIALS

Project:

For Estimate No. _____

Contractor:

For Period Ending _____

B. C. No. _____

A	B	C	D	E	F
DESCRIPTION	MATERIALS STORED LAST PERIOD	PURCHASED THIS PERIOD	TOTAL COLUMNS B + C	MATERIALS USED THIS PERIOD	MATERIALS PRESENTLY STORED




To be used as documentation to support value of Stored Materials reported on APPLICATION AND CERTIFICATE FOR PAYMENT.

Page ____ of ____

<u>PROGRESS SCHEDULE AND</u> <u>REPORT</u> PROJECT	CONTRACTOR:	DATE OF REPORT
	ARCHITECT:	PROCEED DATE
		PROJECTED COMPLETION DATE
B. C. No.		

[illegible]

LEGEND:

	ANTICIPATED ACTIVITY
	ACTUAL ACTIVITY
	ANTICIPATED CASH FLOW
	ACTUAL CASH FLOW

USE ADDITIONAL SHEETS IF JOB IS SCHEDULED MORE THAN 12 MONTHS

CONTRACT CHANGE ORDER

Change Order No. _____ Date _____ B.C.No. _____

TO: <i>(Contractor)</i>	PROJECT:
--------------------------------	-----------------

TERMS: You are hereby authorized, subject to the provisions of your Contract for this project, to make the following changes thereto in accordance with your proposal(s) dated _____

FURNISH the necessary labor, materials, and equipment to *(Description of work to be done or changes to be made.)*

ORIGINAL CONTRACT SUM \$ _____
NET TOTAL OF PREVIOUS CHANGE ORDERS \$ _____
PREVIOUS REVISED CONTRACT SUM \$ _____
THIS CHANGE ORDER WILL ☐ INCREASE ☐ DECREASE
THE CONTRACT SUM BY \$ _____
REVISED CONTRACT SUM, INCLUDING THIS CHANGE ORDER \$ _____

EXTENSION OF TIME resulting from this Change Order _____ *(Insert "None" or No. of days)*

The Owner does hereby certify that this Change Order was executed in accordance with the provisions of Title 39, Code of Alabama, 1975, as amended.

CONSENT OF SURETY

CONTRACTING PARTIES

(Company)

Contractor

By _____
(Attach current Power of Attorney)

By _____
Name & Title _____

RECOMMENDED

By _____
Architect

APPROVALS

STATE OF ALABAMA BUILDING COMMISSION
(Not required for locally-funded SDE projects)

(Awarding Authority)

By _____
Director, Technical Staff

By _____
Name & Title _____

By _____

TO: **STATE OF ALABAMA
BUILDING COMMISSION**
770 Washington Avenue, Suite 444
Montgomery, AL 36130-1150
(334) 242-4082 FAX (334) 242-4182

CERTIFICATE OF SUBSTANTIAL COMPLETION

ROUTING PROCEDURES ON REVERSE SIDE

BC# _____

OWNER(S):	ARCHITECT:
CONTRACTOR:	BONDING COMPANY:
PROJECT	

Substantial Completion has been achieved for ☐ the entire Work ☐ the following portion of the Work _____

The **Date of Substantial Completion** of the Work covered by this certificate is established to be _____.

"Substantial Completion" means the designated Work is sufficiently complete, in accordance with the Contract Documents, such that the Owner may occupy or utilize the Work for its intended use without disruption or interference by the Contractor in completing or correcting any remaining unfinished Work. The Date of Substantial Completion is the date upon which all warranties for the designated Work commence, unless otherwise agreed and recorded herein.

Punch List: A _____ page list of items to be completed or corrected prior to the Owner's approval of Final Payment is attached hereto, but does not alter the Contractor's responsibility to complete or correct all Work in full compliance with the Contract Documents. The Contractor shall complete or correct all items on the attached list, ready for re-inspection for Final Acceptance, within 30 days after the above Date of Substantial Completion, unless another date is stated here: _____. If completed or corrected within this period, warranties of these items commence on the Date of Substantial Completion, otherwise such warranties commence on the date of Final Acceptance of each item.

Only one (1) originally executed substantial completion form should be routed for signature. B.C. office will forward the original to the Owner and provide copies to all other parties.

RECOMMENDED BY:	
ARCHITECT: _____	DATE: _____
CONTRACTING PARTIES:	
CONTRACTOR _____	DATE: _____
OWNER _____	DATE: _____
	DATE: _____
APPROVALS:	
BUILDING COMM. INSPECTOR: _____	DATE: _____
BUILDING COMM. CHIEF INSPECTOR: _____	DATE: _____
BUILDING COMM. DIRECTOR: _____	DATE: _____

CERTIFICATE OF SUBSTANTIAL COMPLETION ROUTING PROCEDURE

Only one (1) originally executed substantial completion form should be routed for signature. B.C. office will forward the original to the owner and provide copies to all other parties.

ARCHITECT/ENGINEER: Please forward to Contractor after signature and date. Please provide Owner with local B.C. Inspector's name & home address.

CONTRACTOR: Please forward to Owner after signature and date.

OWNER: Please forward to local B.C. Inspector's home address after signature and date. You may contact B.C. office at (334) 242-4082 if B.C. Inspector's name/address is needed.

B.C. INSPECTOR: Will forward document to B.C. office for review and distribution.

NOTICE

THE EXECUTED "GENERAL CONTRACTOR'S ROOFING GUARANTEE" (ABC Form C-9) AND ANY OTHER ROOFING WARRANTY REQUIRED BY THE CONTRACT MUST ACCOMPANY THIS CERTIFICATE TO OBTAIN ABC APPROVAL.

FORM OF ADVERTISEMENT FOR COMPLETION

LEGAL NOTICE

In accordance with Chapter 1, Title 39, Code of Alabama, 1975, notice is hereby given
that _____,
(Contractor)
Contractor, has completed the Contract for (Construction) (Renovation) (Alteration) (Equipment)
(Improvement) of _____
(Name of Project)

at _____
(Insert location data in County or City)
for the State of Alabama and the (County) (City) of
,Owner(s), and have made request for final settlement of said Contract. All persons having any
claim for labor, materials, or otherwise in connection with this project should immediately notify

(Architect)

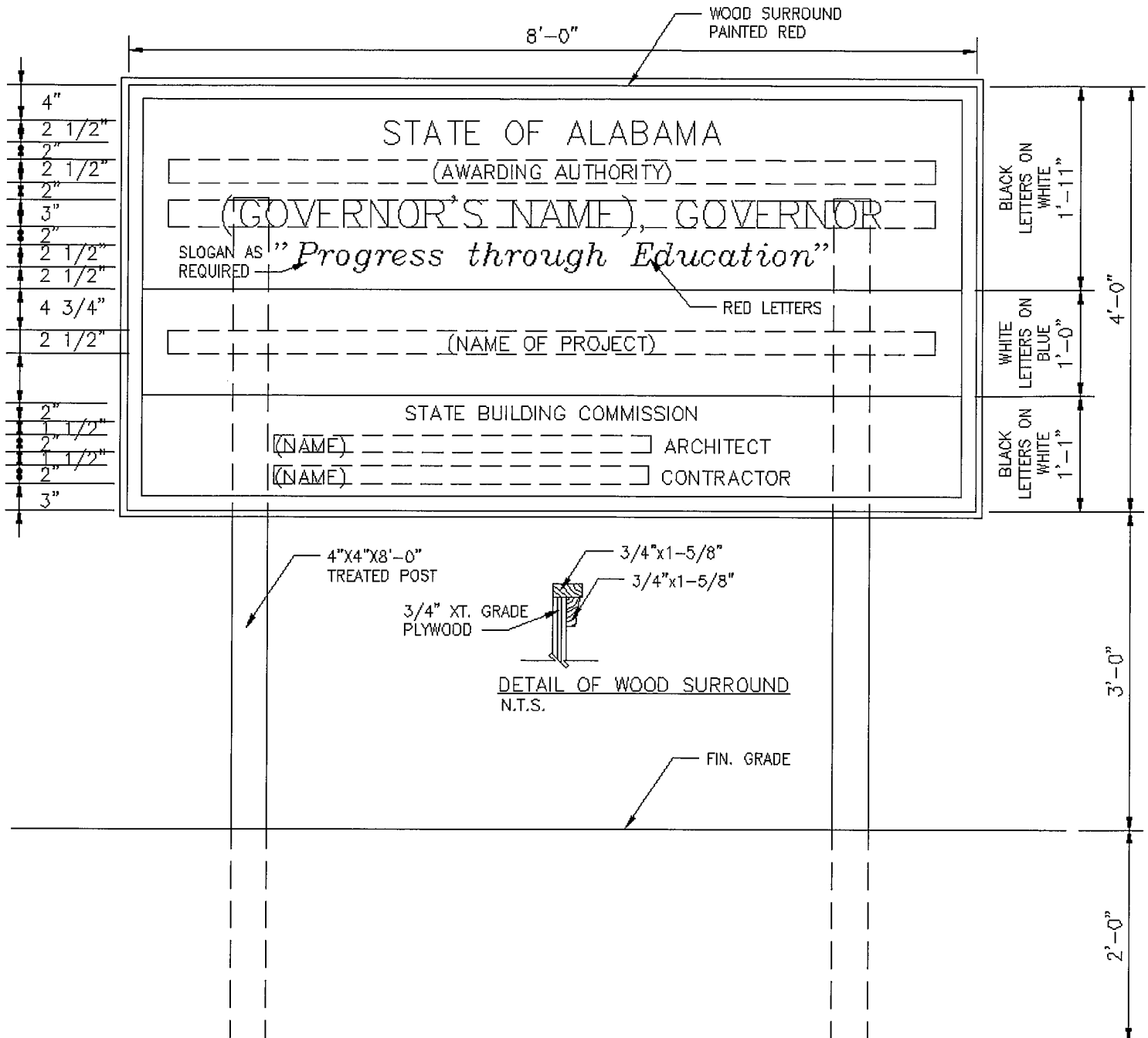
(Contractor)

(Business Address)

NOTE: This notice must be run once a week for four successive weeks for projects exceeding
\$50,000.00, for projects of less than \$50,000.00, run one time only. Proof of
publication is required.

DETAIL OF PROJECT SIGN
SCALE: 3/4" = 1'-0"

ABC FORM C-15
AUG. 2002



NOTES:

- 1.) SIGN TO BE CONSTRUCTED OF 3/4" EXTERIOR GRADE PLYWOOD.
- 2.) PAINT WITH 2 COATS BEST GRADE EXTERIOR PAINT BEFORE LETTERS ARE PAINTED.
OPTION:
IN LIEU OF PAINTED LETTERING ON PLYWOOD, A CORRUGATED PLASTIC SIGN (DISPLAYING THE SAME LETTERING, LAYOUT AND COLORS AS ABOVE) MAY BE SECURED DIRECTLY TO THE UNPAINTED EXT. GRADE PLYWOOD.
- 3.) SIGN SHALL BE PLACED IN A PROMINENT LOCATION AND EASILY READABLE FROM EXISTING STREET OR ROADWAY.
- 4.) SIGN SHALL BE MAINTAINED IN GOOD CONDITION UNTIL PROJECT COMPLETION.

MATERIAL INVOICE SUMMARY No. _____

Date _____

B.C. No. _____

TO: (Owner) 	FROM: (Contractor as Owner's Agent)
--------------------------------	--

Pursuant to the Agency Agreement between the Owner and the undersigned providing for sales and use tax exempt purchase of materials to be used in the construction of _____

_____ Please pay the following amounts shown in column (5) which is the total of the invoices attached to each enclosed Material Invoice Transmittal for the respective vendor.

(1) VENDOR	(2) INVOICE TRANS. NO.	(3) GROSS AMOUNT WITHOUT TAX	(4) CASH DISCOUNT	(5) NET INVOICE AMOUNT	(6) SALES & USE TAX SAVINGS
TOTALS THIS SUMMARY					
TOTALS OF PREVIOUS SUMMARIES					
TOTALS TO DATE					
Transfer Total To Date to APPLICATION FOR PAYMENT, Last Page			Line 6.a	Line 6.b	Line 6.c

Submitted by _____ Contractor _____ Authorized Signature _____ Date _____

Approved by _____ Awarding Authority _____ Signature _____ Date _____

MATERIAL INVOICE TRANSMITTAL No. _____

Date _____

B.C. No. _____

TO: (Owner)			FROM: (Contractor as Owner's Agent)		
Render Payment To: (Vendor)			Regarding: (Project)		
P.O. NUMBER	INVOICE NUMBER	INVOICE DATE	INVOICE AMOUNT WITHOUT TAX	DISCOUNT AMOUNT	NET AMOUNT DUE
TOTALS THIS TRANSMITTAL					

CERTIFICATION: I hereby approve for payment the invoices listed above, which are attached hereto, and certify that these invoices are for materials or equipment to be incorporated into this project and are true, correct, and unpaid.

BY: _____
Contractor as Owner's Agent

Sworn and subscribed before me this _____ day
of _____

(Title)

Notary Public L.S.



State of Alabama Disclosure Statement

(Required by Act 2001-955)

ENTITY COMPLETING FORM

ADDRESS

CITY, STATE, ZIP

TELEPHONE NUMBER

()

STATE AGENCY/DEPARTMENT THAT WILL RECEIVE GOODS, SERVICES, OR IS RESPONSIBLE FOR GRANT AWARD

ADDRESS

CITY, STATE, ZIP

TELEPHONE NUMBER

()

This form is provided with:

☐

Contract

☐

Proposal

☐

Request for Proposal

☐

Invitation to Bid

☐

Grant Proposal

Have you or any of your partners, divisions, or any related business units previously performed work or provided goods to any State Agency/Department in the current or last fiscal year?

☐

Yes

☐

No

If yes, identify below the State Agency/Department that received the goods or services, the type(s) of goods or services previously provided, and the amount received for the provision of such goods or services.

STATE AGENCY/DEPARTMENT	TYPE OF GOODS/SERVICES	AMOUNT RECEIVED

Have you or any of your partners, divisions, or any related business units previously applied and received any grants from any State Agency/Department in the current or last fiscal year?

☐

Yes

☐

No

If yes, identify the State Agency/Department that awarded the grant, the date such grant was awarded, and the amount of the grant.

STATE AGENCY/DEPARTMENT	DATE GRANT AWARDED	AMOUNT OF GRANT

1. List below the name(s) and address(es) of all public officials/public employees with whom you, members of your immediate family, or any of your employees have a family relationship and who may directly personally benefit financially from the proposed transaction. Identify the State Department/Agency for which the public officials/public employees work. (Attach additional sheets if necessary.)

NAME OF PUBLIC OFFICIAL/EMPLOYEE	ADDRESS	STATE DEPARTMENT/AGENCY

OVER

2. List below the name(s) and address(es) of all family members of public officials/public employees with whom you, members of your immediate family, or any of your employees have a family relationship and who may directly personally benefit financially from the proposed transaction. Identify the public officials/public employees and State Department/Agency for which the public officials/public employees work. (Attach additional sheets if necessary.)

NAME OF FAMILY MEMBER	ADDRESS	NAME OF PUBLIC OFFICIAL/ PUBLIC EMPLOYEE	STATE DEPARTMENT/ AGENCY WHERE EMPLOYED
-----------------------	---------	---	--

If you identified individuals in items one and/or two above, describe in detail below the direct financial benefit to be gained by the public officials, public employees, and/or their family members as the result of the contract, proposal, request for proposal, invitation to bid, or grant proposal. (Attach additional sheets if necessary.)

Describe in detail below any indirect financial benefits to be gained by any public official, public employee, and/or family members of the public official or public employee as the result of the contract, proposal, request for proposal, invitation to bid, or grant proposal. (Attach additional sheets if necessary.)

List below the name(s) and address(es) of all paid consultants and/or lobbyists utilized to obtain the contract, proposal, request for proposal, invitation to bid, or grant proposal:

NAME OF PAID CONSULTANT/LOBBYIST	ADDRESS
----------------------------------	---------

By signing below, I certify under oath and penalty of perjury that all statements on or attached to this form are true and correct to the best of my knowledge. I further understand that a civil penalty of ten percent (10%) of the amount of the transaction, not to exceed \$10,000.00, is applied for knowingly providing incorrect or misleading information.

Signature

Date

Notary's Signature

Date

Date Notary Expires

Act 2001-955 requires the disclosure statement to be completed and filed with all proposals, bids, contracts, or grant proposals to the State of Alabama in excess of \$5,000.

SECTION 01 10 00

SUMMARY

PART 1 GENERAL

1.01 PROJECT

- A. Project Name: Austin High School Career Tech Center
- B. Owner's Name: Decatur City Schools
- C. Architect's Name: Nola | Van Peursem Architects, PC.
- D. The Project consists of the alteration of Austin High School Career Tech Center, Decatur, Alabama.

1.02 CONTRACT DESCRIPTION

- A. Contract Type: A single prime contract based on a Stipulated Price as described in Document 00 50 00 - Agreement Form.

1.03 PRE-BID CONFERENCE

- A. A pre-bid conference shall be held at the project site on May 10, 2018 at 11:00 A.M. CDT. All General Contractors and major Subcontractors bidding the project are requested to attend.

1.04 OWNER OCCUPANCY

- A. Owner intends to occupy the Project by the date stated in the Agreement as the contract completion date.
- B. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.
- C. Schedule the Work to accommodate Owner's occupancy.

1.05 CONTRACTOR USE OF SITE

- A. Arrange use of site and premises to allow:
 - 1. Owner occupancy.
 - 2. Work by Other Contractors.
 - 3. Work by Owner.
- B. Provide access to and from site as required by law and by Owner:

1.06 WORK SEQUENCE

- A. Coordinate construction schedule and operations with Owner.

1.07 TIME

- A. It is anticipated that the successful bidder will be issued a notice to proceed within thirty (30) days of the bid date, the date established for substantial completion for all work is August 31 2018. Refer to Special Conditions of the Contract in Section 00 50 00 for contract requirements relating to liquidated damages and for time extensions.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

Austin High School
Career Tech Center
Project No. 17922

01 10 00 - 2
SUMMARY

SECTION 01 20 00

PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

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

1.02 RELATED REQUIREMENTS

- A. Section 00 43 22 - Supplement B - List of Unit Prices.
- B. Section 00 50 00 - Construction Documents and Forms: Agreement: Contract Sum, retainages, payment period, monetary values of unit prices.
- C. Section 00 50 00 - Construction Documents and Forms: General Conditions of the Contract and Document 00 50 00 - Supplementary Conditions: Additional requirements for progress payments, final payment, changes in the Work.
- D. Document 00 50 00 - Supplementary Conditions: Percentage allowances for Contractor's overhead and profit.
- E. Section 01 21 00 - Allowances: Payment procedures relating to allowances.

1.03 SCHEDULE OF VALUES

- A. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to Architect for approval.
- B. Forms filled out by hand will not be accepted.
- C. Submit a printed schedule on ABC Form C-10, August 2001, Application and Certificate for Payment Continuation Sheet. Contractor's standard form or electronic media printout will be considered.
- D. Submit Schedule of Values in duplicate within 15 days after date of Owner-Contractor Agreement.
- E. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the specification Section. Identify site mobilization and bonds and insurance.
- F. Include in each line item, the amount of Allowances specified in this section.
- G. Include within each line item, a direct proportional amount of Contractor's overhead and profit.
- H. Revise schedule to list approved Change Orders, with each Application For Payment.

1.04 APPLICATIONS FOR PROGRESS PAYMENTS

- A. Payment Period: 26th day through the 25th day of the next month.

- B. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to Architect for approval.
- C. Forms filled out by hand will not be accepted.
- D. Present required information in typewritten form.
- E. Form: ABC Form C-10, August 2001, Application and Certification for Payment. Utilize Schedule of Values for listing items in Application and Certificate for Payment.
- F. For each item, provide a column for listing each of the following:
 - 1. Item Number.
 - 2. Description of work.
 - 3. Scheduled Values.
 - 4. Previous Applications.
 - 5. Work in Place and Stored Materials under this Application.
 - 6. Authorized Change Orders.
 - 7. Total Completed and Stored to Date of Application.
 - 8. Percentage of Completion.
 - 9. Balance to Finish.
 - 10. Retainage.
- G. Execute certification by signature of authorized officer.
- H. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored Products.
- I. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of Work.
- J. Submit six copies of each Application for Payment.
- K. Include the following with the application:
 - 1. Transmittal letter as specified for Submittals in Section 01 30 00.
 - 2. Construction progress schedule, revised and current as specified in Section 01 30 00.
 - 3. Affidavits attesting to off-site stored products.
- L. When Architect requires substantiating information, submit data justifying dollar amounts in question.

1.05 MODIFICATION PROCEDURES

- A. Submit name of the individual authorized to receive change documents and who will be responsible for informing others in Contractor's employ or subcontractors of changes to the Contract Documents.
- B. For minor changes not involving an adjustment to the Contract Price or Contract Time, Architect will issue instructions directly to Contractor.
- C. The Architect/Engineer will advise of minor changes in the Work not involving an adjustment to Contract Sum or Contract Time as authorized by the Conditions of the Contract.
- D. For other required changes, Architect will issue a document signed by Owner instructing Contractor to proceed with the change, for subsequent inclusion in a Change Order.
 - 1. The document will describe the required changes and will designate method of determining any change in Contract Sum or Contract Time.
 - 2. Promptly execute the change.

- E. For changes for which advance pricing is desired, Architect will issue a document that includes a detailed description of a proposed change with supplementary or revised drawings and specifications, a change in Contract Time for executing the change . Contractor shall prepare and submit a fixed price quotation within 10 days.
- F. Contractor may propose a change by submitting a request for change to Architect, describing the proposed change and its full effect on the Work, with a statement describing the reason for the change, and the effect on the Contract Sum and Contract Time with full documentation . Document any requested substitutions in accordance with Section 01 60 00.
- G. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.
 - 1. For change requested by Architect for work falling under a fixed price contract, the amount will be based on Contractor's price quotation.
 - 2. For change requested by Contractor, the amount will be based on the Contractor's request for a Change Order as approved by Architect.
 - 3. For pre-determined unit prices and quantities, the amount will based on the fixed unit prices.
- H. Substantiation of Costs: Provide full information required for evaluation.
 - 1. On request, provide following data:
 - a. Quantities of products, labor, and equipment.
 - b. Taxes, insurance, and bonds.
 - c. Overhead and profit.
 - d. Justification for any change in Contract Time.
 - e. Credit for deletions from Contract, similarly documented.
 - 2. Support each claim for additional costs with additional information:
 - a. Origin and date of claim.
 - b. Dates and times work was performed, and by whom.
 - c. Time records and wage rates paid.
 - d. Invoices and receipts for products, equipment, and subcontracts, similarly documented.
 - 3. For Time and Material work, submit itemized account and supporting data after completion of change, within time limits indicated in the Conditions of the Contract.
- I. Execution of Change Orders: Architect will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.
- J. After execution of Change Order, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum.
- K. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.
- L. Promptly enter changes in Project Record Documents.

1.06 APPLICATION FOR FINAL PAYMENT

- A. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Sum, previous payments, and sum remaining due.
- B. Application for Final Payment will not be considered until the following have been accomplished:
 - 1. All closeout procedures specified in Section 01 70 00.

Austin High School
Career Tech Center
Project No. 17922

01 20 00 - 4
PRICE AND PAYMENT PROCEDURES

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 21 00

ALLOWANCES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Contingency allowance.
- B. Payment and modification procedures relating to allowances

1.02 RELATED REQUIREMENTS

- A. Section 01 20 00 - Price and Payment Procedures: Additional payment and modification procedures.

1.03 CONTINGENCY ALLOWANCE

- A. Include the sum of \$40,000.00 for Contingency Allowance. Contingency Allowance shall be used solely at the discretion of the Owner's project representative.
- B. General Contractor's profit and overhead is presumed to be included in the base bid & will not be added to changes covered by the Contingency Allowance.
- C. All changes covered by Contingency Allowance will be approved by the Owner and Architect in writing.
- D. Funds will be drawn from the Contingency Allowance by Change Order prior to Project Closeout.
- E. At closeout of contract funds remaining in Contingency Allowance will be fully credited to Owner by Change Order, plus a minimum of 2 percent for profit and overhead.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 23 00

ALTERNATES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Alternate submission procedures.
- B. Documentation of changes to Contract Sum and Contract Time.

1.02 RELATED REQUIREMENTS

- A. Document 00 50 00 - Instructions to Bidders: Instructions for preparation of pricing for alternates.
- B. Document 00 43 23 - Supplement C - Alternates: List of alternates as supplement to Bid Form.
- C. Document 00 50 00 - Agreement: Incorporating monetary value of accepted alternates.

1.03 ACCEPTANCE OF ALTERNATES

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

1.04 SCHEDULE OF ALTERNATES

- A. Alternate No. 1 - Amount to be added to base bid if new three phase transformer pad and new electrical service entrance, as shown on the Electrical drawings, are included in contract.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 30 00

ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Communication.
- B. Preconstruction meeting.
- C. Site mobilization meeting.
- D. Progress meetings.
- E. Construction progress schedule.
- F. Coordination drawings.
- G. Submittals for review, information, and project closeout.
- H. Number of copies of submittals.
- I. Submittal procedures.

1.02 COMMUNICATION

- A. Electronic mail (e-mail) is required for communications.

1.03 PROJECT COORDINATION

- A. Coordinate scheduling, submittals, and Work of the various sections of the Project Manual to assure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
- B. Verify utility requirements and characteristics of operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service such equipment.
- C. Coordinate space requirements and installation of mechanical and electrical work which are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with line of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- D. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- E. Coordinate completion and clean up of Work of separate sections in preparation for Substantial Completion and for portions of Work designated for Owner's partial occupancy.
- F. After Owner occupancy of premises, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRECONSTRUCTION MEETING

- A. Architect will schedule a meeting after Notice of Award.

- B. Attendance Required:
 - 1. Owner.
 - 2. Architect.
 - 3. Contractor.
 - 4. Major Subcontractors or Suppliers.
- C. Agenda:
 - 1. Execution of Owner-Contractor Agreement.
 - 2. Submission of executed bonds and insurance certificates.
 - 3. Distribution of Contract Documents.
 - 4. Designation of personnel representing the parties to Contract, major subcontractors, and Architect.
 - 5. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
 - 6. Scheduling.
- D. Record minutes and distribute copies within two days after meeting to participants, with one copy to Architect, Owner, participants, and those affected by decisions made.

3.02 SITE MOBILIZATION MEETING

- A. Topics covered under this section will be addressed at the above mentioned Preconstruction Meeting.
- B. Architect will schedule a meeting at the Project site prior to Contractor occupancy.
- C. Attendance Required:
 - 1. Contractor.
 - 2. Owner.
 - 3. Architect.
 - 4. Special Consultants.
 - 5. Contractor's Superintendent.
 - 6. Major Subcontractors.
- D. Agenda:
 - 1. Use of premises by Owner and Contractor.
 - 2. Owner's requirements and occupancy prior to completion.
 - 3. Temporary utilities provided by Owner.
 - 4. Security and housekeeping procedures.
 - 5. Schedules.
 - 6. Application for payment procedures.
 - 7. Procedures for testing.
 - 8. Procedures for maintaining record documents.
 - 9. Requirements for start-up of equipment.
 - 10. Inspection and acceptance of equipment put into service during construction period.
- E. Record minutes and distribute copies within two days after meeting to participants, with one copy to Architect, Owner, participants, and those affected by decisions made.

3.03 PROGRESS MEETINGS

- A. Schedule and administer meetings throughout progress of the Work at maximum maximum two week intervals during initial phase of construction and at one week intervals upon commencement of application of finish materials.
- B. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.

- C. Attendance Required: Job superintendent, major Subcontractors and suppliers, Owner, Architect, as appropriate to agenda topics for each meeting.
- D. Agenda:
 - 1. Review minutes of previous meetings.
 - 2. Review of Work progress.
 - 3. Field observations, problems, and decisions.
 - 4. Identification of problems that impede, or will impede, planned progress.
 - 5. Review of submittals schedule and status of submittals.
 - 6. Review of off-site fabrication and delivery schedules.
 - 7. Maintenance of progress schedule.
 - 8. Corrective measures to regain projected schedules.
 - 9. Planned progress during succeeding work period.
 - 10. Coordination of projected progress.
 - 11. Maintenance of quality and work standards.
 - 12. Effect of proposed changes on progress schedule and coordination.
 - 13. Other business relating to Work.
- E. Record minutes and distribute copies within two days after meeting to participants, with one copy to Architect, Owner, participants, and those affected by decisions made.

3.04 CONSTRUCTION PROGRESS SCHEDULE - SEE SECTION 01 32 16

- A. Within 10 days after date of the Agreement, submit preliminary schedule defining planned operations for the first 60 days of Work, with a general outline for remainder of Work.
- B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.
- C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
 - 1. Include written certification that mechanical and electrical contractors have reviewed and accepted proposed schedule.
- D. Within 10 days after joint review, submit complete schedule.
- E. Submit updated schedule every 30 days. At progress meetings provide a 2-week look ahead.

3.05 SUBMITTALS FOR REVIEW

- A. When the following are specified in individual sections, submit them for review:
 - 1. Product data.
 - 2. Shop drawings.
 - 3. Samples for selection.
 - 4. Samples for verification.
- B. Submit to Architect for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.
- C. Samples will be reviewed only for aesthetic, color, or finish selection.
- D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01 78 00 - Closeout Submittals.

3.06 SUBMITTALS FOR INFORMATION

- A. When the following are specified in individual sections, submit them for information:
 - 1. Design data.
 - 2. Certificates.

3. Test reports.
4. Inspection reports.
5. Manufacturer's instructions.
6. Manufacturer's field reports.
7. Other types indicated.

B. Submit for Architect's knowledge as contract administrator or for Owner.

3.07 SUBMITTALS FOR PROJECT CLOSEOUT

- A. When the following are specified in individual sections, submit them at project closeout:
1. Project record documents.
 2. Operation and maintenance data.
 3. Warranties.
 4. Bonds.
 5. Other types as indicated.
- B. Submit for Owner's benefit during and after project completion.

3.08 NUMBER OF COPIES OF SUBMITTALS

- A. Documents for Review:
1. Small Size Sheets, Not Larger Than 8-1/2 x 11 inches: Submit the number of copies that Contractor requires, plus two that will be retained by Architect.
 2. Larger Sheets, Not Larger Than 30 x 42 inches: Submit the number of opaque reproductions that Contractor requires, plus two copies that will be retained by Architect.
 3. Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.
- B. Documents for Information: Submit two copies.
- C. Documents for Project Closeout: Make one reproduction of submittal originally reviewed. Submit one extra of submittals for information.
- D. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.
1. After review, produce duplicates.
 2. Retained samples will not be returned to Contractor unless specifically so stated.

3.09 SUBMITTAL PROCEDURES

- A. Shop Drawing Procedures:
1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting the Contract Documents and coordinating related Work.
 2. Generic, non-project specific information submitted as shop drawings do not meet the requirements for shop drawings.
- B. Transmit each submittal with a copy of approved submittal form.
- C. Transmit each submittal with approved form.
- D. Sequentially number the transmittal form. Revise submittals with original number and a sequential alphabetic suffix.
- E. Identify Project, Contractor, Subcontractor or supplier; pertinent drawing and detail number, and specification section number, as appropriate on each copy.
- F. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of Products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with the requirements of the Work and Contract Documents.

- G. Deliver submittals to Architect at 301 Jefferson Street, Huntsville, AL 35801.
- H. Schedule submittals to expedite the Project, and coordinate submission of related items.
- I. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor.
- J. Identify variations from Contract Documents and Product or system limitations that may be detrimental to successful performance of the completed Work.
- K. Provide space for Contractor and Architect review stamps.
- L. When revised for resubmission, identify all changes made since previous submission.
- M. Distribute reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with requirements.
- N. Submittals not requested will not be recognized or processed.
- O. Shop Drawings and/or submittals requiring resubmission to the Architect due to non-compliance with the Contract Documents and /or incompleteness shall be thoroughly reviewed by the Contractor prior to delivery to the Architect for review. The Contractor shall ensure the completeness and compliance of the submittal materials. Cost incurred by the Owner for review of submittals after the second submittal is rejected will be the responsibility of the Contractor at the rate of \$150.00 per hour, including travel time.

END OF SECTION

SECTION 01 32 16

CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Preliminary schedule.
- B. Construction progress schedule, bar chart type.

1.02 RELATED SECTIONS

- A. Section 01 10 00 - Summary: Work sequence.

1.03 REFERENCES

- A. AGC (CPSM) - Construction Planning and Scheduling Manual; 2004.
- B. M-H (CPM) - CPM in Construction Management - Project Management with CPM; O'Brien; 2006.

1.04 SUBMITTALS

- A. Within 10 days after date of Agreement, submit preliminary schedule defining planned operations for the first 30 days of Work, with a general outline for remainder of Work.
- B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.
- C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
 - 1. Include written certification that major contractors have reviewed and accepted proposed schedule.
 - 2. Notify Architect of any material or trade that may be a potential delay.
- D. Within 10 days after joint review, submit complete schedule.
- E. Submit updated schedule with each Application for Payment.
- F. Submit under transmittal letter form specified in Section 01 30 00.

1.05 QUALITY ASSURANCE

- A. Scheduler: Contractor's personnel or specialist Consultant specializing in CPM scheduling with one years minimum experience in scheduling construction work of a complexity comparable to this Project, and having use of computer facilities capable of delivering a detailed graphic printout within 48 hours of request.
- B. Contractor's Administrative Personnel: five years minimum experience in using and monitoring CPM schedules on comparable projects.

1.06 SCHEDULE FORMAT

- A. Listings: In chronological order according to the start date for each activity. Identify each activity with the applicable specification section number.
- B. Diagram Sheet Size: Maximum 24 x 36 inches or width required.
- C. Sheet Size: Multiples of 8-1/2 x 11 inches.
- D. Scale and Spacing: To allow for notations and revisions.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRELIMINARY SCHEDULE

- A. Prepare preliminary schedule in the form of a horizontal bar chart.

3.02 CONTENT

- A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.
- B. Identify each item by specification section number.
- C. Identify work of separate stages and other logically grouped activities.
- D. Provide sub-schedules for each stage of Work identified in Section 01 10 00.
- E. Provide sub-schedules to define critical portions of the entire schedule.
- F. Include conferences and meetings in schedule.
- G. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.
- H. Coordinate content with schedule of values specified in Section 01 20 00.
- I. Provide legend for symbols and abbreviations used.

3.03 BAR CHARTS

- A. Include a separate bar for each major portion of Work or operation.
- B. Identify the first work day of each week.

3.04 REVIEW AND EVALUATION OF SCHEDULE

- A. Participate in joint review and evaluation of schedule with Architect at each submittal.
- B. Evaluate project status to determine work behind schedule and work ahead of schedule.
- C. After review, revise as necessary as result of review, and resubmit within 10 days.

3.05 UPDATING SCHEDULE

- A. Maintain schedules to record actual start and finish dates of completed activities.
- B. Indicate progress of each activity to date of revision, with projected completion date of each activity.
- C. Update diagrams to graphically depict current status of Work.
- D. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.
- E. Indicate changes required to maintain Date of Final Completion.
- F. Submit reports required to support recommended changes.
- G. Provide narrative report to define problem areas, anticipated delays, and impact on the schedule. Report corrective action taken or proposed and its effect.

3.06 DISTRIBUTION OF SCHEDULE

- A. Distribute copies of updated schedules to Contractor's project site file, to Subcontractors, suppliers, Architect, Owner .
- B. Instruct recipients to promptly report, in writing, problems anticipated by projections shown in schedules.

END OF SECTION

SECTION 01 40 00

QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. References and standards.
- B. Quality assurance submittals.
- C. Control of installation.
- D. Tolerances.
- E. Testing and inspection services.
- F. Manufacturers' field services.

1.02 RELATED REQUIREMENTS

- A. Document 00 50 00 - General Conditions: Inspections and approvals required by public authorities.
- B. Section 01 30 00 - Administrative Requirements: Submittal procedures.
- C. Section 01 60 00 - Product Requirements: Requirements for material and product quality.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor to Architect, in quantities specified for Product Data.
 - 1. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
 - 2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect.
- C. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.
- D. Manufacturer's Field Reports: Submit reports for Architect's benefit as contract administrator or for Owner.
 - 1. Submit report within 30 days of observation to Architect for information.
 - 2. Submit for information for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents.
- E. Erection Drawings: Submit drawings for Architect's benefit as contract administrator or for Owner.
 - 1. Submit for information for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents.
 - 2. Data indicating inappropriate or unacceptable Work may be subject to action by Architect or Owner.

1.04 REFERENCES AND STANDARDS

- A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Conform to reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.
- C. Obtain copies of standards where required by product specification sections.
- D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.
- E. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.
- F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.05 TESTING AND INSPECTION AGENCIES

- A. Owner will employ and pay for services of an independent testing agency to perform all specified testing. Any required retesting due to failure shall be at the expense of the Contractor as described in this Section.
- B. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.
- B. Comply with manufacturers' instructions, including each step in sequence.
- C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.
- D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Have Work performed by persons qualified to produce required and specified quality.
- F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.
- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.02 TOLERANCES

- A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

- B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

3.03 TESTING AND INSPECTION

- A. See individual specification sections for testing required.
- B. Testing Agency Duties:
 - 1. Test samples of mixes submitted by Contractor.
 - 2. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
 - 3. Perform specified sampling and testing of products in accordance with specified standards.
 - 4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
 - 5. Promptly notify Architect and Contractor of observed irregularities or non-conformance of Work or products.
 - 6. Perform additional tests and inspections required by Architect.
 - 7. Attend preconstruction meetings and progress meetings.
 - 8. Submit reports of all tests/inspections specified.
- C. Limits on Testing/Inspection Agency Authority:
 - 1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 - 2. Agency may not approve or accept any portion of the Work.
 - 3. Agency may not assume any duties of Contractor.
 - 4. Agency has no authority to stop the Work.
- D. Contractor Responsibilities:
 - 1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
 - 2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
 - 3. Provide incidental labor and facilities:
 - a. To provide access to Work to be tested/inspected.
 - b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
 - c. To facilitate tests/inspections.
 - d. To provide storage and curing of test samples.
 - 4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
 - 5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
 - 6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
- E. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by the Architect. Payment for re-testing will be charged to the Contractor by deducting testing charges from the Contract Sum/Price.

3.04 MANUFACTURERS' FIELD SERVICES

- A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, as applicable, and to initiate instructions when necessary.
- B. Submit qualifications of observer to Architect 30 days in advance of required observations.

1. Observer subject to approval of Architect.
 2. Observer subject to approval of Owner.
- C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.05 DEFECT ASSESSMENT

- A. Replace Work or portions of the Work not conforming to specified requirements.
- B. If, in the opinion of Architect, it is not practical to remove and replace the Work, Architect will direct an appropriate remedy or adjust payment.

END OF SECTION

SECTION 01 41 00

REGULATORY REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

- A. Regulatory requirements applicable to this project are the following:
 - 1. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
 - 2. 29 CFR 1910 - Occupational Safety and Health Standards; current edition.
 - 3. ICC (IFC) - International Fire Code; 2015.
 - 4. ICC (IBC) - International Building Code; 2015.
 - 5. ICC (IPC) - International Plumbing Code; 2015.
 - 6. ICC (IMC) - International Mechanical Code; 2015.
 - 7. ICC (IFGC) - International Fuel Gas Code; 2015.
 - 8. National Electric Code, 2014.
 - 9. ANSI/ASHRAE/IESNA Standard 90.1-2013 Energy Standard for Buildings Except Low-Rise Residential.
 - 10. All local governing codes and ordinances.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Temporary utilities.
- B. Temporary telecommunications services.
- C. Temporary telephone service.
- D. Temporary sanitary facilities.
- E. Temporary Controls: Barriers, enclosures, and fencing.
- F. Security requirements.
- G. Vehicular access and parking.
- H. Waste removal facilities and services.
- I. Project identification sign.
- J. Field offices.

1.02 RELATED REQUIREMENTS

- A. Section 01 51 00 - Temporary Utilities.

1.03 TEMPORARY UTILITIES - SEE SECTION 01 51 00

1.04 TELECOMMUNICATIONS SERVICES

- A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization.
- B. Telecommunications services shall include:
 - 1. Windows-based personal computer dedicated to project telecommunications, with necessary software and laser printer.
 - 2. Internet Connections: Minimum of one; DSL modem or faster.
 - 3. Email: Account/address reserved for project use.

1.05 TEMPORARY SANITARY FACILITIES

- A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.
- B. Use of existing facilities located at project site is not permitted.
- C. Maintain daily in clean and sanitary condition.
- D. At end of construction, return facilities to same or better condition as originally found.

1.06 BARRIERS

- A. Provide barriers to prevent unauthorized entry to construction areas and to protect existing facilities and adjacent properties from damage from construction operations .
- B. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.

- C. Provide protection for plants designated to remain. Replace damaged plants.
- D. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.07 FENCING

- A. Construction Material: Contractor's option.

1.08 SECURITY

- A. Provide security and facilities to protect Work, and Owner's operations from unauthorized entry, vandalism, or theft.
- B. Criminal Background Checks: Effective July 21, 2002, an applicant for certification, licensure, or an applicant employed by a local school system or nonpublic school who will have unsupervised access to children in an educational environment and who has not completed a background check since July 1, 1999, as required by the Alabama Child Protection Act of 1999, shall be required to be fingerprinted for a criminal history background check through the Alabama Bureau of Investigation (ABI) and the Federal Bureau of Investigation pursuant to Act 2002-457. Please visit <https://www.cogentid.com/index.htm> for registration and fingerprinting.
- C. Coordinate with Owner.

1.09 VEHICULAR ACCESS AND PARKING

- A. Coordinate access and haul routes with governing authorities and Owner.
- B. Provide and maintain access to fire hydrants, free of obstructions.
- C. Provide means of removing mud from vehicle wheels before entering streets.
- D. Existing on-site roads may be used for construction traffic.
- E. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.
- F. Do not allow vehicle parking on existing pavement.

1.10 WASTE REMOVAL

- A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.
- B. Provide containers with lids. Remove trash from site periodically.
- C. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.
- D. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.11 PROJECT IDENTIFICATION

- A. Provide project identification sign of design and construction as required by State of Alabama Building Commission.
- B. Erect on site at location established by Architect.

1.12 FIELD OFFICES (OPTIONAL)

- A. Office: Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture.
- B. Provide space for Project meetings, with table and chairs to accommodate 10 persons.

1.13 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

- A. Remove temporary utilities, equipment, facilities, materials, prior to Final Application for Payment inspection.
- B. Remove underground installations to a minimum depth of 2 feet. Grade site as indicated.
- C. Clean and repair damage caused by installation or use of temporary work.
- D. Restore existing facilities used during construction to original condition.
- E. Restore new permanent facilities used during construction to specified condition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 51 00

TEMPORARY UTILITIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Temporary Utilities: Electricity, lighting, heat, ventilation, and water.

1.02 RELATED REQUIREMENTS

- A. Section 01 50 00 - Temporary Facilities and Controls: Telephone service for administrative purposes.

1.03 TEMPORARY ELECTRICITY

- A. Cost: By Owner.
- B. Provide power service required from generator source.
- C. Connect to Owner's existing power service.
 - 1. Do not disrupt Owner's need for continuous service.
 - 2. Exercise measures to conserve energy.
- D. Provide power outlets for construction operations, with branch wiring and distribution boxes located at each floor. Provide flexible power cords as required.
- E. Provide main service disconnect and over-current protection at convenient location and meter.
- F. Permanent convenience receptacles may be utilized during construction.
- G. Provide adequate distribution equipment, wiring, and outlets to provide single phase branch circuits for power and lighting.

1.04 TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES

- A. Provide and maintain lighting for construction operations to achieve a minimum lighting level of 2 watt/sq ft .
- B. Provide and maintain 1 watt/sq ft lighting to exterior staging and storage areas after dark for security purposes.
- C. Provide and maintain 0.25 watt/sq ft H.I.D. lighting to interior work areas after dark for security purposes.
- D. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required.
- E. Maintain lighting and provide routine repairs.

1.05 TEMPORARY HEATING

- A. Cost of Energy: By Contractor.
- B. Provide heating devices and heat as needed to maintain specified conditions for construction operations.
- C. Maintain minimum ambient temperature of 50 degrees F in areas where construction is in progress, unless indicated otherwise in specifications.

- D. Prior to operation of permanent equipment for temporary heating purposes, verify that installation is approved for operation, equipment is lubricated and filters are in place. Provide and pay for operation, maintenance, and regular replacement of filters and worn or consumed parts.

1.06 TEMPORARY COOLING

- A. Cost of Energy: By Contractor.
- B. Provide cooling devices and cooling as needed to maintain specified conditions for construction operations.
- C. Maintain maximum ambient temperature of 80 degrees F in areas where construction is in progress, unless indicated otherwise in specifications.
- D. Prior to operation of permanent equipment for temporary cooling purposes, verify that installation is approved for operation, equipment is lubricated and filters are in place. Provide and pay for operation, maintenance, and regular replacement of filters and worn or consumed parts.

1.07 TEMPORARY WATER SERVICE

- A. Cost of Water Used: By Owner.
- B. Provide and maintain suitable quality water service for construction operations at time of project mobilization.
- C. Connect to existing water source.
 - 1. Exercise measures to conserve water.
- D. Extend branch piping with outlets located so water is available by hoses with threaded connections.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 60 00

PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General product requirements.
- B. Re-use of existing products.
- C. Transportation, handling, storage and protection.
- D. Product option requirements.
- E. Substitution limitations and procedures.
- F. Procedures for Owner-supplied products.
- G. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 RELATED REQUIREMENTS

- A. Document 00 21 13 - Instructions to Bidders: Product options and substitution procedures prior to bid date.
- B. Section 01 40 00 - Quality Requirements: Product quality monitoring.

1.03 REFERENCE STANDARDS

- A. NEMA MG 1 - Motors and Generators; 2014.
- B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

- A. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- B. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- C. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
 - 1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.
- D. Indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

PART 2 PRODUCTS

2.01 EXISTING PRODUCTS

- A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by the Contract Documents.

- B. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the Owner, or otherwise indicated as to remain the property of the Owner, become the property of the Contractor; remove from site.

2.02 NEW PRODUCTS

- A. Provide new products unless specifically required or permitted by the Contract Documents.
- B. Provide interchangeable components of the same manufacture for components being replaced.
- C. Motors: Refer to Section 22 05 13, NEMA MG 1 Type. Specific motor type is specified in individual specification sections.
- D. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Size terminal lugs to NFPA 70, include lugs for terminal box.
- E. Cord and Plug: Provide minimum 6 foot cord and plug including grounding connector for connection to electric wiring system. Cord of longer length is specified in individual specification sections.

2.03 PRODUCT OPTIONS

- A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.
- C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

2.04 MAINTENANCE MATERIALS

- A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.
- B. Deliver to to Project site and place in location as directed by Owner; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 SUBSTITUTION PROCEDURES

- A. Instructions to Bidders specify time restrictions for submitting requests for substitutions during the bidding period. Comply with requirements specified in this section.
- B. Architect will consider requests for substitutions only within 15 days after date of Agreement.
- C. Substitutions may be considered when a product becomes unavailable through no fault of the Contractor.
- D. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.
- E. A request for substitution constitutes a representation that the submitter:
 - 1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
 - 2. Will provide the same warranty for the substitution as for the specified product.
 - 3. Will coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner.

- 4. Waives claims for additional costs or time extension that may subsequently become apparent.
 - 5. Will reimburse Owner and Architect for review or redesign services associated with re-approval by authorities.
- F. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

3.02 TRANSPORTATION AND HANDLING

- A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.
- B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.
- C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.
- D. Transport and handle products in accordance with manufacturer's instructions.
- E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.
- F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.
- G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.
- H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.03 STORAGE AND PROTECTION

- A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.
- B. Store and protect products in accordance with manufacturers' instructions.
- C. Store with seals and labels intact and legible.
- D. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.
- E. For exterior storage of fabricated products, place on sloped supports above ground.
- F. Provide bonded off-site storage and protection when site does not permit on-site storage or protection.
- G. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.
- H. Comply with manufacturer's warranty conditions, if any.
- I. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

- J. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
- K. Prevent contact with material that may cause corrosion, discoloration, or staining.
- L. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- M. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION

SECTION 01 70 00

EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Examination, preparation, and general installation procedures.
- B. Pre-installation meetings.
- C. Cutting and patching.
- D. Surveying for laying out the work.
- E. Cleaning and protection.
- F. Starting of systems and equipment.
- G. Demonstration and instruction of Owner personnel.
- H. Closeout procedures, except payment procedures.
- I. General requirements for maintenance service.

1.02 RELATED REQUIREMENTS

- A. Section 01 30 00 - Administrative Requirements: Submittals procedures.
- B. Section 01 40 00 - Quality Requirements: Testing and inspection procedures.
- C. Section 01 50 00 - Temporary Facilities and Controls: Temporary exterior enclosures.
- D. Section 01 78 00 - Closeout Submittals: Project record documents, operation and maintenance data, warranties .

1.03 PROJECT CONDITIONS

- A. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
- B. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
- C. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.

1.04 COORDINATION

- A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
- B. Notify affected utility companies and comply with their requirements.
- C. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

- D. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- E. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- F. Coordinate completion and clean-up of work of separate sections.
- G. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

- A. New Materials: As specified in product sections; match existing products and work for patching and extending work.
- B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.
- C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 60 00.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.
- B. Verify that demolition is complete in alterations areas and areas are ready for installation of new work.
- C. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.
- D. Examine and verify specific conditions described in individual specification sections.
- E. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.
- F. Verify that utility services are available, of the correct characteristics, and in the correct locations.
- G. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

- A. Prepare surfaces and remove surface finishes to provide for proper installation of new work and finishes.
- B. Clean substrate surfaces prior to applying next material or substance.
- C. Seal cracks or openings of substrate prior to applying next material or substance.

- D. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 PREINSTALLATION MEETINGS

- A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.
- B. Require attendance of parties directly affecting, or affected by, work of the specific section.
- C. Notify Architect four days in advance of meeting date.

3.04 GENERAL INSTALLATION REQUIREMENTS

- A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.
- B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.
- C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.
- D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.
- E. Make neat transitions between different surfaces, maintaining texture and appearance.

3.05 CUTTING AND PATCHING

- A. Whenever possible, execute the work by methods that avoid cutting or patching.
- B. Perform whatever cutting and patching is necessary to:
 - 1. Complete the work.
 - 2. Fit products together to integrate with other work.
 - 3. Provide openings for penetration of mechanical, electrical, and other services.
 - 4. Match work that has been cut to adjacent work.
 - 5. Repair areas adjacent to cuts to required condition.
 - 6. Repair new work damaged by subsequent work.
 - 7. Remove samples of installed work for testing when requested.
 - 8. Remove and replace defective and non-conforming work.
- C. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.
- D. Employ skilled and experienced installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.
- E. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.
- F. Restore work with new products in accordance with requirements of Contract Documents.
- G. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- H. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 84 00, to full thickness of the penetrated element.
- I. Patching:

1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
2. Match color, texture, and appearance.
3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.06 PROGRESS CLEANING

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
- B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
- C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
- D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.07 PROTECTION OF INSTALLED WORK

- A. Protect installed work from damage by construction operations.
- B. Provide special protection where specified in individual specification sections.
- C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- D. Remove protective coverings when no longer needed; reuse or recycle plastic coverings if possible.

3.08 SYSTEM STARTUP

- A. Coordinate schedule for start-up of various equipment and systems.
- B. Notify Architect and owner seven days prior to start-up of each item.
- C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.
- D. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- E. Verify that wiring and support components for equipment are complete and tested.
- F. Execute start-up under supervision of applicable Contractor personnel in accordance with manufacturers' instructions.
- G. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.09 DEMONSTRATION AND INSTRUCTION

- A. Demonstrate operation and maintenance of products to Owner's personnel two weeks prior to date of final inspection.
- B. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at agreed time, at designated location.

- C. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
- D. Provide a qualified person who is knowledgeable about the Project to perform demonstration and instruction of owner personnel.
- E. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.
- F. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.
- G. The amount of time required for instruction on each item of equipment and system is that specified in individual sections.

3.10 ADJUSTING

- A. Adjust operating products and equipment to ensure smooth and unhindered operation.

3.11 FINAL CLEANING

- A. Execute final cleaning just prior to full Owner occupancy. THE PROJECT WILL NOT BE ACCEPTED UNTIL THE SITE IS CLEANED TO THE SATISFACTION OF THE OWNER/ARCHITECT.
 - 1. The site must be reasonably clean prior to requesting the Architect generate a punch list. The Architect shall solely determine whether the site is sufficiently clean to perform the inspection.
- B. Use cleaning materials that are nonhazardous.
- C. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.
- D. Clean debris from drainage systems.
- E. Clean site; sweep paved areas, rake clean landscaped surfaces.
- F. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.12 CLOSEOUT PROCEDURES

- A. Make submittals that are required by governing or other authorities.
 - 1. Provide copies to Architect.
- B. The General Contractor shall perform a preliminary inspection and shall transmit a copy of the report with each item verified as complete prior to requesting the Architect generate a punch list.
- C. Accompany Architect on punch list inspection to determine items to be listed for completion or correction.
- D. Notify Architect when work is considered ready for Substantial Completion.
- E. Submit written certification that Contract Documents have been reviewed, work has been inspected, punch list items have been completed and verified, and that work is complete in accordance with Contract Documents and ready for Architect's review.
- F. Correct items of work listed in executed Certificates of Substantial Completion and comply with requirements for access to Owner-occupied areas.
- G. Accompany Architect on preliminary final inspection.

- H. Notify Architect when work is considered finally complete.
- I. Complete items of work determined by Architect's final inspection.

3.13 MAINTENANCE

- A. Provide service and maintenance of components indicated in specification sections.
- B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.
- C. Furnish service and maintenance of components indicated in specification sections during the warranty period.
- D. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

END OF SECTION

SECTION 01 78 00

CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Project Record Documents.
- B. Operation and Maintenance Data.
- C. Warranties and bonds.

1.02 RELATED REQUIREMENTS

- A. Section 00 50 00 - General Conditions: Performance bond and labor and material payment bonds, warranty, and correction of work.
- B. Section 01 30 00 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.
- C. Section 01 70 00 - Execution and Closeout Requirements: Contract closeout procedures.
- D. Individual Product Sections: Specific requirements for operation and maintenance data.
- E. Individual Product Sections: Warranties required for specific products or Work.

1.03 SUBMITTALS

- A. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.
- B. Operation and Maintenance Data:
 - 1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review draft and return one copy with comments.
 - 2. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
 - 3. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
 - 4. Submit one set of hardcopy revised final documents and two copies of final documents in PDF format on CD's in final form within 10 days after final inspection.
- C. Warranties and Bonds:
 - 1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
 - 2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
 - 3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

- A. Maintain on site one set of the following record documents; record actual revisions to the Work:

1. Drawings.
 2. Specifications.
 3. Addenda.
 4. Change Orders and other modifications to the Contract.
 5. Reviewed shop drawings, product data, and samples.
 6. Manufacturer's instruction for assembly, installation, and adjusting.
- B. Ensure entries are complete and accurate, enabling future reference by Owner.
- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress.
- E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
1. Manufacturer's name and product model and number.
 2. Product substitutions or alternates utilized.
 3. Changes made by Addenda and modifications.
- F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
1. Measured depths of foundations in relation to finish first floor datum.
 2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
 4. Field changes of dimension and detail.
 5. Details not on original Contract drawings.
 6. Provide electronic copy (pdf) of all submittals, identified by Submittal Number.

3.02 OPERATION AND MAINTENANCE DATA

- A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.
- B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
- C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
- D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

- A. For Each Product, Applied Material, and Finish:
1. Product data, with catalog number, size, composition, and color and texture designations.
 2. Information for re-ordering custom manufactured products.
- B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.
- C. Moisture protection and weather-exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.
- D. Additional information as specified in individual product specification sections.

- E. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.
- F. Provide a listing in Table of Contents for design data, with tabbed fly sheet and space for insertion of data.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

- A. For Each Item of Equipment and Each System:
 - 1. Description of unit or system, and component parts.
 - 2. Identify function, normal operating characteristics, and limiting conditions.
 - 3. Include performance curves, with engineering data and tests.
 - 4. Complete nomenclature and model number of replaceable parts.
- B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.
- C. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.
- D. Include color coded wiring diagrams as installed.
- E. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
- F. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- G. Provide servicing and lubrication schedule, and list of lubricants required.
- H. Include manufacturer's printed operation and maintenance instructions.
- I. Include sequence of operation by controls manufacturer.
- J. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- K. Provide control diagrams by controls manufacturer as installed.
- L. Provide Contractor's coordination drawings, with color coded piping diagrams as installed.
- M. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- N. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- O. Include test and balancing reports.
- P. Additional Requirements: As specified in individual product specification sections.

3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

- A. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.

- B. Where systems involve more than one specification section, provide separate tabbed divider for each system.
- C. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable plastic covers; 2 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.
- D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.
- E. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.
- F. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.
- G. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.
- H. Text: Manufacturer's printed data, or typewritten data on 24 pound paper.
- I. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- J. Arrange content by systems under section numbers and sequence of Table of Contents of this Project Manual.
- K. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, in three parts as follows:
 - 1. Part 1: Directory, listing names, addresses, and telephone numbers of Architect, Contractor, Subcontractors, and major equipment suppliers.
 - 2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
 - a. Significant design criteria.
 - b. List of equipment.
 - c. Parts list for each component.
 - d. Operating instructions.
 - e. Maintenance instructions for equipment and systems.
 - f. Maintenance instructions for special finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
 - 3. Part 3: Project documents and certificates, including the following:
 - a. Shop drawings and product data.
 - b. Air and water balance reports.
 - c. Certificates.
 - d. Photocopies of warranties and bonds.
- L. Provide a listing in Table of Contents for design data, with tabbed dividers and space for insertion of data.
- M. Table of Contents: Provide title of Project; names, addresses, and telephone numbers of Architect, Consultants, and Contractor with name of responsible parties; schedule of products and systems, indexed to content of the volume.

3.06 WARRANTIES AND BONDS

- A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Substantial completion is determined.
- B. Verify that documents are in proper form, contain full information, and are notarized.
- C. Co-execute submittals when required.
- D. Retain warranties and bonds until time specified for submittal.
- E. Include originals of each in operation and maintenance manuals, indexed separately on Table of Contents.
- F. Manual: Bind in commercial quality 8-1/2 by 11 inch three D side ring binders with durable plastic covers.
- G. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible company principal.
- H. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.
- I. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

END OF SECTION

SECTION 02 41 19

MINOR DEMOLITION FOR REMODELING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Removal of designated building equipment and fixtures.
- B. Removal of designated construction.
- C. Disposal of materials.
- D. Identification of utilities.

1.02 RELATED SECTIONS

- A. Section 01 50 00 - Temporary Facilities and Controls: Temporary enclosures.
- B. Section 01 78 00 - Closeout Submittals: Project record documents.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate demolition; location and construction of temporary facilities.
- C. Project Record Documents: Accurately record actual locations of capped or abandoned utilities.

1.04 REGULATORY REQUIREMENTS

- A. Conform to applicable code for demolition work, dust control, products requiring electrical disconnection and re-connection .
- B. Obtain required permits from authorities.
- C. Do not close or obstruct egress from any building exit or site exit.
- D. Conform to applicable regulatory procedures when hazardous or contaminated materials are discovered.

1.05 SEQUENCING

- A. Sequence work under the provisions of Section 01 10 00.

1.06 SCHEDULING

- A. Schedule work under the provisions of Section 01 32 16.
- B. Schedule work to coincide with new construction.
- C. Describe demolition removal procedures and schedule.

1.07 PROJECT CONDITIONS

- A. Conduct demolition to minimize interference with adjacent building areas.
- B. Cease operations immediately if structure appears to be in danger and notify Architect. Do not resume operations until directed.

PART 2 PRODUCTS - NOT USED.

PART 3 EXECUTION

3.01 PREPARATION

- A. Erect and maintain weatherproof closures for exterior openings.
- B. Protect existing materials that are not to be demolished.
- C. Prevent movement of structure; provide bracing and shoring.
- D. Notify affected utility companies before starting work and comply with their requirements.
- E. Mark location and termination of utilities.
- F. Provide appropriate temporary signage including signage for exit or building egress.

3.02 DEMOLITION

- A. Disconnect, remove, and identify designated utilities within demolition areas.
- B. Demolish in an orderly and careful manner. Protect existing supporting structural members .
- C. Remove demolished materials from site except where specifically noted otherwise. Do not burn or bury materials on site.
- D. Remove materials as demolition progresses. Upon completion of demolition, leave areas in clean condition.
- E. Remove temporary facilities.

END OF SECTION

SECTION 03 10 00

CONCRETE FORMING AND ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Formwork for cast-in place concrete, with shoring, bracing and anchorage.
- B. Openings for other work.
- C. Form accessories.
- D. Form stripping.

1.02 RELATED REQUIREMENTS

- A. Section 03 20 00 - Concrete Reinforcing.
- B. Section 03 30 00 - Cast-in-Place Concrete.
- C. Section 04 20 00 - Unit Masonry: Reinforcement for masonry.

1.03 REFERENCE STANDARDS

- A. ACI 301 - Specifications for Structural Concrete; 2010 (Errata 2012).
- B. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2011.
- C. ACI 347R - Guide to Formwork for Concrete; 2014.
- D. ASME A17.1 - Safety Code for Elevators and Escalators; 2013.
- E. PS 1 - Structural Plywood; 2009.

1.04 QUALITY ASSURANCE

- A. Designer Qualifications: Design of formwork is the responsibility of the General Contractor.

PART 2 PRODUCTS

2.01 FORMWORK - GENERAL

- A. Provide concrete forms, accessories, shoring, and bracing as required to accomplish cast-in-place concrete work.
- B. Design and construct to provide resultant concrete that conforms to design with respect to shape, lines, and dimensions.
- C. Comply with applicable State and local codes with respect to design, fabrication, erection, and removal of formwork.

2.02 FORM FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
 - 1. Plywood, metal, or other approved panel materials.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

- C. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.

2.03 FORMWORK ACCESSORIES

- A. Form Release Agent: Colorless mineral oil that will not stain concrete, absorb moisture, impair natural bonding of concrete finish coatings, or affect color characteristics of concrete finish coatings.
- B. Dovetail Anchor Slot: Galvanized steel, at least 22 gage, 0.0299 inch thick, foam filled, release tape sealed slots, anchors for securing to concrete formwork.
- C. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.

PART 3 EXECUTION

3.01 GENERAL

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
 - 1. Class A, 1/8 inch (3.2 mm) for smooth-formed finished surfaces. (This includes all formed concrete exposed to view.)
 - 2. Class B, 1/4 inch (6 mm) for rough-formed finished surfaces. (This includes formed concrete not exposed to view.)
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 - 1. Install keyways, reglets, recesses, and the like, for easy removal.
 - 2. Do not use rust-stained steel form-facing material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- H. Chamfer exterior corners and edges of permanently exposed concrete.
- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.02 EXAMINATION

- A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

3.03 EARTH FORMS

- A. Hand trim sides and bottom of earth forms. Remove loose soil prior to placing concrete.

3.04 ERECTION - FORMWORK

- A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301.
- B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.
- C. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.
- D. Align joints and make watertight. Keep form joints to a minimum.
- E. Obtain approval before framing openings in structural members that are not indicated on drawings.
- F. Install void forms in accordance with manufacturer's recommendations. Protect forms from moisture or crushing.
- G. Coordinate this section with other sections of work that require attachment of components to formwork.
- H. If formwork is placed after reinforcement, resulting in insufficient concrete cover over reinforcement, request instructions from Architect before proceeding.

3.05 APPLICATION - FORM RELEASE AGENT

- A. Apply form release agent on formwork in accordance with manufacturer's recommendations.
- B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.
- C. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

3.06 INSERTS, EMBEDDED PARTS, AND OPENINGS

- A. Provide formed openings where required for items to be embedded in passing through concrete work.
- B. Locate and set in place items that will be cast directly into concrete.
- C. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other work.
- D. Install accessories in accordance with manufacturer's instructions, so they are straight, level, and plumb. Ensure items are not disturbed during concrete placement.

- E. Install waterstops in accordance with manufacturer's instructions, so they are continuous without displacing reinforcement. Heat seal joints so they are watertight.
- F. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.
- G. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

3.07 FORM CLEANING

- A. Clean forms as erection proceeds, to remove foreign matter within forms.
- B. Clean formed cavities of debris prior to placing concrete.
 - 1. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

3.08 FIELD QUALITY CONTROL

- A. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and to verify that supports, fastenings, wedges, ties, and items are secure.

3.09 FORM REMOVAL AND REUSING

- A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.
 - 1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
 - 2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- B. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.
- C. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.
- D. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.
- E. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.
- F. Store removed forms to prevent damage to form materials or to fresh concrete. Discard damaged forms.

END OF SECTION

SECTION 03 20 00

CONCRETE REINFORCING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Reinforcing steel for cast-in-place concrete.
- B. Supports and accessories for steel reinforcement.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete.
- B. Section 04 20 00 - Unit Masonry: Reinforcement for masonry.

1.03 REFERENCE STANDARDS

- A. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement; 2015.
- B. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2015.
- C. AWS D1.4/D1.4M - Structural Welding Code - Reinforcing Steel; 2011.
- D. CRSI (DA4) - Manual of Standard Practice; 2009.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Include bar schedules, shapes of bent bars, spacing of bars, and location of splices.
- C. Manufacturer's Certificate: Certify that reinforcing steel and accessories supplied for this project meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

- A. Welders' Certificates: Submit certifications for welders employed on the project, verifying AWS qualification within the previous 12 months.

PART 2 PRODUCTS

2.01 REINFORCEMENT

- A. Reinforcing Steel: ASTM A615/A615M, Grade 60 - 60,000 psi.
 - 1. Deformed billet-steel bars.
 - 2. Unfinished.
- B. Plain Steel Wire: ASTM A 82/A 82M steel wire, unfinished.
- C. Steel Welded Wire Reinforcement (WWR): Galvanized, deformed type; ASTM A1064/A1064M.
 - 1. Form: Flat Sheets.
 - 2. WWR Style: 4 x 8-W6 x W10.
 - 3. Mesh Size and Wire Gage: As indicated on drawings.
- D. Reinforcement Accessories:
 - 1. Tie Wire: Annealed, minimum 16 gage, 0.0508 inch.

2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.
3. Provide stainless steel, galvanized, plastic, or plastic coated steel components for placement within 1-1/2 inches of weathering surfaces.

2.02 FABRICATION

- A. Fabricate concrete reinforcing in accordance with CRSI (DA4) - Manual of Standard Practice.
- B. Welding of reinforcement is permitted only with the specific approval of Architect. Perform welding in accordance with AWS D1.4/D1.4M.
- C. Locate reinforcing splices not indicated on drawings at point of minimum stress.
 1. Review locations of splices with Architect.

PART 3 EXECUTION

3.01 PLACEMENT

- A. Place, support and secure reinforcement against displacement. Do not deviate from required position.
- B. Do not displace or damage vapor barrier.
- C. Accommodate placement of formed openings.
- D. Maintain concrete cover around reinforcing as follows, unless noted otherwise on drawings:
 1. Beams: 1 1/2 inch
 2. Supported Slabs and Joists: 3/4 inch.
 3. Column Ties: 1 1/2 inch.
 4. Walls (exposed to weather or backfill): 2 inch.
 5. Footings and Concrete Formed Against Earth: 3 inch.
 6. Slabs on Fill: 3/4 inch.
- E. Conform to applicable code for concrete cover over reinforcement.
- F. Bond and ground all reinforcement to requirements of Section 26 05 26.

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Concrete formwork.
- B. Elevated concrete slabs.
- C. Floors and slabs on grade.
- D. Joint devices associated with concrete work.
- E. Miscellaneous concrete elements, including equipment pads, light pole bases, flagpole bases, thrust blocks, and manholes.
- F. Concrete curing.

1.02 RELATED REQUIREMENTS

- A. Section 03 20 00 - Concrete Reinforcing.
- B. Section 07 95 13 - Expansion Joint Cover Assemblies.
- C. Section 07 90 05 - Joint Sealers.

1.03 REFERENCE STANDARDS

- A. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; 1991 (Reapproved 2009).
- B. ACI 301 - Specifications for Structural Concrete; 2010 (Errata 2012).
- C. ACI 302.1R - Guide for Concrete Floor and Slab Construction; 2004 (Errata 2007).
- D. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000.
- E. ACI 305R - Hot Weather Concreting; 2010.
- F. ACI 306R - Cold Weather Concreting; 2010.
- G. ACI 308R - Guide to Curing Concrete; 2001 (Reapproved 2008).
- H. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2011.
- I. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2016.
- J. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2015a.
- K. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2015.
- L. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2012.
- M. ASTM C150/C150M - Standard Specification for Portland Cement; 2015.
- N. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete; 2007.
- O. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2015.

- P. ASTM C881/C881M - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete; 2014.
- Q. ASTM C1059/C1059M - Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete; 2013.
- R. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types); 2004 (Reapproved 2013).

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.
- C. Samples: Submit two, 12 inch long samples of waterstops and construction joint devices.
- D. Manufacturer's Installation Instructions: For concrete accessories, indicate installation procedures and interface required with adjacent construction.
- E. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.
- F. Design Mixes: For each concrete mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
- G. Qualification Statement: A letter from each of the concrete Manufacturer, Installer, and Finisher indicating that they meet the qualification requirements noted in Quality Assurance portion of this specification.

1.05 FIELD SAMPLES

- A. All strength and control test required for concrete shall be performed by a laboratory selected and directed by the Architect, in accordance with provisions of Section 01 40 00.
- B. The testing laboratory, under the direction of the Architect or his representative, shall make, identify, and transport to the testing laboratory a minimum of 1 set of 4 cylinders from each 50 cubic yards or from each day's pour if less than 50 cubic yards. Cylinders shall be made and cured in accordance with ASTM C31 and tested at 7 days and 2 cylinders at 28 days. The fourth cylinder shall be held in reserve and tested at 56 days in the event the 28-day strength is below specification requirements. The 7-day strength shall be at least 60 percent of the required 28-day compressive strength. Each strength test result shall be the average strength of 2 cylinders from the same sample tested at 28 days.
- C. Make at least 1 slump test from each 25 cubic yards of concrete and from each sample from which cylinders are made. Slump tests shall be made in accordance with ASTM C143.
- D. Percent of entrained air shall be determined in accordance with ASTM C231 on the sample from which cylinders are made.

1.06 COMPRESSION TESTS

- A. Building Code Requirements for Reinforced Concrete: Evaluation of results of cylinder tests for concrete shall be according to Section 5.6 of ACI 318-95.
- B. Qualification: Section 5.6 of ACI 318-95 is qualified as follows. No individual strength test result shall be less than the specified 28-day compressive strength for concrete placed in position of

critical structural importance in the building or structure, the Architect's decision in identifying positions of critical structural importance in building or structure shall be final.

- C. Compliance: Failure to comply with required evaluation procedure outlined in Paragraphs A and B above shall constitute questionable concrete and the following additional tests shall be made at no cost to the Owner:
1. A minimum of 3 usable cores shall be taken from each area where questionable concrete was placed. Cores shall be taken and tested in accordance with ASTM C42 and Section 5.6 of ACI 318-95. Core test results shall be evaluated in accordance with Section 5.6 of ACI 318-95.
 2. If results of core tests do not meet acceptance criteria or if structural inadequacy is in doubt, the Architect may require remedial measures to be taken or load tests in accordance with Part 6, Chapter 20 of ACI 318-77.

1.07 DEFECTIVE CONCRETE

- A. Where concrete fails to meet specified strength or where defects which cannot be repaired exist, the Work shall be removed and replaced, at Contractor's expense, with Work that meets specification requirements.
- B. The Contractor is solely responsible for furnishing concrete of the strength, quality, and appearance specified.

1.08 BUILT-IN ITEMS

- A. All items specified under other sections of the Project Manual which require being built into the concrete shall be installed as the concrete work progresses.
- B. The Contractor shall be responsible for placing of items required by subcontractors.
- C. Electrical conduits and other pipes indicated to be embedded in concrete shall be of such size and location so as not to reduce strength of structures. Conduits less than 1 inch in diameter are not regarded as reducing strength of structure. Any areas weakened by conduit or pipe shall be reinforced with additional reinforcement as directed by the Architect.

1.09 QUALITY ASSURANCE

- A. Pre-Installation Conference: Prior to the installation of concrete slabs.
 1. Required attendees include the Owner, Architect, General Contractor, Construction Manager, and Concrete Finisher.
- B. Perform work of this section in accordance with ACI 301 and ACI 318.
 1. Maintain one copy of each document on site.
- C. Acquire cement from same source and aggregate from same source for entire project.
- D. Follow recommendations of ACI 305R when concreting during hot weather.
- E. Follow recommendations of ACI 306R when concreting during cold weather.
- F. Installer Qualifications: Concrete Installer must have placed at least 40,000 square feet of stained, exposed concrete slab on grade using concrete with a shrinkage reducing admixture within the past 3 years.
- G. Manufacturer Qualifications: Concrete Manufacturer must have supplied at least 500 cubic yards of concrete using a shrinkage reducing admixture stained for stained exposed concrete slabs on grade within the past 3 years.

- H. Finisher Qualifications: Concrete Finisher must have placed at least 40,000 square feet of stained, exposed concrete slab on grade using concrete with a shrinkage reducing admixture within the past 3 years.

PART 2 PRODUCTS

2.01 FORMWORK

- A. Form Materials: Contractor's choice of standard products with sufficient strength to withstand hydrostatic head without distortion in excess of permitted tolerances.
 - 1. Form Facing for Exposed Finish Concrete: Contractor's choice of materials that will provide smooth, stain-free final appearance.
 - 2. Form Coating: Release agent that will not adversely affect concrete or interfere with application of coatings.

2.02 REINFORCEMENT

- A. Comply with requirements of Section 03 20 00.

2.03 CONCRETE MATERIALS

- A. Cement: ASTM C150, Type I - Normal Portland type.
- B. Fine and Coarse Aggregates: ASTM C 33.
- C. Fly Ash: ASTM C618, Class C or F.
- D. Water: Clean and not detrimental to concrete.

2.04 ADMIXTURES

- A. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.
- B. Air Entrainment Admixture: ASTM C 260. Provide Air Mix manufactured by Euclid.
- C. Chemical Admixtures: ASTM C 494/C 494M, Type F - Water Reducing, High Range and Type G - Water Reducing, High Range and Retarding.
 - 1. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.
- D. Shrinkage Reducing Admixture: Eclipse Floor by Grace Concrete Products
 - 1. Shrinkage Reducing Admixture must be used at all stained, exposed concrete slabs on grade.
 - 2. Proportion dosage rate to provide a maximum shrinkage of 0.021% on a mix design that otherwise has a shrinkage of 0.030% based on ASTM C157 Shrinkage Tests. Shrinkage reduction must be based on trial mixtures. Provide results of ASTM C157 test results for trial mixtures as part of the mix design submittal.

2.05 ACCESSORY MATERIALS

- A. Bonding Agent: ASTM C 1059, Type II acrylic non-redispersable type.
- B. Epoxy Bonding System: ASTM C 881, type as required by project conditions.
- C. Vapor Barriers (Underslab): Moistop Ultra® 15 Underslab Vapor Retarder (or approved equal), , extremely durable and puncture resistant polyolefin manufactured from ISO certified virgin resins.
 - 1. Types:
 - a. Premium Plus: Fortifiber® / Moistop Ultra® 15.

2. Reference Standard: ASTM E 1745-97 Class B (premium).
 3. Puncture Resistance: 2000 grams minimum (premium), ASTM D-1709
 4. Water Vapor Permeance: less than .02 perms (premium), ASTM F-1249
- D. Chemical Hardener: Fluosilicate solution designed for densification of cured concrete slabs.
- E. Non-Shrink Cementitious Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.
1. Minimum Compressive Strength at 48 Hours: 2,000 psi.
- F. Moisture-Retaining Cover: ASTM C171; regular curing paper, white curing paper, clear polyethylene, white polyethylene, or white burlap-polyethylene sheet.
- G. Liquid Curing Compound: ASTM C 309, Type 1, clear or translucent.

2.06 BONDING AND JOINTING PRODUCTS

- A. Joint Filler: Nonextruding, resilient asphalt impregnated fiberboard or felt, complying with ASTM D1751, 1/2 inch thick and 4 inches deep; tongue and groove profile.
- B. Construction Joint Devices: Integral extruded plastic; 1/2 inch thick, formed to tongue and groove profile, with removable top strip exposing sealant trough, knockout holes spaced at 6 inches, ribbed steel spikes with tongue to fit top screed edge.
- C. Sealant and Primer: As specified in Section 07 90 05.

2.07 CONCRETE MIX DESIGN

- A. Mix and deliver concrete in accordance with ASTM C94.
- B. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.
- C. Limit percentage of fly ash to 25% (by weight).
- D. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended by manufacturer. Use of admixtures will not relax cold weather placement requirements.
- E. Do not use admixtures that contain calcium chloride.
- F. Use set retarding admixtures during hot weather only when approved by the Architect/Engineer.
- G. Add air entraining agent to normal weight concrete mix for work exposed to exterior.
- H. Concrete at Exposed Concrete Slabs on Grade:
1. Minimum Compressive Strength: 4000 psi at 28 days.
 2. Maximum Water-Cementitious Materials Ratio: 0.45
 3. Slump Limit: 4 inches, plus or minus 1 inch
 4. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.
 5. Use Eclipse Floor shrinkage reducing admixture by Grace Concrete Products. Proportion dosage rate to provide a maximum shrinkage of 0.021% on a mix design that otherwise has a shrinkage of 0.030% based on ASTM C157 Shrinkage Tests. Shrinkage reduction must be based on trial mixtures. Provide results of ASTM C157 test results for trial mixtures as part of the mix design submittal.
 6. Coarse Aggregate: Normal Weight #78 crushed limestone
- I. Concrete at Other Slabs on Grade:
1. Minimum Compressive Strength: 4000 psi at 28 days.
 2. Maximum Water-Cementitious Materials Ratio: 0.45
 3. Slump Limit: 4 inches, plus or minus 1 inch

- 4. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.
- J. Concrete Metal Form Deck:
 - 1. Minimum Compressive Strength: 3000 psi at 28 days.
 - 2. Maximum Water-Cementitious Materials Ratio: 0.57
 - 3. Slump Limit: 4 inches, plus or minus 1 inch
 - 4. Air Content: 4%-6%
- K. Other Concrete:
 - 1. Minimum Compressive Strength: 3000 psi at 28 days.
 - 2. Maximum Water-Cementitious Materials Ratio: 0.50
 - 3. Slump Limit: 4 inches, plus or minus 1 inch

2.08 BATCHING

- A. Provide necessary equipment to accurately determine and control the actual amount of materials entering the concrete mix. Weigh individual ingredients separately for each batch. The accuracy of weighing devices shall be such that successive quantities can be measured to within 1 percent of the desired amount.
- B. Completely discharge contents of mixer before each new batch is loaded. The use of retempered concrete is not acceptable.

2.09 MIXING

- A. Transit Mixers: Comply with ASTM C 94 and as follows.
 - 1. Use a separate water metering device (not truck tank) for measuring water added to the original batch.
 - 2. The use of wash water as a portion of the mixing water is not acceptable. Dump all wash water added to empty drums after discharging, before a new batch is received.
 - 3. Mixing drums shall be watertight.
 - 4. Discharge concrete within 1-1/2 hours from time concrete was mixed, if central mixed, or from the time original water was added, if transit mixed.
 - 5. Producer shall furnish delivery tickets with each load of concrete delivered under this specification. Delivery ticket shall show clearly the class and strength of concrete, size of coarse aggregate, and the slump ordered.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify lines, levels, and dimensions before proceeding with work of this section.

3.02 PREPARATION

- A. Formwork: Comply with requirements of ACI 301. Design and fabricate forms to support all applied loads until concrete is cured, and for easy removal without damage to concrete.
- B. Verify that forms are clean and free of rust before applying release agent.
- C. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.
- D. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions.
- E. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.

- F. Interior Slabs on Grade: Install vapor retarder under interior slabs on grade. Lap joints minimum 6 inches. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions. Repair damaged vapor retarder before covering.

3.03 PLACING CONCRETE

- A. Place concrete in accordance with ACI 304R.
- B. Place concrete for floor slabs in accordance with ACI 302.1R.
- C. Notify Architect not less than 24 hours prior to commencement of placement operations.
- D. Ensure reinforcement, inserts, waterstops, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.

3.04 SLAB JOINTING

- A. Repair underslab vapor retarder damaged during placement of concrete reinforcing. Repair with vapor retarder material; lap over damaged areas minimum 6 inches and seal watertight.
- B. Separate slabs on grade from vertical surfaces with joint filler.
- C. Place joint filler in floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.
- D. Extend joint filler from bottom of slab to within 1/8 inch of finished slab surface. Conform to Section 07 90 05 for finish joint sealer requirements.
- E. Install joint devices in accordance with manufacturer's instructions.
- F. Install construction joint devices in coordination with floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.
- G. Apply sealants in joint devices in accordance with Section 07 90 05.
- H. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.
- I. Place concrete continuously between predetermined expansion, control, and construction joints.
- J. Do not interrupt successive placement; do not permit cold joints to occur.
- K. Place floor slabs in checkerboard or saw cut pattern indicated.
- L. Saw cut joints within 8 hours after placing. Use 3/16 inch thick blade, cut into 1/4 depth of slab thickness.
- M. Screed floors level, maintaining surface flatness of maximum 1/16 inch in 10 ft.
- N. Concrete shall be placed by an ACI certified and experienced crew with sufficient equipment to place the entire panel or section in a continuous unbroken operation from beginning to end.
- O. The conveying of concrete from the mixer to the forms shall be as rapid as possible. The conveying equipment shall be of sufficient capacity to ensure a practically continuous flow of concrete to the placing point without segregation or loss of materials.
- P. No concrete that has partially hardened or been contaminated shall be deposited on the work, nor shall retempered concrete be used. In no case shall concrete be used when the elapsed time after addition of water to the batch exceeds 1-1/2 hours. No concrete shall be placed with a slump greater than 6 inches.

- Q. All concrete shall be thoroughly spaded around reinforcement, embedded items, and faces of forms. Vibrators of an approved internal type shall be used to assist but not replace the spading. Concrete shall be placed and compacted in layers not over 18 inches thick.
- R. Concrete shall not be allowed to drop freely more than 5 feet in unexposed work or more than 3 feet in exposed work. Where greater drops are required, a tremie or other approved means shall be employed to prevent segregation.
- S. All concrete slabs shall be consolidated and screeded to an even surface by the use of a straight edge and screeding strips accurately and securely set to the proper grade and prepared for the specified finish. Depress slabs as required for toppings, setting beds, and tile. Slope surfaces 1/8 inch per foot to drains, unless otherwise shown.
- T. On suspension of placing, all keys for joining work shall be made before initial set of concrete. All concrete deposited on exposed reinforcement for future work shall be washed off immediately.

3.05 CONCRETE FINISHING - SEE SECTION 03 35 10 - CONCRETE FINISHES

3.06 CURING AND PROTECTION

- A. Comply with requirements of ACI 308R. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
- B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
 - 1. Normal concrete: Not less than 7 days.
- C. Monitor rates of evaporation per ACI 305R. Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- D. Formed Surfaces: Cure by moist curing with forms in place for full curing period.
- E. Surface Not in Contact with Forms: Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
 - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
 - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.
 - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall

within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

- a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.
- b. Curing Compounds are not allowed at stained exposed concrete slabs.

3.07 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00.
- B. Provide free access to concrete operations at project site and cooperate with appointed firm.
- C. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.
- D. Tests of concrete and concrete materials may be performed at any time to ensure conformance with specified requirements.
- E. Compressive Strength Tests: ASTM C39/C39M. For each test, mold and cure four concrete test cylinders. Obtain test samples for every 50 cu yd or less of each class of concrete placed.
- F. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.
- G. Perform one slump test for each set of test cylinders taken, following procedures of ASTM C143/C143M.
- H. Monitor rates of evaporation per ACI 305R.

3.08 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 (1.18-mm) sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension to solid concrete. Limit cut depth to 3/4 inch (19 mm). Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
 - 1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 - 2. After concrete has cured at least 14 days, correct high areas by grinding.
 - 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
 - 4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
 - 5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch (6 mm) to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 - 6. Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch (19-mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
 - 7. Repair random cracks and single holes 1 inch (25 mm) or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete.
- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.09 DEFECTIVE CONCRETE

- A. Test Results: The testing agency shall report test results in writing to Architect and Contractor within 24 hours of test.
- B. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.
- C. Repair or replacement of defective concrete will be determined by the Architect. The cost of additional testing shall be borne by Contractor when defective concrete is identified.
- D. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect for each individual area.

END OF SECTION

SECTION 03 35 10

CONCRETE FINISHES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Scratch, broom, troweled, and non-slip finishes.

1.02 SAMPLE PANELS

- A. Sample panels to be inspected by the Architect/Engineer for uniformity, color and texture.
- B. The finishes in the complete structure shall match the sample panels approved by the Architect/Engineer.
- C. Prepare sample panels of the following finishes:
 - 1. Rubbed Finish: Select a portion of the structure which will not be exposed to view and apply a rubbed finish. See Paragraph 3.01, Subparagraph D, Item 2 of this Section for rubbed finish requirements.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 FORMED SURFACES FINISHES

- A. Immediately after removal of forms, the surface shall be inspected by the Architect/Engineer.
- B. Minor defects (1-1/2 inches or less in depth) in the Work shall be repaired by patching the same day the forms are removed. Defects shall be cut back at 90 degrees to the surface at least 1 inch deep without feather edges. After soaking with water, a dry mortar mix shall be packed into defect. In exposed work, the mortar mix shall be determined by trial method to produce a color and texture which will match adjoining concrete. After the mortar has attained its initial set, the patch shall be scraped or rubbed flush with the concrete and matched to the color and texture of the adjoining surface.
- C. Description of Finishes:
 - 1. Common Finish: Remove all fins and loose material and patch defects and tie holes.
 - 2. Rubbed Finish: After applying a common finish, rub the surface as follows. Finish shall be produced on green concrete as soon as possible after removal of forms, but no later than the day following removal of forms. Surface shall be wet with water and rubbed with carborundum brick or other abrasive until a uniform color and texture are produced. No cement grout or slush shall be used other than the cement paste drawn from the green concrete by the rubbing process. Match finish of approved sample.
- D. Schedule of Finishes:
 - 1. Common Finish: For all formed surfaces which will not be exposed to view in the finish structure.
 - 2. Rubbed Finish: For exposed surfaces where indicated on Drawings.

3.02 FLATWORK FINISHES

- A. Slabs shall be consolidated and screeded to an even surface using a straight edge and screed strips to set accurately and securely to the proper grade and prepared for finishing. Surfaces shall slope to drains where applicable.

- B. Exterior Concrete Walks, Platforms and Landings: Slope 1/8 inch per foot unless otherwise indicated. Walks shown crown in the center or if adjoining the building, slope away from the building unless otherwise shown. All exposed edges of walks shall be tooled to form 1/4 inch radius rounded edges.
- C. Scratch Finish: Remove surface water and laitance and roughen the surface with a stiff brush, leaving the aggregate slightly exposed and rough to provide good mechanical bond.
- D. Float Finish: Begin when water sheen has disappeared and the concrete has hardened sufficiently so that the weight of a man standing on it leaves only a slight imprint on the surface. Consolidate the surface by hand or machine floating. Recheck the trueness of surface at this state with a 10 foot straight edge applied at not less than 2 different angles. Cut down all high spots and fill all low spots to produce planes checking true under the straight edge in all directions with a tolerance not to exceed 1/8 inch every 10 feet. Immediately refloat the slab to a uniform, smooth granular texture.
- E. Broom Finish: Provide a float finish and then score the surface in a transverse direction by drawing a broom or burlap belt across the surface, to a texture approved by the Architect/Engineer.
- F. Trowel Finish: Provide a float finish and follow by steel troweling. Produce a smooth surface relatively free from defects with a power trowel. After the surface has hardened sufficiently, trowel by hand. After a ringing sound is produced as the trowel is moved over the surface, make the final troweling. Thoroughly consolidate the surface by hand troweling. The finish surface shall be free of trowel marks, pin holes, and other imperfections; producing a uniform texture and appearance, in a plane within the tolerance specified. Correct any deviation from the above condition which remains after troweling by grinding or filling with an approved material.
 - 1. Finish stained exposed concrete surfaces to the following tolerances, according to ASTM E 1155, for randomly trafficked floor surfaces:
 - a. Specified overall values of flatness, F(F) 40; and of levelness, F(L) 30; with minimum local values of flatness F(F) 25; and of levelness, F(L) 20.
 - 2. Finish other concrete slab on grade surfaces to the following tolerances, according to ASTM E 1155, for randomly trafficked floor surfaces:
 - a. Specified overall values of flatness, F(F) 25 and of levelness, F(L) 20; with minimum local values of flatness F(F) 17; and of levelness, F(L) 15.

3.03 SCHEDULE OF FINISHES

- A. Scratch Finish: For all concrete surfaces which will be covered with setting beds or topping.
- B. Broom Finish: For all exterior walks, exterior steps, exterior landings, and entrance slabs.
- C. Trowel Finish: For all interior floor slabs which are to be exposed or covered, and other areas where indicated on Drawings.
- D. Do not use curing compounds, hardeners, or sealers on areas to be covered with carpet.

3.04 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - 1. Apply to concrete surfaces not exposed to public view.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.
- C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:
 1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
 2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
 3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix one part portland cement and one part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.
- D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.05 FLOOR TREATMENTS

- A. Concrete floors: Concrete floors which will be covered with floor coverings shall be thoroughly cured in accordance with Section 03 30 00.

3.06 CURING

- A. Curing of finished surfaces is specified in Section 03 30 00 - Cast-In-Place Concrete

3.07 INSPECTION

- A. The Architect/Engineer or his representative shall inspect finished concrete for compliance with the requirement of this Section.
- B. Areas which do not comply therewith shall be refinished or corrective measures made, directed by the Architect.

END OF SECTION

SECTION 04 05 11

MASONRY MORTARING AND GROUTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Mortar for masonry.
- B. Grout for masonry.

1.02 RELATED REQUIREMENTS

- A. Section 04 20 00 - Unit Masonry: Installation of mortar and grout.

1.03 REFERENCE STANDARDS

- A. ACI 530/530.1/ERTA - Building Code Requirements and Specification for Masonry Structures and Related Commentaries; 2011.
- B. ACI 530.1/ASCE 6/TMS 602 - Specification for Masonry Structures; American Concrete Institute International; 2008.
- C. ASTM C91/C91M - Standard Specification for Masonry Cement; 2012.
- D. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2015.
- E. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2011.
- F. ASTM C150/C150M - Standard Specification for Portland Cement; 2015.
- G. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2006 (Reapproved 2011).
- H. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2014a.
- I. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2011.
- J. ASTM C476 - Standard Specification for Grout for Masonry; 2010.
- K. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry; 2012.
- L. IMIABC (HW) - Recommended Practices & Guide Specifications for Hot Weather Masonry Construction; International Masonry Industry All-Weather Council; current edition.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Design Mix: For masonry grout.

1.05 QUALITY ASSURANCE

- A. Comply with provisions of ACI 530/ASCE 5/TMS 402 and ACI 530.1/ASCE 6/TMS 602, except where exceeded by requirements of the contract documents.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Maintain packaged materials clean, dry, and protected against dampness, freezing, and foreign matter.

1.07 FIELD CONDITIONS

- A. Cold Weather Requirements: Comply with recommendations of IMIAWC (CW).
- B. Hot Weather Requirements: Comply with IMIAWC (HW).

PART 2 PRODUCTS

2.01 MORTAR AND GROUT APPLICATIONS

- A. Mortar Mix Designs: ASTM C270, Property Specification.
 - 1. Masonry below grade and in contact with earth: Type M.
 - 2. Masonry above grade: Type S.
- B. Grout Mix Designs:
 - 1. Bond Beams, Lintels, and Filled Cells, and Reinforced Masonry Columns: 300 psi strength at 28 days; 8-10 inches slump; provide premixed type in accordance with ASTM C 94/C 94M.

2.02 MATERIALS

- A. Portland Cement: ASTM C150.
 - 1. Type: Type I - Normal.
- B. Masonry Cement: ASTM C91.
 - 1. Type: Type N.
- C. Hydrated Lime: ASTM C207, Type S.
- D. Mortar Aggregate: ASTM C144.
- E. Grout Aggregate: ASTM C404.
- F. Water: Clean and potable.

2.03 MORTAR MIXING

- A. Thoroughly mix mortar ingredients using mechanical batch mixer, in accordance with ASTM C270 and in quantities needed for immediate use.
- B. Maintain sand uniformly damp immediately before the mixing process.
- C. Do not use anti-freeze compounds to lower the freezing point of mortar.
- D. If water is lost by evaporation, re-temper only within two hours of mixing.
- E. Use mortar within two hours after mixing at temperatures of 90 degrees F, or two-and-one-half hours at temperatures under 40 degrees F.

2.04 GROUT MIXING

- A. Mix grout in accordance with ASTM C94/C94M.
- B. Thoroughly mix grout ingredients in quantities needed for immediate use in accordance with ASTM C476 for fine and coarse grout.
- C. Do not use anti-freeze compounds to lower the freezing point of grout.

2.05 PRECONSTRUCTION TESTING

- A. Testing will be conducted by an independent test agency, in accordance with provisions of Section 01 40 00.

- B. Mortar Mixes: Test mortars prebatched by weight in accordance with ASTM C780 recommendations for preconstruction testing.
 - 1. Test results will be used to establish optimum mortar proportions and establish quality control values for construction testing.

PART 3 EXECUTION

3.01 PREPARATION

- A. Plug clean-out holes for grouted masonry with block masonry units. Brace masonry to resist wet grout pressure.

3.02 INSTALLATION

- A. Install mortar to requirements of section(s) in which masonry is specified.
- B. Work grout into masonry cores and cavities to eliminate voids.
- C. Do not install grout in lifts greater than 16 inches without consolidating grout by vibration.
- D. Do not displace reinforcement while placing grout.
- E. Remove excess mortar from grout spaces.

3.03 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field tests, in accordance with provisions of Section 01 40 00.
- B. Test and evaluate mortar in accordance with ASTM C780 procedures.

END OF SECTION

SECTION 04 20 00

UNIT MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Concrete Block.
- B. Reinforcement and Anchorage.
- C. Flashings.
- D. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 03 20 00 - Concrete Reinforcing: Reinforcing steel for grouted masonry.
- B. Section 04 05 11 - Masonry Mortaring and Grouting.
- C. Section 07 62 00 - Flashing & Sheet Metal.
- D. Section 07 90 05 - Joint Sealers: Backing rod and sealant at control and expansion joints.

1.03 REFERENCE STANDARDS

- A. ACI 530/530.1/ERTA - Building Code Requirements and Specification for Masonry Structures and Related Commentaries; 2011.
- B. ACI 530.1/ASCE 6/TMS 602 - Specification For Masonry Structures; American Concrete Institute International; 2008.
- C. ASTM A82/A82M - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement; 2007.
- D. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.
- E. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units; 2014.
- F. ASTM C129 - Standard Specification for Nonloadbearing Concrete Masonry Units; 2011.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data for masonry units, fabricated wire reinforcement, and mortar.
- C. Samples: Submit four samples of facing brick units to illustrate color, texture, and extremes of color range.

1.05 QUALITY ASSURANCE

- A. Comply with provisions of ACI 530/ASCE 5/TMS 402 and ACI 530.1/ASCE 6/TMS 602, except where exceeded by requirements of the contract documents.
 - 1. Maintain one copy of each document on project site.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

- B. Handle and store ceramic glazed masonry units in protective cartons or trays. Do not remove from protective packaging until ready for installation.

PART 2 PRODUCTS

2.01 CONCRETE MASONRY UNITS

- A. Concrete Block: Comply with referenced standards and as follows:
 - 1. Size: Standard units with nominal face dimensions of 16 x 8 inches and nominal depths as indicated on the drawings for specific locations.
 - 2. Special Shapes: Provide non-standard blocks configured for corners and lintels.
 - 3. Load-Bearing Units: ASTM C90, normal weight.
 - a. Type I - Moisture-controlled; normal weight.
 - 1) Smooth face
 - b. Exposed faces: Manufacturer's standard color and texture.
 - 4. Non-Loadbearing Units: ASTM C129.
 - a. Hollow block, as indicated.
 - b. Lightweight.
 - 1) Smooth face

2.02 MORTAR AND GROUT MATERIALS

- A. Mortar and grout: As specified in Section 04 05 11.

2.03 REINFORCEMENT AND ANCHORAGE

- A. Reinforcing Steel: Deformed billet bar type, specified in Section 03 20 00; size as indicated on drawings; uncoated finish.
- B. Single Wythe Joint Reinforcement: Ladder type; ASTM A 82/A 82M steel wire, hot dip galvanized after fabrication to ASTM A 153/A 153M, Class B; 0.1483 inch side rods with 0.1483 inch cross rods; width as required to provide not more than 1 inch and not less than 1/2 inch of mortar coverage on each exposure.
 - 1. Manufacturers:
 - a. Dur-O-Wal.
 - b. Hohmann & Barnard, Inc.
 - c. Substitutions: See Section 01600 - Product Requirements.

2.04 ACCESSORIES

- A. Preformed Control Joints: Rubber material. Provide with corner and tee accessories, fused joints.
 - 1. Manufacturers:
 - a. Dur-O-Wal: www.dur-o-wal.com.
 - b. Heckmann Building Products, Inc.
 - c. Hohmann & Barnard, Inc: www.h-b.com.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive masonry.
- B. Verify that related items provided under other sections are properly sized and located.
- C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.02 PREPARATION

- A. Direct and coordinate placement of metal anchors supplied for installation under other sections.
- B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.03 COLD AND HOT WEATHER REQUIREMENTS

- A. Maintain materials and surrounding air temperature to minimum 40 degrees F prior to, during, and 48 hours after completion of masonry work.
- B. Maintain materials and surrounding air temperature to maximum 90 degrees F prior to, during, and 48 hours after completion of masonry work.

3.04 COURSING

- A. Establish lines, levels, and coursing indicated. Protect from displacement.
- B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
- C. Concrete Masonry Units:
 - 1. Bond: Running.
 - 2. Coursing: One unit and one mortar joint to equal 8 inches.
 - 3. Mortar Joints: Concave.

3.05 PLACING AND BONDING

- A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.
- B. Lay hollow masonry units with face shell bedding on head and bed joints.
- C. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.
- D. Remove excess mortar and mortar smears as work progresses.
- E. Interlock intersections and external corners, except for units laid in stack bond.
- F. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
- G. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
- H. Cut mortar joints flush where wall tile is scheduled, resilient base is scheduled, or bitumen dampproofing is applied.

3.06 REINFORCEMENT AND ANCHORAGE - GENERAL

3.07 REINFORCEMENT AND ANCHORAGE - SINGLE WYTHER MASONRY

- A. Install horizontal joint reinforcement 16 inches on center.
- B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.
- C. Place continuous joint reinforcement in first and second joint below top of walls.
- D. Lap joint reinforcement ends minimum 6 inches.

- E. Reinforce joint corners and intersections with strap anchors 16 inches on center.

3.08 LINTELS

- A. Refer to Structural Drawings.

3.09 GROUTED COMPONENTS

- A. Lap splices minimum 48 bar diameters.
- B. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.
- C. Place and consolidate grout fill without displacing reinforcing.
- D. At bearing locations, fill masonry cores with grout for a minimum 12 inches either side of opening.

3.10 CONTROL JOINTS

- A. Do not continue horizontal joint reinforcement through control joints.
- B. Form control joint with a sheet building paper bond breaker fitted to one side of the hollow contour end of the block unit. Fill the resultant core with grout fill. Rake joint at exposed unit faces for placement of backer rod and sealant.
- C. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.
- D. Size control joint in accordance with Section 07 90 05 for sealant performance.
- E. Form expansion joint as detailed.

3.11 BUILT-IN WORK

- A. As work progresses, install built-in metal door frames, fabricated metal frames, and block-outs for openings and other items to be built into the work and furnished under other sections.
- B. Install built-in items plumb, level, and true to line.
- C. Bed anchors of metal door frames in adjacent mortar joints. Fill frame voids solid with grout.
 - 1. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.
- D. Do not build into masonry construction organic materials that are subject to deterioration.

3.12 TOLERANCES

- A. Maximum Variation from Alignment of Columns: 1/4 inch.
- B. Maximum Variation From Unit to Adjacent Unit: 1/32 inch.
- C. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.
- D. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.
- E. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.
- F. Maximum Variation of Joint Thickness: 1/8 inch in 3 ft.
- G. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.

3.13 CUTTING AND FITTING

- A. Cut and fit for chases. Coordinate with other sections of work to provide correct size, shape, and location.
- B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.14 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00.

3.15 CLEANING

- A. Remove excess mortar and mortar droppings.
- B. Replace defective mortar. Match adjacent work.
- C. Clean soiled surfaces with cleaning solution.
- D. Use non-metallic tools in cleaning operations.

3.16 PROTECTION

- A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

END OF SECTION

SECTION 05 12 00

STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Structural steel framing members, support members.
- B. Base plates.
- C. Grouting under base plates.

1.02 RELATED REQUIREMENTS

- A. Section 05 50 00 - Metal Fabrications: Steel fabrications affecting structural steel work.

1.03 REFERENCE STANDARDS

- A. AISC (MAN) - Steel Construction Manual; 2011.
- B. AISC S303 - Code of Standard Practice for Steel Buildings and Bridges; 2016.
- C. AISC S348 - Specification for Structural Joints Using ASTM A325 or A490 Bolts; 2004.
- D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.
- E. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.
- F. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2014.
- G. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength; 2014.
- H. ASTM A490 - Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength; 2014a.
- I. ASTM A490M - Standard Specification for High-Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints (Metric); 2014a.
- J. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2013.
- K. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts; 2007a (Reapproved 2014).
- L. ASTM A563M - Standard Specification for Carbon and Alloy Steel Nuts [Metric]; 2007.
- M. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2015.
- N. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2014.
- O. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2014.

- P. ASTM F436 - Standard Specification for Hardened Steel Washers; 2011.
- Q. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength; 2007a.
- R. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.
- S. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015.
- T. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings:
 - 1. Indicate profiles, sizes, spacing, locations of structural members, openings, attachments, and fasteners.
 - 2. Connections.
 - 3. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths.
 - 4. Shop drawings shall be sealed by a qualified professional engineer responsible for their preparation.
 - 5. For structural-steel connections indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Manufacturer's Mill Certificate: Certify that products meet or exceed specified requirements.
- D. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within the previous 12 months.

1.05 QUALITY ASSURANCE

- A. Fabricate structural steel members in accordance with AISC "Steel Construction Manual."
- B. Comply with Section 10 of AISC "Code of Standard Practice for Steel Buildings and Bridges" for architecturally exposed structural steel.
- C. Design connections not detailed on the drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in Alabama.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Steel Angles and Plates: ASTM A36/A36M.
- B. Wide Flange Shapes: ASTM A992/A992M, Grade 50.
- C. Cold-Formed Structural Tubing: ASTM A500, Grade B.
- D. Steel Sheet: ASTM A1011/A1011M, Designation SS, Grade 30 hot-rolled, or ASTM A1008/A1008M, Designation SS, Grade 30 cold-rolled.
- E. Pipe: ASTM A53/A53M, Grade B, Finish black.
- F. High-Strength Structural Bolts, Nuts, and Washers: ASTM A325 (ASTM A325M), Type 1, medium carbon, plain.

- G. High-Strength Structural Bolts: ASTM A490 (ASTM A490M), with matching ASTM A563 (ASTM A563M) nuts and ASTM F436 washers; Type 1 alloy steel.
- H. Headed Anchor Rods: ASTM F1554, Grade 36, plain.
- I. Welding Materials: AWS D1.1; type required for materials being welded.
- J. Grout: Non-shrink, non-metallic aggregate type, complying with ASTM C1107/C1107M and capable of developing a minimum compressive strength of 7,000 psi at 28 days.
- K. Shop and Touch-Up Primer: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

- A. Shop fabricate to greatest extent possible.
- B. Fabricate connections for bolt, nut, and washer connectors.

2.03 FINISH

- A. Prepare structural component surfaces in accordance with SSPC SP 20.
- B. Shop prime structural steel members. Do not prime surfaces that will be field welded, in contact with concrete, or high strength bolted.

2.04 SOURCE QUALITY CONTROL

- A. Provide shop testing of structural steel.
- B. High-Strength Bolts: Provide testing and verification of shop-bolted connections in accordance with AISC "Specification for Structural Joints Using ASTM A325 or A490 Bolts".
- C. Welded Connections: Visually inspect all shop-welded connections.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that conditions are appropriate for erection of structural steel and that the work may properly proceed.

3.02 ERECTION

- A. Erect structural steel in compliance with AISC "Code of Standard Practice for Steel Buildings and Bridges".
- B. Allow for erection loads, and provide sufficient temporary bracing to maintain structure in safe condition, plumb, and in true alignment until completion of erection and installation of permanent bracing.
- C. Field weld components indicated on shop drawings.
- D. Use carbon steel bolts only for temporary bracing during construction, unless otherwise specifically permitted on drawings. Install high-strength bolts in accordance with AISC "Specification for Structural Joints Using ASTM A325 or A490 Bolts".
- E. Do not field cut or alter structural members without approval of Architect.
- F. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

- G. Grout solidly between column plates and bearing surfaces, complying with manufacturer's instructions for nonshrink grout. Trowel grouted surfaces smooth, splaying neatly to 45 degrees.

3.03 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch.

3.04 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00.
- B. High-Strength Bolts: Provide testing and verification of field-bolted connections in accordance with AISC "Specification for Structural Joints Using ASTM A325 or A490 Bolts".

END OF SECTION

SECTION 05 50 00

METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Shop fabricated steel items.

1.02 REFERENCE STANDARDS

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.
- B. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.
- C. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2013.
- D. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2014.
- E. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength; 2014.
- F. ASTM A325M - Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength (Metric); 2014.
- G. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2013.
- H. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2014.
- I. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.
- J. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015.
- K. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 1999 (Ed. 2004).
- L. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).
- M. SSPC-SP 2 - Hand Tool Cleaning; 1982 (Ed. 2004).

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
 - 1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
- C. Welders' Certificates: Submit certification for welders employed on the project, verifying AWS qualification within the previous 12 months.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

- A. Steel Sections: ASTM A 36/A 36M.
- B. Steel Tubing: ASTM A 500, Grade B cold-formed structural tubing.
- C. Plates: ASTM A 283.
- D. Pipe: ASTM A 53/A 53M, Grade B Schedule 40, black finish.
- E. Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1.
- F. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- G. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

- A. Fit and shop assemble items in largest practical sections, for delivery to site.
- B. Fabricate items with joints tightly fitted and secured.
- C. Continuously seal joined members by intermittent welds and plastic filler.
- D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
- F. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.03 FABRICATED ITEMS

- A. Ledge Angles, Shelf Angles, Channels, and Plates Not Attached to Structural Framing: For support of metal decking; prime paint finish.
- B. Lintels: As detailed; prime paint finish.

2.04 FINISHES - STEEL

- A. Prime paint all steel items.
 - 1. Exceptions: Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing.
- B. Prepare surfaces to be primed in accordance with SSPC-SP2.
- C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- D. Prime Painting: One coat.

2.05 FABRICATION TOLERANCES

- A. Squareness: 1/8 inch maximum difference in diagonal measurements.
- B. Maximum Offset Between Faces: 1/16 inch.
- C. Maximum Misalignment of Adjacent Members: 1/16 inch.

- D. Maximum Bow: 1/8 inch in 48 inches.
- E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.
- B. Beginning of installation means erector accepts existing conditions.

3.02 PREPARATION

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.03 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Field weld components indicated on shop drawings.
- D. Perform field welding in accordance with AWS D1.1/D1.1M.
- E. Obtain approval prior to site cutting or making adjustments not scheduled.
- F. After erection, prime welds, abrasions, and surfaces not shop primed.

3.04 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch.
- C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

SECTION 06 10 00

ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Preservative treated wood materials.
- B. Communications and electrical room mounting boards.
- C. Wood nailers and curbs for roofing and items installed on roof.
- D. Concealed wood blocking, nailers, and supports.

1.02 REFERENCE STANDARDS

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- C. AWWA U1 - Use Category System: User Specification for Treated Wood; 2012.
- D. PS 1 - Structural Plywood; 2009.
- E. PS 20 - American Softwood Lumber Standard; 2010.
- F. SPIB (GR) - Grading Rules; 2014.

1.03 QUALITY ASSURANCE

- A. Lumber: Comply with PS 20 and approved grading rules and inspection agencies.
 - 1. Lumber of other species or grades, or graded by other agencies, is acceptable provided structural and appearance characteristics are equivalent to or better than products specified.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
 - 1. If no species is specified, provide any species graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.
 - 2. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
- B. Lumber fabricated from old growth timber is not permitted.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

- A. Grading Agency: Southern Pine Inspection Bureau, Inc. (SPIB).
- B. Sizes: Nominal sizes as indicated on drawings, S4S.
- C. Moisture Content: S-dry or MC19.

- D. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
 - 1. Lumber: S4S, No. 2 or Standard Grade.
 - 2. Boards: Standard or No. 3.
- E. Miscellaneous Blocking, Furring, and Nailers:
 - 1. Lumber: S4S, No. 2 or Standard Grade.

2.03 CONSTRUCTION PANELS

- A. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.
- B. Other Applications:
 - 1. Plywood Concealed From View But Located Within Exterior Enclosure: PS 1, C-C Plugged or better, Exterior grade.
 - 2. Plywood Exposed to View But Not Exposed to Weather: PS 1, A-D, or better.
 - 3. Other Locations: PS 1, C-D Plugged or better.
 - 4. Electrical Component Mounting: APA rated sheathing, fire retardant treated.

2.04 ACCESSORIES

- A. Fasteners and Anchors:
 - 1. Metal and Finish: Hot-dipped galvanized steel per ASTM A 153/A 153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
 - 2. Drywall Screws: Bugle head, hardened steel, power driven type, length three times thickness of sheathing.
 - 3. Anchors: Toggle bolt type for anchorage to hollow masonry.

2.05 FACTORY WOOD TREATMENT

- A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
 - 1. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.
- B. Preservative Pressure Treatment of Lumber Above Grade: AWPA U1, Use Category UC3B, Commodity Specification A using waterborne preservative to 0.25 lb/cu ft retention.
 - 1. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
 - 2. Treat lumber in contact with masonry or concrete.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

- A. Select material sizes to minimize waste.
- B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.
- C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.02 BLOCKING, NAILERS, AND SUPPORTS

- A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

3.03 INSTALLATION OF CONSTRUCTION PANELS

- A. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches on center on all edges and into studs in field of board.
 - 1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
 - 2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
 - 3. Install adjacent boards without gaps.

END OF SECTION

SECTION 07 84 00

FIRESTOPPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Firestopping systems.
- B. Firestopping of all joints and penetrations in fire-resistance rated and smoke-resistant assemblies, whether indicated on drawings or not, and other openings indicated.

1.02 REFERENCE STANDARDS

- A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2015.
- B. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops; 2013a.
- C. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition.
- D. UL (FRD) - Fire Resistance Directory; current edition.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on product characteristics.

1.04 QUALITY ASSURANCE

- A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.

PART 2 PRODUCTS

2.01 FIRESTOPPING SYSTEMS

- A. Firestopping: Any material meeting requirements.
 - 1. Fire Ratings: See Drawings for required systems and ratings.

2.02 MATERIALS

- A. Firestopping Sealants: Provide only products having lower volatile organic compound (VOC) content than required by South Coast Air Quality Management District Rule No.1168.
- B. Elastomeric Silicone Firestopping: Single component silicone elastomeric compound and compatible silicone sealant; conforming to the following:
 - 1. Manufacturers:
 - a. 3M Fire Protection Products: www.3m.com/firestop.
 - b. Tremco: www.tremcofirestop.com
 - c. Hilti .
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Fibered Compound Firestopping: Formulated compound mixed with incombustible non-asbestos fibers; conforming to the following:
 - 1. Manufacturers:
 - a. A/D Fire Protection Systems Inc: www.adfire.com.
 - b. USG: www.usg.com.
 - c. Tremco: www.tremcofirestop.com

- d. Substitutions: See Section 01 60 00 - Product Requirements.
- D. Fiber Firestopping: Mineral fiber insulation used in conjunction with elastomeric surface sealer forming airtight bond to opening; conforming to the following:
 - 1. Manufacturers:
 - a. A/D Fire Protection Systems Inc: www.adfire.com.
 - b. Pecora Corporation: www.pecora.com.
 - c. Tremco: www.tremcofirestop.com
 - d. Thermafiber, Inc: www.thermafiber.com.
 - e. Substitutions: See Section 01 60 00 - Product Requirements.
- E. Firestop Devices - Wrap Type: Mechanical device with incombustible filler and sheet stainless steel jacket, intended to be installed after penetrating item has been installed; conforming to the following:
 - 1. Manufacturers:
 - a. 3M Fire Protection Products: www.3m.com/firestop.
 - b. Tremco: www.tremcofirestop.com
 - c. Substitutions: See Section 01 60 00 - Product Requirements.
- F. Intumescent Putty: Compound that expands on exposure to surface heat gain; conforming to the following:
 - 1. Manufacturers:
 - a. 3M Fire Protection Products: www.3m.com/firestop.
 - b. Tremco: www.tremcofirestop.com
 - c. Substitutions: See Section 01 60 00 - Product Requirements.
- G. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Type required for tested assembly design.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify openings are ready to receive the work of this section.

3.02 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter that could adversely affect bond of firestopping material.
- B. Remove incompatible materials that could adversely affect bond.
- C. Install backing materials to arrest liquid material leakage.

3.03 INSTALLATION

- A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.
- B. Do not cover installed firestopping until inspected by authority having jurisdiction.
- C. Install labeling required by code.

3.04 CLEANING

- A. Clean adjacent surfaces of firestopping materials.

3.05 PROTECTION

- A. Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 07 90 05

JOINT SEALERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Sealants and joint backing.
- B. Precompressed foam sealers.

1.02 REFERENCE STANDARDS

- A. ASTM C834 - Standard Specification for Latex Sealants; 2014.
- B. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014.
- C. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2013.
- D. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data indicating sealant chemical characteristics.

1.04 MOCK-UP

- A. Provide mock-up of sealant joints in conjunction with window under provisions of Section 01 40 00.
- B. Construct mock-up with specified sealant types and with other components noted.
- C. Locate where directed.
- D. Mock-up may remain as part of the Work.

1.05 FIELD CONDITIONS

- A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

1.06 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective work within a five year period after Date of Substantial Completion.
- C. Warranty: Include coverage for installed sealants and accessories which fail to achieve airtight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Gunnable and Pourable Sealants:
 - 1. BASF Construction Chemicals-Building Systems: www.buildingsystems.basf.com.
 - 2. Bostik Inc: www.bostik-us.com.
 - 3. Dow Corning Corporation: www.dowcorning.com.
 - 4. Tremco Global Sealants: www.tremcosealants.com.
 - 5. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 SEALANTS

- A. Sealants and Primers - General: Provide only products having lower volatile organic compound (VOC) content than required by South Coast Air Quality Management District Rule No.1168.
- B. Type 1 - General Purpose Exterior Sealant: Silicone; ASTM C920, Grade NS, Class 25 minimum; Uses M, G, and A; single component.
 - 1. Applications: Use for:
 - a. Control, expansion, and soft joints in masonry.
 - b. Joints between concrete and other materials.
 - c. Joints between metal frames and other materials.
 - d. Other exterior joints for which no other sealant is indicated.
- C. Type 2 - Exterior Expansion Joint Sealer: Precompressed foam sealer; urethane with water-repellent;
 - 1. Face color: As selected.
 - 2. Size as required to provide weathertight seal when installed.
 - 3. Applications: Use for:
 - a. Exterior wall expansion joints.
- D. Type 3 - Exterior Metal Lap Joint Sealant: Butyl or polyisobutylene, nondrying, nonskinning, noncuring.
 - 1. Applications: Use for:
 - a. Concealed sealant bead in sheet metal work.
 - b. Concealed sealant bead in siding overlaps.
- E. Type 4 - General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C834, Type OP, Grade NF single component, paintable.
 - 1. Applications: Use for:
 - a. Interior wall and ceiling control joints.
 - b. Joints between door and window frames and wall surfaces.
 - c. Other interior joints for which no other type of sealant is indicated.
- F. Type 5 - Bathtub/Tile Sealant: White silicone; ASTM C920, Uses I, M and A; single component, mildew resistant.
 - 1. Applications: Use for:
 - a. Joints between plumbing fixtures and floor and wall surfaces.
 - b. Joints between kitchen and bath countertops and wall surfaces.
- G. Type 6 - Concrete Paving Joint Sealant: Polyurethane, self-leveling; ASTM C920, Class 25, Uses T, I, M and A; single component.
 - 1. Color: Gray.
 - 2. Applications: Use for:
 - a. Joints in sidewalks and vehicular paving.

2.03 ACCESSORIES

- A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.
- B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.
- C. Joint Backing: Round foam rod compatible with sealant; ASTM D 1667, closed cell PVC; oversized 30 to 50 percent larger than joint width.
- D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces are ready to receive work.
- B. Verify that joint backing and release tapes are compatible with sealant.

3.02 PREPARATION

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.
- B. Clean and prime joints in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
- D. Protect elements surrounding the work of this section from damage or disfigurement.

3.03 INSTALLATION

- A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Perform installation in accordance with ASTM C1193.
- C. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.
- D. Install bond breaker where joint backing is not used.
- E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.
- F. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- G. Tool joints concave.
- H. Precompressed Foam Sealant: Do not stretch; avoid joints except at corners, ends, and intersections; install with face 1/8 to 1/4 inch below adjoining surface.

3.04 CLEANING

- A. Clean adjacent soiled surfaces.

3.05 PROTECTION

- A. Protect sealants until cured.

3.06 SCHEDULE

- A. Control and Expansion Joints in Paving: Type 6.
- B. Exterior Wall Expansion Joints: Type 2.
- C. Lap Joints in Exterior Sheet Metal Work: Type 3.
- D. Butt Joints in Exterior Metal Work and Siding: Type 1.
- E. Joints Between Exterior Metal Frames and Adjacent Work (except masonry): Type 1.
- F. Under Exterior Door Thresholds: Type 3.

- G. Interior Joints for Which No Other Sealant is Indicated: Type 4; colors as shown on the drawings.
- H. Control and Expansion Joints in Interior Concrete Slabs and Floors: Type 6.
- I. Joints Between Plumbing Fixtures and Walls and Floors, and Between Countertops and Walls: Type 5.

SECTION 08 11 13

HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Non-fire-rated steel doors and frames.
- B. Steel frames for wood doors.
- C. Fire-rated steel doors and frames.

1.02 RELATED REQUIREMENTS

- A. Section 08 71 00 - Door Hardware.
- B. Section 08 80 00 - Glazing: Glass for doors and borrowed lites.
- C. Section 09 90 00 - Painting and Coating: Field painting.

1.03 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- B. ANSI/ICC A117.1 - American National Standard for Accessible and Usable Buildings and Facilities; International Code Council; 2009.
- C. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2014.
- D. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2011.
- E. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames; 2014.
- F. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2009.
- G. NAAMM HMMA 840 - Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames; 2007.
- H. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2016.
- I. UL (BMD) - Building Materials Directory; Underwriters Laboratories Inc.; current edition.
- J. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced grade standard.
- C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and identifying location of different finishes, if any.
- D. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.

- E. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- B. Maintain at the project site a copy of all reference standards dealing with installation.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store in accordance with NAAMM HMMA 840.
- B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Steel Doors and Frames:
1. Assa Abloy Ceco or Curries: www.assaabloydss.com.
 2. Mesker: www.meskerdoor.com.
 3. Overly Manufacturing Company: www.overly.com.
 4. Republic Doors: www.republicdoor.com.
 5. Steelcraft, an Allegion brand: www.allegion.com/us.

2.02 DOORS AND FRAMES

- A. Requirements for All Doors and Frames:
1. Accessibility: Comply with ICC A117.1 and ADA Standards.
 2. Door Texture: Smooth faces.
 3. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.
 4. Hardware Preparation: In accordance with BHMA A156.115, with reinforcement welded in place, in addition to other requirements specified in door grade standard.
 5. Finish: Factory primed, for field finishing.
- B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with all the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.03 STEEL DOORS

- A. Interior Doors, Non-Fire-Rated:
1. Grade: ANSI A250.8 - SDI-100; Level 3 - Extra Heavy-Duty, Physical Performance Level A, Model 2 - Seamless.
 2. Core: Polyurethane.
- B. Interior Doors, Fire-Rated:
1. Grade: ANSI A250.8 - SDI-100; Level 3 - Extra Heavy-Duty, Physical Performance Level A, Model 2 - Seamless.
 2. Fire Rating: As indicated on drawings, tested in accordance with UL 10C ("positive pressure").
 - a. Provide units listed and labeled by UL (Underwriters Laboratories) - UL (BMD).
 - b. Attach fire rating label to each fire rated unit.
 3. Core: Mineral board.

2.04 STEEL FRAMES

- A. General:
 - 1. Comply with the requirements of grade specified for corresponding door.
 - 2. Finish: Same as for door.
- B. Interior Door Frames, Non-Fire-Rated: Face welded type.
- C. Interior Door Frames, Fire-Rated: Face welded type.
 - 1. Fire Rating: Same as door, labeled.
 - 2. Frames for fire rated openings shall be classified and listed in accordance with latest addition of NFPA 80 and tested in compliance with NFPA-252 and UL10C. A physical label is to be affixed to the fire door frame at an authorized facility.

2.05 ACCESSORY MATERIALS

- A. Glazing: As specified in Section 08 80 00, factory installed.
- B. Mechanical Fasteners for Concealed Metal-to-Metal Connections: Self-drilling, self-tapping, steel with electroplated zinc finish.
- C. Electrical Wiring:
 - 1. Provide hollow metal doors receiving electrified hardware with concealed wiring harness and standardized Molex plug connectors on both ends to accommodate up to twelve wires. Coordinate connectors on end of the wiring harness to plug directly into the electrified hardware and the electric thru wire hinge or pivot specified in hardware sets in Section 08 71 00 - Door Hardware.
 - 2. Provide hollow metal frames receiving electrified hardware with concealed wiring harness and standard Molex plug connectors on one end to accommodate up to twelve wires. Coordinate connectors on end of the wiring harness to plug directly into the electric thru wire hinge or pivot specified in hardware sets in Section 08 71 00 - Door Hardware.

2.06 FINISH MATERIALS

- A. Primer: Rust-inhibiting, complying with ANSI A250.10, door manufacturer's standard.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 INSTALLATION

- A. Install in accordance with the requirements of the specified door grade standard and NAAMM HMMA 840.
- B. In addition, install fire rated units in accordance with NFPA 80.
- C. Coordinate frame anchor placement with wall construction.
- D. Coordinate installation of hardware.
- E. Coordinate installation of glazing.
- F. Coordinate installation of electrical connections to electrical hardware items.

- G. Touch up damaged factory finishes.

3.03 TOLERANCES

- A. Maximum Diagonal Distortion: 1/16 in measured with straight edge, corner to corner.

3.04 ADJUSTING

- A. Adjust for smooth and balanced door movement.

3.05 SCHEDULE - SEE DRAWINGS

END OF SECTION

SECTION 08 14 16

FLUSH WOOD DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Flush wood doors; flush configuration; fire rated and non-rated.

1.02 RELATED REQUIREMENTS

- A. Section 06 20 00 - Finish Carpentry.
- B. Section 08 11 13 - Hollow Metal Doors and Frames.
- C. Section 08 71 00 - Finish Hardware.
- D. Section 08 80 00 - Glazing.

1.03 REFERENCE STANDARDS

- A. AWI/AWMAC (QSI) - Architectural Woodwork Quality Standards Illustrated; Architectural Woodwork Institute and Architectural Woodwork Manufacturers Association of Canada; 2005, 8th Ed., Version 2.0.
- B. ICC (IBC) - International Building Code; 2012.
- C. ITS (DIR) - Directory of Listed Products; Intertek Testing Services NA, Inc.; current edition.
- D. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2016.
- E. UL (BMD) - Building Materials Directory; Underwriters Laboratories Inc.; current edition.
- F. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.
- C. Specimen warranty.
- D. Shop Drawings: Illustrate door opening criteria, elevations, sizes, types, swings, undercuts required, special beveling, special blocking for hardware, factory machining criteria, identify cutouts for glazing.
- E. Samples: Submit two samples of door veneer, 4x6 inch in size illustrating wood grain, stain color, and sheen.
- F. Manufacturer's Installation Instructions: Indicate special installation instructions.
- G. Warranty, executed in Owner's name.

1.05 QUALITY ASSURANCE

- A. Perform work in accordance with AWI Architectural Woodwork Quality Standards Illustrated, Section 1300, Custom Grade. Maintain one copy on site.

- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.06 REGULATORY REQUIREMENTS

- A. Fire Door and Panel Construction: Conform to NFPA 252.
 - 1. Listed and classified by UL as suitable to for the purpose specified and indicated.
- B. Installed Fire Rated Door and Transom Panel Assembly: Conform to NFPA 80 for fire rated class as indicated.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Package, deliver and store doors in accordance with specified quality standard.
- B. Accept doors on site in manufacturer's packaging. Inspect for damage.
- C. Protect doors with resilient packaging sealed with heat shrunk plastic. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges with tinted sealer if stored more than one week. Break seal on site to permit ventilation.

1.08 PROJECT CONDITIONS

- A. Coordinate the work with door opening construction, door frame and door hardware installation.

1.09 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Interior Doors: Provide manufacturer's warranty for the life of the installation.
- C. Provide warranty for the following term:
 - 1. Interior Doors: Life of installation.
- D. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Wood Veneer Faced Doors:
 - 1. Eggers Industries: www.eggersindustries.com.
 - 2. Graham Wood Doors: www.grahamdoors.com.
 - 3. Chappell Door Company: www.chappelldoor.net
 - 4. Marshfield DoorSystems, Inc: www.marshfelddoors.com.
 - 5. Oshkosh Door Company: www.oshkoshdoor.com
 - 6. Algoma Hardwoods, Inc. : www.algomahardwoods.com.
 - 7. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 DOORS

- A. All Doors: See drawings for locations and additional requirements.
- B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.
 - 1. Provide solid core doors at all locations .
 - 2. Fire Rated Doors: Tested to ratings indicated on drawings in accordance with International Building Code ("positive pressure"); UL or WH (ITS) labeled without any visible seals when door is open.

2.03 DOOR AND PANEL CORES

- A. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core (PC), plies and faces as indicated above.
- B. Fire Rated Doors: Mineral core, Type FD, plies and faces as indicated above; with core blocking as required to provide adequate anchorage of hardware without through-bolting.

2.04 DOOR FACINGS

- A. Interior Doors - Veneer: Select White Birch species, veneer grade as specified by door quality standard, plain sliced select, with book matched grain, for transparent finish.
 - 1. 5-ply construction.
- B. Facing Adhesive: Type I - waterproof.

2.05 ACCESSORIES

- A. Glazing Stops: Rolled steel channel shape, color black, mitered corners; prepared for countersink style tamper proof screws.

2.06 DOOR CONSTRUCTION

- A. Fabricate doors in accordance with door quality standard specified.
- B. Cores Constructed with stiles and rails:
- C. Fabricate fire rated doors in accordance with UL requirements. Attach fire rating label to door.
- D. Astragals for Non-Rated Double Doors: Steel, T shaped, overlapping and recessed at face edge.
- E. Provide solid blocks at lock edge for hardware reinforcement.
- F. Fit door edge trim to edge of stiles after applying veneer facing.
- G. Vertical Exposed Edge of Stiles - Veneer Faces: Of same species as veneer facing.
- H. Fit door edge trim to edge of stiles after applying veneer facing.
- I. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.
- J. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
- K. Provide edge clearances in accordance with AWI Quality Standards Illustrated Section 1700.
- L. Electrical Wiring: Provide flush wood doors receiving electrified hardware with concealed wiring harness and standardized Molex™ plug connectors on both ends to accommodate up to twelve wires. Coordinate connectors on end of the wiring harness to plug directly into the electrified hardware and the electric thru wire hinge or pivot specified in hardware sets in Section 08 71 00 "Door Hardware".

2.07 FACTORY FINISHING - WOOD VENEER DOORS

- A. Factory finish doors in accordance with approved sample.
 - 1. All doors are to remain protected by individual poly-bagging or some other means until the job is accepted.

2. Minor damage to the finish of the door may be touched up in accordance with the manufacturer's recommendations. More extensive damage shall result in replacement of the door at no additional cost to the Owner.
- B. Seal door top and bottom edges with color sealer to match door facing.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.02 INSTALLATION

- A. Install doors in accordance with manufacturer's instructions and specified quality standard.
 1. Install fire-rated doors in accordance with NFPA 80 requirements.
- B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.
- C. Trim door height by cutting bottom edges to a maximum of 3/4 inch (19 mm).
 1. Trim fire door height at bottom edge only, in accordance with fire rating requirements.
- D. Use machine tools to cut or drill for hardware.
- E. Coordinate installation of doors with installation of frames and hardware.
- F. Coordinate installation of glazing.

3.03 TOLERANCES

- A. Conform to specified quality standard for fit and clearance tolerances.
- B. Conform to specified quality standard for telegraphing, warp, and squareness.

3.04 ADJUSTING

- A. Adjust doors for smooth and balanced door movement.
- B. Adjust closers for full closure.

3.05 SCHEDULE - SEE DRAWINGS

END OF SECTION

SECTION 08 71 00

DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes commercial door hardware for the following:
 - 1. Swinging doors.
 - 2. Other doors to the extent indicated.
- B. Door hardware includes, but is not necessarily limited to, the following:
 - 1. Mechanical door hardware.
 - 2. Electromechanical door hardware.
 - 3. Cylinders specified for doors in other sections.
- C. Related Sections:
 - 1. Division 08 Section "Door Hardware Schedule".
 - 2. Division 08 Section "Hollow Metal Doors and Frames".
 - 3. Division 08 Section "Flush Wood Doors".
 - 4. Division 28 Section "Access Control".
- D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
 - 1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
 - 2. FEMA 361 2008 - Design and Construction Guidance for Community Safe Rooms.
 - 3. ICC/IBC - International Building Code.
 - 4. NFPA 70 - National Electrical Code.
 - 5. NFPA 80 - Fire Doors and Windows.
 - 6. NFPA 101 - Life Safety Code.
 - 7. NFPA 105 - Installation of Smoke Door Assemblies.
 - 8. UL/ULC and CSA C22.2 – Standards for Automatic Door Operators Used on Fire and Smoke Barrier Doors and Systems of Doors.
 - 9. State Building Codes, Local Amendments.
- E. Standards: All hardware specified herein shall comply with the following industry standards:
 - 1. ANSI/BHMA Certified Product Standards - A156 Series

2. UL10C – Positive Pressure Fire Tests of Door Assemblies

1.3 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.
- B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
 2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
 3. Content: Include the following information:
 - a. Type, style, function, size, label, hand, and finish of each door hardware item.
 - b. Manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
 - e. Explanation of abbreviations, symbols, and codes contained in schedule.
 - f. Mounting locations for door hardware.
 - g. Door and frame sizes and materials.
 - h. Warranty information for each product.
 4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.
- C. Shop Drawings: Details of electrified access control hardware indicating the following:
 1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:
 - a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.

- b. Complete (risers, point-to-point) access control system block wiring diagrams.
 - c. Wiring instructions for each electronic component scheduled herein.
- 2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.
- D. Proof of Certification: Provide copy of manufacturer(s) official certification or accreditation document indicating proof of status as a qualified and authorized provider of the primary Integrated Wiegand Access Control Products.
- E. Proof of Certification: Provide copy of manufacturer(s) official certification or accreditation document indicating proof of status as a qualified installer of Windstorm assemblies.
- F. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.
- G. Informational Submittals:
 - 1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.
- H. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Submittals.

1.4 QUALITY ASSURANCE

- A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.
- B. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.
- D. Integrated Wiegand, Wireless, and IP-Enabled Access Control Products Supplier Qualifications: Integrated access control products and accessories are required to be supplied and installed

through current members of the ASSA ABLOY "Authorized Channel Partner" (ACP) and "Certified Integrator" (CI) programs. Suppliers are to be factory trained, certified prior to project bid, and a direct purchaser of the specified product. Installers are to be factory trained, certified prior to project bid, and are responsible for commissioning, servicing, and warranting the installed equipment specified for the project.

- E. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.
 - 1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
 - 2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.
- F. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.
- G. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:
 - 1. Function of building, purpose of each area and degree of security required.
 - 2. Plans for existing and future key system expansion.
 - 3. Requirements for key control storage and software.
 - 4. Installation of permanent keys, cylinder cores and software.
 - 5. Address and requirements for delivery of keys.
- H. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.
 - 1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
 - 2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
 - 3. Review sequence of operation narratives for each unique access controlled opening.
 - 4. Review and finalize construction schedule and verify availability of materials.
 - 5. Review the required inspecting, testing, commissioning, and demonstration procedures
- I. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.6 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
- B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.
- C. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
 - 1. Structural failures including excessive deflection, cracking, or breakage.
 - 2. Faulty operation of the hardware.
 - 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 4. Electrical component defects and failures within the systems operation.
- C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.
- D. Special Warranty Periods:

1. Seven years for heavy duty cylindrical (bored) locks and latches.
2. Five years for exit hardware.
3. Twenty five years for manual surface door closer bodies.
4. Two years for electromechanical door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.
- B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:
- C. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.
- D. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 HANGING DEVICES

- A. Hinges: ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles as specified in the Door Hardware Sets.
 1. Quantity: Provide the following hinge quantity, unless otherwise indicated:
 - a. Two Hinges: For doors with heights up to 60 inches.
 - b. Three Hinges: For doors with heights 61 to 90 inches.
 - c. Four Hinges: For doors with heights 91 to 120 inches.
 - d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
 2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
 - a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
 - b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.
 3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
 - a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.

- b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.
 - c. Tornado Resistant Assemblies: At a minimum, provide heavy weight hinges with stainless steel screws used in accordance with and specified as part of a Severe Storm Shelter Opening meeting ICC 500 and FEMA 361.
 - 4. Hinge Options: Comply with the following where indicated in the Hardware Sets or on Drawings:
 - a. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.
 - 5. Acceptable Manufacturers:
 - a. Hager Companies (HA).
 - b. McKinney Products (MK).
 - c. Ives 5BB1
- B. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 certified continuous geared hinge. with minimum 0.120-inch thick extruded 6060 T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.
 - 1. Acceptable Manufacturers:
 - a. Bommer Industries (BO).
 - b. Hager Companies (HA).
 - c. McKinney Products (MK).
 - d. Pemko Manufacturing (PE).
 - e. Ives 224HD
- C. Continuous Geared Double-acting Hinges. ANSI/BHMA A156.26 Grade 1-600 Certified continuous geared hinges. Hinges are non-handed and allow the door to swing up to 100 degrees in either direction.
 - 1. Acceptable Manufacturers:
 - a. Pemko Manufacturing (PE) – DHS Series.
- D. Pin and Barrel Continuous Hinges: ANSI/BHMA A156.26 Grade 1-600 certified pin and barrel continuous hinges with minimum 14 gauge Type 304 stainless steel hinge leaves, concealed teflon coated stainless pin, and twin self lubricated nylon bearings at each knuckle separation. Factory trim hinges to suit door height and prepare for electrical cut-outs.
 - 1. Acceptable Manufacturers:
 - a. Hager Companies (HA).
 - b. Markar Products (MR).
 - c. McKinney Products (MK).

- d. Pemko Manufacturing (PE).
- e. Ives 705

2.3 POWER TRANSFER DEVICES

- A. Electrified Quick Connect Transfer Hinges: Provide electrified transfer hinges with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Acceptable Manufacturers:

- a. Hager Companies (HA) - ETW-QC (# wires) Option.
- b. McKinney Products (MK) - QC (# wires) Option.
- c. Ives – TW

- B. Electrified Quick Connect Continuous Geared Transfer Hinges: Provide electrified transfer continuous geared hinges with a 12" removable service panel cutout accessible without de-mounting door from the frame. Furnish with Molex™ standardized plug connectors with sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Acceptable Manufacturers:

- a. Bommer Industries (BO) - SER-QC (# of wires) Option.
- b. McKinney Products (MK) - SER-QC (# wires) Option.
- c. Pemko Manufacturing (PE) - SER-QC (# wires) Option.

- C. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.

1. Provide one each of the following tools as part of the base bid contract:

- a. McKinney Products (MK) - Electrical Connecting Kit: QC-R001.
- b. McKinney Products (MK) - Connector Hand Tool: QC-R003.
- c. CON

2. Acceptable Manufacturers:

- a. McKinney Products (MK) – QC-C Series.

2.4 DOOR OPERATING TRIM

- A. Flush Bolts and Surface Bolts: ANSI/BHMA A156.3 and A156.16, Grade 1, certified.
 - 1. Manual flush bolts to be furnished with top rod of sufficient length to allow bolt location approximately six feet from the floor.
 - 2. Furnish dust proof strikes for bottom bolts.
 - 3. Surface bolts to be minimum 8" in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
 - 4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
 - 5. Acceptable Manufacturers:
 - a. Door Controls International (DC).
 - b. Rockwood Manufacturing (RO).
 - c. Trimco (TC).
- B. Coordinators: ANSI/BHMA A156.3 certified door coordinators consisting of active-leaf, hold-open lever and inactive-leaf release trigger. Model as indicated in hardware sets.
 - 1. Acceptable Manufacturers:
 - a. Door Controls International (DC).
 - b. Rockwood Manufacturing (RO).
 - c. Trimco (TC).
- C. Door Push Plates and Pulls: ANSI/BHMA A156.6 certified door pushes and pulls of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.
 - 1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
 - 2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
 - 3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
 - 4. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.
 - 5. Acceptable Manufacturers:
 - a. Hiawatha, Inc. (HI).
 - b. Rockwood Manufacturing (RO).
 - c. Trimco (TC).

2.5 CYLINDERS AND KEYING

- A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.

- B. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as locksets and exit devices, unless otherwise indicated.
- C. Cylinders: Original manufacturer cylinders complying with the following:
 - 1. Mortise Type: Threaded cylinders with rings and cams to suit hardware application.
 - 2. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
 - 3. Bored-Lock Type: Cylinders with tailpieces to suit locks.
 - 4. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
 - 5. Keyway: Manufacturer's Standard.
- D. Permanent Cores: Manufacturer's standard; finish face to match lockset; complying with the following:
 - 1. Interchangeable Cores: Core insert, removable by use of a special key; usable with other manufacturers' cylinders.
- E. Patented Cylinders: ANSI/BHMA A156.5, Grade 1, certified cylinders employing a utility patented and restricted keyway requiring the use of patented controlled keys. Provide bump resistant, fixed core cylinders as standard with solid recessed cylinder collars. Cylinders are to be factory keyed where permanent keying records will be established and maintained.
 - 1. Provide a 6 pin multi-level master key system comprised of patented controlled keys and security and high security cylinders operated by one (1) key of the highest level. Geographical exclusivity to be provided for all security and high security cylinders and UL437 certification where specified.
 - a. Level 1 Cylinders: Provide utility patented controlled keyway cylinders that are furnished with patented keys available only from authorized distribution.
 - b. Level 2 Cylinders: Provide utility patented controlled keyway and side bar locking incorporating unique angled bottom pins for geographical exclusivity. Cylinders constructed to provide protection against bumping and picking.
 - c. Level 3 Cylinders: Provide utility patented controlled keyway and side bar locking incorporating unique angled bottom pins for geographical exclusivity. Cylinders to be UL437 certified and constructed to provide protection against bumping, picking, and drilling.
 - d. Refer to hardware sets for specified levels.
 - 2. Acceptable Manufacturers:
 - a. Sargent Manufacturing (SA) - Degree Series.
 - b. Corbin Russwin (RU) – Access 3 Series.
 - c. No Substitution.
- F. Key Quantity: Provide the following minimum number of keys:
 - 1. Change Keys per Cylinder: Three (3).
 - 2. Master Keys (per Master Key Level/Group): Five (5).
 - 3. Construction Keys (where required): Ten (10).
- G. Construction Keying: Provide temporary keyed construction cores.

H. Key Registration List (Bitting List):

1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
2. Provide transcript list in writing or electronic file as directed by the Owner.

I. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150% of the number of locks required for the project.

1. Acceptable Manufacturers:

- a. Lund Equipment (LU).
- b. MMF Industries (MM).
- c. Telkee (TK).

2.6 MECHANICAL LOCKS AND LATCHING DEVICES

A. Cylindrical Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.2, Series 4000, Grade 1 certified.

1. Furnish with solid cast levers, standard 2 3/4" backset, and 1/2" (3/4" at rated paired openings) throw brass or stainless steel latchbolt.
2. Locks are to be non-handed and fully field reversible.
3. Extended cycle test: Locks to have been cycle tested in ordinance with ANSI/BHMA 156.2 requirements to 2 million cycles.
4. Acceptable Manufacturers:
 - a. Corbin Russwin Hardware (RU) – CL3300 Series.
 - b. Schlage ND

2.7 ELECTROMECHANICAL LOCKING DEVICES

A. Electromechanical Mortise Locksets, Grade 1 (Heavy Duty): Subject to same compliance standards and requirements as mechanical mortise locksets, electrified locksets to be of type and design as specified below.

1. Electrified Lock Options: Where indicated in the Hardware Sets, provide electrified options including: outside door lock/unlock trim control, latchbolt and lock/unlock status monitoring, deadbolt monitoring, and request-to-exit signaling. Support end-of-line resistors contained within the lock case. Unless otherwise indicated, provide electrified locksets standard as fail secure.
2. Energy Efficient Design: Provide lock bodies which have a holding current draw of 15mA maximum, and can operate on either 12 or 24 volts. Locks are to be field configurable for fail safe or fail secure operation.

3. Acceptable Manufacturers:

- a. Corbin Russwin Hardware (RU) - ML20900 Series.
- b. Schlage L909X

2.8 INTEGRATED WIEGAND OUTPUT ACCESS CONTROL LOCKING DEVICES

- A. Integrated Wiegand Output Mortise Locks: Wiegand output ANSI A156.13, Grade 1, mortise lockset with integrated proximity card reader, request-to-exit signaling, door position status switch, and latchbolt monitoring in one complete unit. Hard wired, solenoid driven locking/unlocking control of the lever handle trim, 3/4" deadlocking anti-friction latch, and 1" case-hardened steel deadbolt. Lock is U.L listed and labeled for use on up to 3 hour fire rated openings. Available with or without keyed high security cylinder override.
- 1. Open architecture, hard wired platform supports centralized control of locking units with new or existing Wiegand compatible access control systems. Latchbolt monitoring and door position switch act in conjunction to report door-in-frame (DPS) and door latched (door closed and latched) conditions.
 - 2. Reader supports either HID 125 kHz proximity (up to 39 bits, including Corporate 1000) or 13.56 MHz (2K-32K) iClass® credentials.
 - 3. 12VDC external power supply required for reader and lock, with optional 24VDC operation available with iClass® reader (125 kHz reader is always 12VDC). Fail safe or fail secure options.
 - 4. Energy Efficient Design: Provide lock bodies which have a holding current draw of 15mA maximum, and can operate on either 12 or 24 volts. Locks are to be field configurable for fail safe or fail secure operation.
 - 5. Installation requires only one cable run from the lock to the access control panel without requirements for additional proprietary lock panel interface boards or modules.
 - 6. Support end-of-line resistors contained within the lock case.
 - 7. Installation to include manufacturer's access control panel interface board or module where required for Wiegand output protocol.
8. Acceptable Manufacturers:
- a. Corbin Russwin Hardware (RU) - Access 600 - ML20600 RNE1 Series.
 - b. Schlage AD-300

2.9 AUXILIARY LOCKS

- A. Mortise Deadlocks, Small Case: ANSI/BHMA A156.5, Grade 1, certified small case mortise type deadlocks constructed of heavy gauge wrought corrosion resistant steel. Steel or stainless steel bolts with a 1" throw and hardened steel roller pins. Deadlocks to be products of the same source manufacturer and keyway as other specified locksets.
1. Acceptable Manufacturers:
- a. Corbin Russwin Hardware (RU) - DL4100 Series.
 - b. Schlage L400

2.10 LOCK AND LATCH STRIKES

- A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:
1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
 2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
 3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
 4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.
- B. Standards: Comply with the following:
1. Strikes for Mortise Locks and Latches: BHMA A156.13.
 2. Strikes for Bored Locks and Latches: BHMA A156.2.
 3. Strikes for Auxiliary Deadlocks: BHMA A156.5.
 4. Dustproof Strikes: BHMA A156.16.

2.11 ELECTRIC STRIKES

- A. Standard Electric Strikes: Heavy duty, cylindrical and mortise lock electric strikes conforming to ANSI/BHMA A156.31, Grade 1, UL listed for both Burglary Resistance and for use on fire rated door assemblies. Stainless steel construction with dual interlocking plunger design tested to exceed 3000 lbs. of static strength and 350 ft-lbs. of dynamic strength. Strikes tested for a minimum 1 million operating cycles. Provide strikes with 12 or 24 VDC capability and supplied standard as fail-secure unless otherwise specified. Option available for latchbolt and latchbolt strike monitoring indicating both the position of the latchbolt and locked condition of the strike.
1. Acceptable Manufacturers:
 - a. Folger Adam EDC (FO).
 - b. HES (HS).
 - c. Von Duprin 6000

2.12 CONVENTIONAL EXIT DEVICES

- A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:
1. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
 2. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the

proper fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.

3. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
 4. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
 5. Electromechanical Options: Subject to same compliance standards and requirements as mechanical exit devices, electrified devices to be of type and design as specified in hardware sets. Include any specific controllers when conventional power supplies are not sufficient to provide the proper inrush current.
 6. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.
 - a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
 - b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.
 7. Vertical Rod Exit Devices: Provide and install interior surface and concealed vertical rod exit devices as Less Bottom Rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.
 8. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.
 9. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
 10. Rail Sizing: Provide exit device rails factory sized for proper door width application.
 11. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.
- B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 certified panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be stainless steel, pullman type, with deadlock feature.
1. Acceptable Manufacturers:
 - a. Corbin Russwin Hardware (RU) - ED4000 / ED5000 Series.
 - b. Sargent Manufacturing (SA) - 80 Series.
 - c. Yale Locks and Hardware (YA) - 7000 Series.
 - d. Von Duprin 35/98 Series
- C. Security Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 certified rim panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be constructed of high grade, heat treated, corrosion resistant nickel steel alloy, and have a full 3/4" throw projection with slide action positive deadlocking.

1. Static Load Force Resistance: Minimum 3000 lbs certified independent tested.
 2. Acceptable Manufacturers:
 - a. Corbin Russwin Hardware (RU) - ED4000S / ED5000S Series.
 - b. Von Duprin XP98
- D. Tube Steel Removable Mullions: ANSI/BHMA A156.3 removable steel mullions with malleable-iron top and bottom retainers and a primed paint finish.
1. Provide keyed removable feature where specified in the Hardware Sets.
 2. Provide stabilizers and mounting brackets as required.
 3. Provide electrical quick connection wiring options as specified in the hardware sets.
 4. Acceptable Manufacturers:
 - a. Corbin Russwin Hardware (RU) - 700/900 Series.
 - b. Von Duprin 4954/9954

2.13 INTEGRATED WIEGAND OUTPUT ACCESS CONTROL EXIT DEVICES

- A. Wiegand Output Integrated Card Reader Exit Hardware: Wiegand output ANSI 156.3 Grade 1 rim, mortise, and vertical rod exit device hardware with integrated proximity card reader, latchbolt and touchbar monitoring, and request-to-exit signaling, in one complete unit. Hard wired, solenoid driven locking/unlocking control of the lever handle exit trim with 3/4" throw latch bolt. U.L listed and labeled for either panic or "fire exit hardware" for use on up to 3 hour fire rated openings. Available with or without keyed high security cylinder override.
1. Open architecture, hard wired platform supports centralized control of locking units with new or existing Wiegand compatible access control systems. Inside push bar (request-to-exit) signaling and door position (open/closed status) monitoring (via separately connected DPS).
 2. Reader supports either HID 125 kHz proximity (up to 39 bits, including Corporate 1000) or 13.56 MHz (2K-32K) iClass® credentials.
 3. 12VDC external power supply required for reader, with optional 24VDC operation available with iClass® reader (125 kHz reader is always 12VDC). 24VDC required for solenoid operated exit trim (12VDC if applicable). Fail safe or fail secure options.
 4. Installation requires only one cable run from the exit hardware to the access control panel without requirements for additional proprietary lock panel interface boards or modules.
 5. Installation to include manufacturer's access control panel interface board or module where required for Wiegand output protocol.
 6. Acceptable Manufacturers:
 - a. Corbin Russwin Hardware (RU) - Access 600 - ED5000 RNE1 Series.
 - b. Von 98 x AD-300

2.14 DOOR CLOSERS

- A. All door closers specified herein shall meet or exceed the following criteria:
1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers including installation and adjusting information on inside of cover.
 2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
 3. Cycle Testing: Provide closers which have surpassed 15 million cycles in a test witnessed and verified by UL.
 4. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the physically handicapped, provide units complying with ANSI ICC/A117.1.
 5. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
 6. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
 7. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates, and through-bolt and security type fasteners as required for proper installation.
- B. Door Closers, Surface Mounted (Large Body Cast Iron): ANSI/BHMA A156.4, Grade 1 surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control.
1. Acceptable Manufacturers:
 - a. Corbin Russwin Hardware (RU) - DC8000 Series.
 - b. Norton Door Controls (NO) – 9500 Series.
 - c. Sargent Manufacturing (SA) - 281 Series.
 - d. LCN 4040XP

2.15 ARCHITECTURAL TRIM

- A. Door Protective Trim
1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.

2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1" LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.
3. Protection Plates: ANSI/BHMA A156.6 certified protection plates (kick, armor, or mop), fabricated from the following:
 - a. Stainless Steel: 300 grade, .050-inch thick.
4. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.
5. Acceptable Manufacturers:
 - a. Rockwood Manufacturing (RO).
 - b. Trimco (TC).

2.16 DOOR STOPS AND HOLDERS

- A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.
- B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.
 1. Acceptable Manufacturers:
 - a. Hiawatha, Inc. (HI).
 - b. Rockwood Manufacturing (RO).
 - c. Trimco (TC).
- C. Overhead Door Stops and Holders: ANSI/BHMA A156.6, Grade 1 certified overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.
 1. Acceptable Manufacturers:
 - a. Architectural Builders Hardware (AH).
 - b. Rixson Door Controls (RF).
 - c. Rockwood Manufacturing (RO).
 - d. Sargent Manufacturing (SA).

2.17 ARCHITECTURAL SEALS

- A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.
- B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
 - 1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.
- C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.
 - 1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and UBC 7-2, Fire Tests of Door Assemblies.
- D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.
- E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
- F. Acceptable Manufacturers:
 - 1. National Guard Products (NG).
 - 2. Pemko Manufacturing (PE).
 - 3. Reese Enterprises, Inc. (RE).

2.18 ELECTRONIC ACCESSORIES

- A. Networked Proximity Card Readers: Card readers to support HID 125 kHz proximity technology and interface with the access control reader modules and door control hardware devices as specified. Card readers to meet the following, minimum, design and performance specifications.
 - 1. Reader to operate on 12VDC or 5VDC power from the reader I/O modules at a maximum current rating of 150 mA per reader.
 - 2. Reader to be weatherproof type when installed in exterior or other wet environments.
 - 3. Reader to communicate with the reader I/O modules using industry standard Wiegand protocol interface.
 - 4. Reader to have multi-color LED display and audible status indications.
 - 5. Reader type and model to meet the design and mounting applications needs of each entry point as indicated on the drawings.
 - 6. Acceptable Manufacturers (125 kHz Proximity):
 - a. Corbin Russwin Hardware (RU) - 752F909/751F929 Series.
 - b. HID Global (HG) - MiniProx 5365/ProxPro II 5455 Series.

- c. Sargent Manufacturing (SA) - 4302/4304 Series.
 - d. Aptiq Series
- B. Key Switches: Key switches furnished standard with stainless steel single gang face plate with a 12/24VDC bi-color LED indicator. Integral backing bracket permits integration with any 1 1/4" or 1 1/2" mortise type cylinder. Key switches available as momentary or maintained action and in narrow face plate options.
 - 1. Acceptable Manufacturers:
 - a. Securitron (SU) - MK Series.
- C. Power Supplies: Provide Nationally Recognized Testing Laboratory Listed 12VDC or 24VDC (field selectable) filtered and regulated power supplies. Include battery backup option with integral battery charging capability in addition to operating the DC load in event of line voltage failure. Provide the least number of units, at the appropriate amperage level, sufficient to exceed the required total draw for the specified electrified hardware and access control equipment.
 - 1. Acceptable Manufacturers:
 - a. Corbin Russwin Hardware (RU) – 782.
 - b. Securitron (SU) - BPS Series.
 - c. Yale Locks and Hardware (YA) 782.
 - d. Von Duprin PS900
- D. Energy Efficient Switching Power Supplies: Provide UL listed or recognized filtered and regulated power supplies. Provide single voltage units as shown in the hardware sets. Units must have one access control input and one fire alarm input. Standby power consumption of unit must be less than 10mW at 120VAC. Provide integral battery backup as standard for all units. Provide the least number of units, at the appropriate amperage level, sufficient to exceed the required total draw for the specified electrified hardware and access control equipment.
 - 1. Acceptable Manufacturers:
 - a. Securitron (SU) – EPS Series.

2.19 FABRICATION

- A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.20 FINISHES

- A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware.
- C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

- A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.
- B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

- A. Shop Installation: Install hardware on the doors prior to shipment to the jobsite. Field installed hardware will only be permitted as itemized below. Comply with all other Part 3 installation requirements.
 - 1. Extent of shop installed hardware shall include, but is not limited to:
 - a. Hanging devices.
 - b. Latching devices.
 - c. Operating trim.
 - d. Through-door wiring cables.
 - e. Door closers and overhead stops.
 - f. Flush bolts, surface bolts, and coordinating accessories.
 - g. Protective trim – protection plates, edge guards, trim protectors.
 - h. Coat hooks, viewers, and all other door mounted accessories.
 - 2. Hardware items which are permitted to be installed in the field include:
 - a. Door stops (wall, floor, other mounting).
 - b. Frame mounted closer brackets.
 - c. Lock and latch strike plates.
 - d. Frame wiring cables.

3. Bench test shop installed work. This includes both mechanical and electrical components. Replace defective items.
 4. Ship field installed hardware items clearly labeled with the door number and attached to the door using shrink wrap. Include all templates and instructions which are required to complete the installation.
- B. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.
- C. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
 3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
 4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.
- D. Integrated Wiegand access control products are required to be installed through current members of the ASSA ABLOY "Certified Integrator" (CI) program.
- E. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
- F. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
- G. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

- A. Field Inspection: Supplier will perform a final inspection of installed door hardware and state in report whether work complies with or deviates from requirements, including whether door hardware is properly installed, operating and adjusted.

3.5 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.6 CLEANING AND PROTECTION

- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.
- B. Clean adjacent surfaces soiled by door hardware installation.
- C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

- A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SCHEDULE

- A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.
- B. Manufacturer's Abbreviations:
 - 1. MK - McKinney
 - 2. PE - Pemko
 - 3. MR - Markar
 - 4. RO - Rockwood
 - 5. SA - Sargent
 - 6. RU - Corbin Russwin
 - 7. AD - Adams Rite
 - 8. MC - Medeco
 - 9. HS - HES
 - 10. RF - Rixson
 - 11. NO - Norton
 - 12. SU - Securitron
 - 13. 00 - Other
 - 14. BB - Bobrick

Hardware Schedule

Set: 1.0

Doors: SPA 113C.1, SPA 113C.2, SPA 132, SPA 134, SPA 135C

Description: Sgl. Keyed Lock - W/OH Stop -Interior Classrooms

3	Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Cylindrical Lock (passage)	CL3310 PZD	626	RU
1	Concealed Overhead Stop	6ADJ-X36	630	RF
1	Gasketing	S88D		PE
1	Sweep	18061CNB x LAR		PE

Set: 2.0

Doors: SPA 113B

Description: Sgl. Keyed Lock - W/OH Stop -Interior Classrooms

4	Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Cylindrical Lock (passage)	CL3310 PZD	626	RU
1	Concealed Overhead Stop	6ADJ-X36	630	RF
1	Gasketing	S88D		PE
1	Sweep	18061CNB x LAR		PE

Set: 3.0

Doors: SPA 109 & SPA 110

Description: Sgl. Privacy Latch - I/S- Men, Women

3	Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Cylindrical Lock (privacy)	CL3320 PZD	626	RU
1	Closer (surface)	DC8200 A10	689	RU
1	Kick Plate	K1050 8" x 2" LDW BE CSK	US32D	RO
1	Wall Stop	409	US32D	RO
1	Gasketing	S88D		PE

Set: 4.0

Doors: SPA 117B.2

Description: Pair Keyed Locks- Classroom W/ OH Stop Holder

6	Hinge (heavy weight)	T4A3786 4-1/2" x 4-1/2"	US26D	MK
1	Dust Proof Strike	570	US26D	RO
1	Flush Bolt	2945	US26D	RO
1	Cylindrical Lock (classroom)	CL3355 PZD LC	626	RU
1	Cylinder	As Required		
2	Concealed Overhead Holder	5-X26	652	RF
2	Wall Stop	409	US32D	RO
2	Silencer	608		RO

Set: 5.0

Doors: SPA 119, SPA 120.2

Description: Sgl . Keyed Exit- Rated- Classroom

3	Hinge	TA2714 NRP 4-1/2" x 4-1/2"	US26D	MK
1	Exit Device (rim, classroom)	ED5200SA PR955 ACP CT6B	630	RU
1	Interchangeable Core	As Required		
1	Closer (surface)	DC8210 A4	689	RU
1	Kick Plate	K1050 8" x 2" LDW BE CSK	US32D	RO
1	Gasketing	S88D		PE

Set: 6.0

Doors: SPA 117A

Description: Sgl. Keyed Lock - Office

3	Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Cylindrical Lock (office)	CL3351 PZD LC	626	RU
1	Cylinder	As Required		
1	Wall Stop	409	US32D	RO
3	Silencer	608		RO

Set: 7.0

Doors: SPA 101

Description: Exterior Exit w/Card Reader

1	Elec Hinge	5BB1 TW8 630	IVE	
1	Elec Exit Device	QEL-98-L	VON	
1	SFIC Rim Cylinder	As Required	SCH	
1	Construction Core	As Required	SCH	
1	SFIC Core	As Required		
1	Kick Plate	8400 CS B4E	IVE	
1	Card Reader	MT11	SCE	
1	Door Contact	679-05	SCE	
1	Power Supply	PS902 900-2RS	VON	

Coordinate hardware with electrical and security systems.

Operation: card reader to momentarily retract latch. Free egress at all times.

Coordinate new hardware with existing door and frame. Field verify existing hardware and replace center butt hinge with electric hinge matching existing hinge preparation size and weight.

END OF SECTION

SECTION 08 80 00

GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Glass.
- B. Glazing compounds and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 08 11 13 - Hollow Metal Doors and Frames: Glazed doors and borrowed lites.
- B. Section 08 14 16 - Flush Wood Doors: Glazed lites in doors.

1.03 REFERENCE STANDARDS

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; current edition.
- B. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2011).
- C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014.
- D. ASTM C1036 - Standard Specification for Flat Glass; 2011.
- E. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2012.
- F. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2013.
- G. GANA (GM) - GANA Glazing Manual; 2009.
- H. GANA (SM) - GANA Sealant Manual; 2008.
- I. ICC (IBC) - International Building Code; 2015.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data on Glass Types: Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.
- C. Product Data on Glazing Compounds: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors.
- D. Samples: Submit two samples 12 x 12 inch in size of glass units, showing coloration.

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with GANA Glazing Manual and GANA Sealant Manual for glazing installation methods.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum three (3) years documented experience.

1.06 FIELD CONDITIONS

- A. Do not install glazing when ambient temperature is less than 50 degrees F.

- B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.07 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Sealed Insulating Glass Units: Provide a five (5) year warranty to include coverage for seal failure, interpane dusting or misting, including replacement of failed units.
- C. Laminated Glass: Provide a five (5) year warranty to include coverage for delamination, including replacement of failed units.

PART 2 PRODUCTS

2.01 GLASS MATERIALS

- A. Float Glass Manufacturers:
 - 1. Guardian Industries Corp: www.sunguardglass.com.
 - 2. Pilkington North America Inc: www.pilkington.com/na.
 - 3. PPG Industries, Inc: www.ppgideascales.com.
 - 4. Substitutions: Refer to Section 01 60 00 - Product Requirements.
- B. Float Glass: All glazing is to be float glass unless otherwise indicated.
 - 1. Annealed Type: ASTM C1036, Type I, transparent flat, Class 1 clear, Quality Q3 (glazing select).
 - 2. Heat-Strengthened and Fully Tempered Types: ASTM C1048.
 - 3. Tinted Types: Color and performance characteristics as indicated.
 - 4. Obscured where required.
 - 5. Thicknesses: 1/4 inch thick; for exterior glazing comply with specified requirements for wind load design regardless of specified thickness.
- C. Fire-Protection-Rated Glazing: Type, thickness, and configuration as required to achieve indicated ratings.
 - 1. IBC Fire Protection Rating: As indicated on drawings.
 - 2. Provide products listed by Underwriters Laboratories.
 - 3. Safety Certification: 16 CFR 1201 Category II.
 - 4. Labeling: Provide permanent label on each piece giving the IBC rating and other information required by the applicable code.
 - 5. Thickness: 1/4 inch thick, minimum.

2.02 PLASTIC FILMS

- A. Opaque window film to be applied to an existing interior lite.

2.03 GLAZING COMPOUNDS

- A. Butyl Sealant : Single component; ASTM C 920, Grade NS, Class 12-1/2, Uses M and A; Shore A hardness of 10 to 20; black color; non-skinning.
- B. Acrylic Sealant : Single component, solvent curing, non-bleeding; ASTM C 920, Type S, Grade NS, Class 12-1/2, Uses M and A; cured Shore A hardness of 15 to 25; color as selected.
- C. Silicone Sealant : Single component; chemical curing; capable of water immersion without loss of properties; non-bleeding, non-staining; ASTM C 920, Type S, Grade NS, Class 25, Uses M, A, and G; cured Shore A hardness of 15 to 25; color as selected.

2.04 GLAZING ACCESSORIES

- A. Setting Blocks: Neoprene, 80 to 90 Shore A durometer hardness, ASTM C864 Option I. Length of 0.1 inch for each square foot of glazing or minimum 4 inch x width of glazing rabbet space minus 1/16 inch x height to suit glazing method and pane weight and area.
- B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness, ASTM C 864 Option I. Minimum 3 inch long x one half the height of the glazing stop x thickness to suit application, self adhesive on one face.
- C. Glazing Tape: Closed cell polyvinyl chloride foam, coiled on release paper over adhesive on two sides, maximum water absorption by volume of 2 percent, designed for compression of 25 percent to effect an air barrier and vapor retarder seal.
- D. Glazing Splines: Resilient polyvinyl chloride extruded shape to suit glazing channel retaining slot; ASTM C864 Option I; color as selected.
- E. Glazing Clips: Manufacturer's standard type.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that openings for glazing are correctly sized and within tolerance.
- B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and ready to receive glazing.

3.02 PREPARATION

- A. Clean contact surfaces with solvent and wipe dry.
- B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- C. Prime surfaces scheduled to receive sealant.
- D. Install sealants in accordance with ASTM C1193 and GANA Sealant Manual.
- E. Install sealant in accordance with manufacturer's instructions.

3.03 INSTALLATION - INTERIOR DRY METHOD (TAPE AND TAPE)

- A. Cut glazing tape to length and set against permanent stops, projecting 1/16 inch (1.6 mm) above sight line.
- B. Place setting blocks at 1/4 points with edge block no more than 6 inches from corners.
- C. Rest glazing on setting blocks and push against tape for full contact at perimeter of pane or unit.
- D. Place glazing tape on free perimeter of glazing in same manner described above.
- E. Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.
- F. Knife trim protruding tape.

3.04 INSTALLATION - INTERIOR WET METHOD (COMPOUND AND COMPOUND)

- A. Install glazing resting on setting blocks. Install applied stop and center pane by use of spacer shims at 24 inch centers, kept 1/4 inch below sight line.
- B. Locate and secure glazing pane using spring wire clips.

- C. Fill gaps between glazing and stops with glazing compound until flush with sight line. Tool surface to straight line.

3.05 INSTALLATION - PLASTIC FILM

- A. Install plastic film with adhesive, applied in accordance with film manufacturer's instructions.
- B. Place without air bubbles, creases or visible distortion.
- C. Fit tight to glass perimeter with razor cut edge.

3.06 CLEANING

- A. Remove glazing materials from finish surfaces.
- B. Remove labels after Work is complete.
- C. Clean glass and adjacent surfaces.

3.07 PROTECTION

- A. After installation, mark pane with an 'X' by using removable plastic tape or paste.

END OF SECTION

SECTION 09 21 16

GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Metal stud wall framing.
- B. Cementitious backing board.
- C. Gypsum wallboard.
- D. Joint treatment and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 05 40 00 - Cold-Formed Metal Framing: Exterior wind-load-bearing metal stud framing.
- B. Section 06 10 00 - Rough Carpentry: Wood blocking product and execution requirements.
- C. Section 07 21 00 - Thermal Insulation: Acoustic insulation.

1.03 REFERENCE STANDARDS

- A. ANSI A108.11 - American National Standard for Interior Installation of Cementitious Backer Units; 2010 (Revised).
- B. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2015.
- C. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2014.
- D. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2015.
- E. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2013.
- F. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2015.
- G. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2014.
- H. ASTM C1288 - Standard Specification for Discrete Non-Asbestos Fiber-Cement Interior Substrate Sheets; 2014.
- I. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2014.
- J. GA-216 - Application and Finishing of Gypsum Board; 2013.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Test Reports: For all stud framing products that do not comply with ASTM C645 or C754, provide independent laboratory reports showing maximum stud heights at required spacings and deflections.

1.05 QUALITY ASSURANCE

- A. Perform in accordance with GA-214 and GA-216. Comply with requirements of GA-600 for fire-rated assemblies.
- B. Installer Qualifications: Company specializing in performing gypsum board application and finishing, with minimum 5 years of documented experience.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

- A. Provide completed assemblies complying with ASTM C840 and GA-216.

2.02 METAL FRAMING MATERIALS

- A. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf.
 - 1. Exception: The minimum metal thickness and section properties required of ASTM C 645 are waived provided steel of 40 ksi minimum yield strength is used, the metal is continuously dimpled, the effective thickness is at least twice the base metal thickness, k and maximum stud heights are determined by testing in accordance with ASTM E 72 using assemblies specified by ASTM C 754.
 - 2. Studs: "C" shaped with flat or formed webs .
 - 3. Runners: U shaped, sized to match studs.

2.03 BOARD MATERIALS

- A. Manufacturers - Gypsum-Based Board:
 - 1. American Gypsum: www.americangypsum.com.
 - 2. CertainTeed Corporation: www.certainteed.com.
 - 3. Continental Building Products (formally known as Lafarge North America): www.continental-bp.com.
 - 4. Georgia-Pacific Gypsum: www.gpgypsum.com.
 - 5. National Gypsum Company: www.nationalgypsum.com.
 - 6. Temple-Inland Building Product by Georgia-Pacific, LLC: www.temple.com.
 - 7. USG Corporation: www.usg.com.
- B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
 - 1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
 - 2. At Assemblies Indicated with Fire-Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
 - 3. Thickness:
 - a. Vertical Surfaces: 5/8 inch.
 - b. Ceilings: 1/2 inch.
 - c. Multi-Layer Assemblies: Thicknesses as indicated on drawings.
- C. Backing Board For Wet Areas: One of the following products:
 - 1. Application: Surfaces behind tile in wet areas including all restroom and kitchen areas..
 - 2. ASTM Cement-Based Board: Non-gypsum-based, cementitious board complying with ASTM C1288.
 - a. Thickness: 1/2 inch.
- D. Backing Board For Non-Wet Areas: Water-resistant gypsum backing board as defined in ASTM C1396/C1396M; sizes to minimum joints in place; ends square cut.

1. Application: On restroom and janitor room walls, except those behind thinset tile..
2. Type: Regular and Type X, in locations indicated.
3. Type X Thickness: 5/8 inch.
4. Regular Board Thickness: 1/2 inch.
5. Edges: Tapered.

2.04 ACCESSORIES

- A. Corner Beads: Galvanized steel.
- B. Trim: GA-201 and GA-216; Bead type as detailed.
- C. Joint Materials: ASTM C475 and as recommended by gypsum board manufacturer for project conditions.
- D. Screws for Attachment to Steel Members Less Than 0.03 inch In Thickness, to Wood Members, and to Gypsum Board: ASTM C1002; self-piercing tapping type; cadmium-plated for exterior locations.
- E. Screws for Attachment to Steel Members From 0.033 to 0.112 inch in Thickness: ASTM C954; steel drill screws for application of gypsum board to loadbearing steel studs.
- F. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that project conditions are appropriate for work of this section to commence.

3.02 FRAMING INSTALLATION

- A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.
- B. Studs: Space studs as indicated.
 1. Extend partition framing to structure where indicated and to ceiling in other locations.
 2. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
 3. Extend stud framing through ceiling to deck above, only where indicated. Provide extended leg ceiling runners.
- C. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.
- D. Blocking: Install wood blocking for support of:
 1. Wall mounted cabinets.
 2. Plumbing fixtures.
 3. Toilet partitions.
 4. Toilet accessories.
 5. Wall mounted door hardware.

3.03 BOARD INSTALLATION

- A. Comply with ASTM C 840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.
- B. Single-Layer Non-Rated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.

- C. Double-Layer Non-Rated: Use gypsum board for first layer, placed perpendicular to framing or furring members, with ends and edges occurring over firm bearing. Place second layer perpendicular to framing or furring members. Offset joints of second layer from joints of first layer.
- D. Fire-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.
- E. Exterior Soffits: Install exterior soffit board perpendicular to framing, with staggered end joints over framing members or other solid backing.
- F. Cementitious Backing Board: Install over steel framing members where indicated, in accordance with ANSI A108.11 and manufacturer's instructions.
- G. Installation on Metal Framing: Use screws for attachment of all gypsum board .
- H. Moisture Protection: Treat cut edges and holes in moisture resistant gypsum board and exterior gypsum soffit board with sealant.

3.04 INSTALLATION OF TRIM AND ACCESSORIES

- A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
 - 1. Not more than 30 feet apart on walls and ceilings over 50 feet long.
 - 2. At exterior soffits, not more than 30 feet apart in both directions.
- B. Corner Beads: Install at external corners, using longest practical lengths.
- C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials and as indicated.

3.05 JOINT TREATMENT

- A. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
 - 1. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
 - 2. Level 1: Fire rated wall areas above finished ceilings, whether or not accessible in the completed construction.
- B. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
 - 1. Feather coats of joint compound so that camber is maximum 1/32 inch.
 - 2. Taping, filling, and sanding is not required at surfaces behind adhesive applied ceramic tile.

3.06 TOLERANCES

- A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

END OF SECTION

SECTION 09 30 00

TILING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Tile for floor applications.
- B. Tile for wall applications.
- C. Non-ceramic trim.

1.02 RELATED REQUIREMENTS

- A. Section 07 90 05 - Joint Sealers.
- B. Section 09 21 16 - Gypsum Board Assemblies: Tile backer board.

1.03 REFERENCE STANDARDS

- A. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2015.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Samples: Mount tile and apply grout on two plywood panels, minimum 18 x 18 inches in size illustrating pattern, color variations, and grout joint size variations.

1.05 QUALITY ASSURANCE

- A. Maintain one copy of and ANSI A108/A118/A136.1 and TCNA (HB) on site.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.07 FIELD CONDITIONS

- A. Maintain ambient and substrate temperature of 50 degrees F during installation of mortar materials.

PART 2 PRODUCTS

2.01 TILE

- A. Manufacturers: All products by the same manufacturer, with the exception of the paver tile.
 - 1. American Olean Corporation: www.americanolean.com.
 - 2. Dal-Tile Corporation: www.daltile.com.
 - 3. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Glazed Wall Tile : ANSI A137.1, and as follows:
 - 1. Size and Shape: 4-1/4 inch square.
 - 2. Edges: Cushioned.
 - 3. Surface Finish: To be selected.
 - 4. Colors:
 - a. Restrooms:
 - 1) Field: Groups 1, 2 and 3
 - 5. Trim Units: Matching bead, bullnose, and cove shapes in sizes coordinated with field tile.

- C. Quarry Floor Tile : ANSI A137.1, and as follows:
 - 1. Size and Shape: 8 inch square.
 - 2. Thickness: 1/2 inch.
 - 3. Edges: Square.
 - 4. Surface Finish: Unglazed.
 - 5. Colors: To be selected from manufacturers full range of colors.
 - 6. Trim Units: Matching bullnose, cove, and cove base shapes in sizes coordinated with field tile.
- D. Porcelain Tile Type PT-1: ANSI A137.1, and as follows:
 - 1. Porcelalto Graniti manufactured by Daltile or approved equivalent product.
 - 2. Moisture Absorption: 0.5 to 3.0 percent.
 - 3. Size and Shape: 12 inch square.
 - 4. Thickness: 5/16"
 - 5. Face: Plain.
 - 6. Edges: Square.
 - 7. Surface Finish: Matte.
 - 8. Colors: To be selected from manufacturers full color selection..
 - 9. Trim Units: Matching cove base and bullnosed base shapes in sizes coordinated with field tile.

2.02 TRIM AND ACCESSORIES

- A. Non-Ceramic Trim: Satin natural anodized extruded aluminum, style and dimensions to suit application, for setting using tile mortar or adhesive.
 - 1. Applications:
 - a. Transition between floor finishes of different heights. Product Reno-U and Deco (see drawings for locations) as manufactured by Schluter-Systems or approved equal.
 - 2. Manufacturers:
 - a. Schluter-Systems: www.schluter.com.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 MORTAR MATERIALS

- A. Mortar Bed Materials: Portland cement, sand, latex additive and water.
- B. Mortar Bond Coat Materials:
 - 1. Dry-Set Portland Cement type: ANSI A118.1.
 - 2. Latex-Portland Cement type: ANSI A118.4.

2.04 GROUTS

- A. Standard Grout: ANSI A118.6 standard cement grout.
 - 1. Applications: Use this type of grout where indicated and where no other type of grout is indicated.
 - 2. Use sanded grout for joints 1/8 inch wide and larger; use unsanded grout for joints less than 1/8 inch wide.
 - 3. Color(s): As selected by Architect from manufacturer's full line.
- B. Epoxy Grout: ANSI A118.3 chemical resistant and water-cleanable epoxy grout.
 - 1. Applications: For mud set application at quarry tile floors.
 - 2. Color(s): As selected by Architect from manufacturer's full line.
- C. Grout Sealer: Liquid-applied, moisture and stain protection for existing or new Portland cement grout.
 - 1. Composition: Water-based colorless silicone.

2.05 ACCESSORY MATERIALS

- A. Non-Ceramic Trim: Satin natural anodized extruded aluminum, style and dimensions to suit application, for setting using tile mortar or adhesive.
 - 1. Applications: Use in the following locations:
 - a. Transition between floor finishes of different heights.
 - 2. Manufacturer:
 - a. Schluter-Systems; Product Reno-U: www.schluter.com.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.
- B. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of setting materials to sub-floor surfaces.

3.02 PREPARATION

- A. Protect surrounding work from damage.
- B. Vacuum clean surfaces and damp clean.
- C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.

3.03 INSTALLATION - GENERAL

- A. Install tile, thresholds, and stair treads and grout in accordance with applicable requirements of ANSI A108.1a thru A108.13, manufacturer's instructions, and TCNA (HB) recommendations.
- B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.
- C. Place thresholds at exposed tile edges.
- D. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.
- E. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.
- F. Form internal angles square and external angles bullnosed.
- G. Install non-ceramic trim in accordance with manufacturer's instructions.
- H. Sound tile after setting. Replace hollow sounding units.
- I. Keep control and expansion joints free of mortar, grout, and adhesive.
- J. Keep expansion joints free of adhesive or grout. Apply sealant to joints.
- K. Prior to grouting, allow installation to completely cure; minimum of 48 hours.
- L. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.
- M. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.
- N. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.

3.04 INSTALLATION - FLOORS - THIN-SET METHODS

- A. Over interior concrete substrates, install in accordance with TCA Handbook Method F113, dry-set or latex-portland cement bond coat, with standard grout, unless otherwise indicated.
 - 1. Where epoxy bond coat and grout are indicated, install in accordance with TCNA (HB) Method F131.

3.05 INSTALLATION - WALL TILE

- A. On exterior walls install in accordance with TCA Handbook Method W244, thin-set over cementitious backer units, with waterproofing membrane.
- B. Over cementitious backer units install in accordance with TCNA (HB) Method W223, organic adhesive.

3.06 CLEANING

- A. Clean tile and grout surfaces.

3.07 PROTECTION

- A. Do not permit traffic over finished floor surface for 4 days after installation.
- B. Protect floor as required with material suitable to withstand construction traffic. Maintain and replace protective covering as required during construction.

END OF SECTION

SECTION 09 51 00

ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Suspended metal grid ceiling system.
- B. Acoustical units.
- C. Supplementary acoustical insulation above ceiling.

1.02 RELATED REQUIREMENTS

- A. Section 07 21 00 - Thermal Insulation: Acoustical insulation.

1.03 REFERENCE STANDARDS

- A. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2013a.
- B. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2013.
- C. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2014.
- D. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2014.
- E. CAL (CHPS LEM) - Low-Emitting Materials Product List; California Collaborative for High Performance Schools (CHPS); current edition at www.chps.net/.
- F. GEI (SCH) - GREENGUARD "Children and Schools" Certified Products; GREENGUARD Environmental Institute; current listings at www.greenguard.org.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
- B. Do not install acoustical units until after interior wet work is dry.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on suspension system components.
- C. Samples: Submit two full size samples illustrating material and finish of acoustical units.
- D. Samples: Submit two samples each, 12 inches long, of suspension system main runner.
- E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.06 QUALITY ASSURANCE

- A. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

- B. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 FIELD CONDITIONS

- A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

PART 2 PRODUCTS

2.01 ACOUSTICAL UNITS

- A. Manufacturers:
1. Armstrong World Industries, Inc: www.armstrong.com.
 2. CertainTeed Corporation: www.certainteed.com.
 3. Chicago Metallic: www.chicagometallic.com.
 4. USG: www.usg.com.
 5. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Acoustical Panels Type 1: Painted mineral fiber, ASTM E1264 Type III, with the following characteristics:
1. VOC Content: Certified as Low Emission by one of the following :
 - a. GreenGuard Children and Schools; www.greenguard.org.
 - b. Product listing in the CHPS Low-Emitting Materials Product List at; www.chps.net/manual/lem_table.htm.
 2. Size: 24 x 24 inches.
 3. Thickness: 5/8 inches.
 4. Edge: Square.
 5. Surface Color: White.
 6. Surface Pattern: Non-directional fissured.
 7. Sag resistant.
 8. Mold and Mildew guard.
 9. Ten year limited warranty from the date of substantial completion against visible sag, warping, shrinking, buckling, and delamination as a direct result of manufacturing defects.
 10. Products:
 11. Suspension System: Exposed steel grid Type 1.
- C. Acoustical Panels Type 2: Vinyl faced gypsum, with the following characteristics:
1. VOC Content: Certified as Low Emission by one of the following :
 - a. GreenGuard Children and Schools; www.greenguard.org.
 - b. Product listing in the CHPS Low-Emitting Materials Product List at; www.chps.net/manual/lem_table.htm.
 2. Size: 24 x 24 inches.
 3. Thickness: 1/2 or 5/8 inches.
 4. Edge: Square.
 5. Surface Color: White.
 6. Surface Pattern: lightly textured.
 7. Suspension System: Exposed steel grid Type 1, (Use exposed aluminum grid Type 2 grid in areas indicated on drawings).

2.02 SUSPENSION SYSTEM(S)

- A. Manufacturers:
1. Same as for acoustical units.
 2. Substitutions: See Section 01 60 00 - Product Requirements.

- B. Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with stabilizer bars, clips, splices, perimeter moldings, and hold down clips as required.
- C. Exposed Steel Suspension System Type 1: Formed steel, commercial quality cold rolled; heavy-duty.
 - 1. Profile: Tee; 15/16 inch wide face.
 - 2. Construction: Double web.
 - 3. Finish: White painted.
- D. Exposed Aluminum Suspension System Type 2: Extruded aluminum; intermediate-duty.
 - 1. Profile: Tee; 15/16 inch wide face.
 - 2. Construction: Double web.
 - 3. Finish: Painted white.
 - 4. Space hangers at 3 feet on center to achieve intermediate-duty classification.

2.03 ACCESSORIES

- A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.
- B. Perimeter Moldings: Same material and finish as grid.
 - 1. At Exposed Grid: Provide L-shaped molding for mounting at same elevation as face of grid.
- C. Acoustical Insulation: Specified in Section 07 21 00.
 - 1. Size: To fit acoustical suspension system.
- D. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that layout of hangers will not interfere with other work.

3.02 INSTALLATION - SUSPENSION SYSTEM

- A. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions and as supplemented in this section.
- B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:240.
- C. Lay out system to a balanced grid design with edge units no less than 50 percent of acoustical unit size.
- D. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.
- E. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
- F. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
- G. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

- H. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.
- I. Do not eccentrically load system or induce rotation of runners.
- J. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
 - 1. Use longest practical lengths.
 - 2. Miter corners.

3.03 INSTALLATION - ACOUSTICAL UNITS

- A. Install acoustical units in accordance with manufacturer's instructions.
- B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
- C. Lay directional patterned units with pattern parallel to longest room axis.
- D. Fit border trim neatly against abutting surfaces.
- E. Install units after above-ceiling work is complete.
- F. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
- G. Cutting Acoustical Units:
 - 1. Cut to fit irregular grid and perimeter edge trim.
 - 2. Make field cut edges of same profile as factory edges.
- H. Where round obstructions occur, provide preformed closures to match perimeter molding.
- I. Lay acoustical insulation for a distance of 48 inches either side of acoustical partitions as indicated.
- J. Install hold-down clips on panels within 20 ft of an exterior door.

3.04 TOLERANCES

- A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.
- B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

END OF SECTION

SECTION 09 65 00

RESILIENT FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Resilient tile flooring.
- B. Resilient base.
- C. Installation accessories.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors.

1.03 REFERENCE STANDARDS

- A. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2011.
- B. ASTM F1066 - Standard Specification for Vinyl Composition Floor Tile; 2004 (Reapproved 2014).
- C. ASTM F1861 - Standard Specification for Resilient Wall Base; 2008 (Reapproved 2012).

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
- C. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.
- D. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

1.05 FIELD CONDITIONS

- A. Maintain temperature in storage area between 55 degrees F and 90 degrees F.
- B. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

PART 2 PRODUCTS

2.01 TILE FLOORING

- A. Vinyl Composition Tile (Type 1): Homogeneous, with color extending throughout thickness, and:
 - 1. Minimum Requirements: Comply with ASTM F1066, of Class corresponding to type specified.
 - 2. Size: 12 x 12 inch.
 - 3. Thickness: 0.125 inch.
 - 4. Pattern: Marbleized.
 - 5. Manufacturers:

- a. Armstrong World Industries, Inc.; Product "Standard Excelon", color to be selected: www.armstrong.com.
- b. Mannington Mills, Inc.; Product "Essentials", equal in grade and color range to Armstrong product: www.mannington.com.
- c. Substitutions: See Section 01 60 00 - Product Requirements.

B. Feature Strips: Of same material as tile, 1 inch wide.

2.02 RESILIENT BASE

- A. Resilient Base: ASTM F1861, Type TP, rubber, thermoplastic; top set Style A, Straight, and as follows:
 1. Height: 4 inch.
 2. Thickness: 0.080 inch thick.
 3. Finish: Satin.
 4. Color: Color as selected from manufacturer's standards.

2.03 ACCESSORIES

- A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.
- B. Primers, Adhesives, and Seaming Materials: Waterproof; types recommended by flooring manufacturer.
 1. All materials and products to comply with LEED VOC requirements.
- C. Moldings, Transition and Edge Strips: Metal.
- D. Sealer and Wax: Types recommended by flooring manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.
- C. Verify that concrete sub-floor surfaces are dry enough and ready for resilient flooring installation by testing for moisture emission rate and alkalinity in accordance with ASTM F710; obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.

3.02 PREPARATION

- A. Remove sub-floor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with sub-floor filler to achieve smooth, flat, hard surface.
- B. Prohibit traffic until filler is cured.
- C. Clean substrate.
- D. Flooring shall not commence until such time that the roof is complete, all site concrete and asphalt is installed, and above ceiling work is completed and verified.

3.03 INSTALLATION

- A. Starting installation constitutes acceptance of sub-floor conditions.

- B. Install in accordance with manufacturer's instructions.
- C. Spread only enough adhesive to permit installation of materials before initial set.
- D. Fit joints tightly.
- E. Set flooring in place, press with heavy roller to attain full adhesion.
- F. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.
- G. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.
- H. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

3.04 TILE FLOORING

- A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless manufacturer's instructions say otherwise.
- B. Lay flooring with joints and seams parallel to building lines to produce symmetrical tile pattern.
- C. Install tile to ashlar pattern. Allow minimum 1/2 full size tile width at room or area perimeter.

3.05 RESILIENT BASE

- A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.
- B. Install base on solid backing. Bond tightly to wall and floor surfaces.

3.06 CLEANING

- A. Remove excess adhesive from floor, base, and wall surfaces without damage.
- B. Clean in accordance with manufacturer's instructions.
- C. Clean, seal, and wax resilient flooring products in accordance with manufacturer's instructions.
- D. Classrooms to receive five (5) coats of wax.
- E. Corridors to receive three (3) coats of wax.
- F. Clean and strip VCT before waxing.

3.07 PROTECTION

- A. Prohibit traffic on resilient flooring for 48 hours after installation.
- B. Flooring exhibiting evidence of staining and/or damage from construction traffic shall be replaced at Contractor's expense.

END OF SECTION

SECTION 09 77 33

GLASS FIBER REINFORCED PLASTIC PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Glass fiber reinforced plastic panels.
- B. Trim.

1.02 REFERENCE STANDARDS

- A. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics; 2010.
- B. ASTM D2583 - Standard Test Method for Indentation Hardness of Rigid Plastics by Means of Barcol Impressor; 2013a.
- C. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2012.
- D. ASTM D5319 - Standard Specification for Glass-Fiber Reinforced Polyester Wall and Ceiling Panels; 2012.
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- F. FDA Food Code - Chapter 6 - Physical Facilities; current edition with Supplements, if any.
- G. ISO 846 - Plastics -- Evaluation of the action of microorganisms; 1997.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
- C. Samples: Submit two samples 2 by 2 inch in size illustrating material and surface design of panels.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Store panels flat, indoors, on a clean, dry surface. Remove packaging and allow panels to acclimate to room temperature for 48 hours prior to installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Glass Fiber Reinforced Plastic Panels:
 - 1. Marlite; : www.marlite.com.
 - 2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PANEL SYSTEMS

- A. Wall Panels :
 - 1. Panel Size: 4 by 8 feet (1219 mm by 2438 mm).
 - 2. Panel Thickness: 0.075 inch (1.9 mm).
 - 3. Surface Design: Embossed.

4. Color: To be selected from manufacturers full range of colors..
5. Attachment Method: Adhesive only, sealant joints, no trim.

2.03 MATERIALS

- A. Panels: Glass fiber reinforced plastic, complying with ASTM D5319.
 1. Surface Burning Characteristics: Flame Spread Index of 25, maximum; Smoke Developed Index of 450, maximum; when whole system is tested in accordance with ASTM E84.
 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 3. Scratch Resistance: Barcol hardness score of not less than 35, when tested in accordance with ASTM D2583.
 4. Impact Strength: Not less than 6 ft-lb/in, when tested in accordance with ASTM D256.
 5. Surface Characteristics and Cleanability: Provide products that are smooth, durable, and easily cleanable, in compliance with FDA Food Code, Chapter 6 - Physical Facilities.
 6. Biological Resistance: Rating of 0, when tested in accordance with ISO 846.
- B. Trim: Vinyl; color coordinating with panel.
- C. Adhesive: Type recommended by panel manufacturer.
- D. Sealant: Type recommended by panel manufacturer; white.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions and substrate flatness before starting work.
- B. Verify that substrate conditions are ready to receive the work of this section.

3.02 INSTALLATION - WALLS

- A. Install panels in accordance with manufacturer's instructions.
- B. Cut and drill panels with carbide tipped saw blades or drill bits, or cut with snips.
- C. Apply adhesive to the back side of the panel using trowel recommended by adhesive manufacturer.
- D. Apply panels to wall with seams plumb and pattern aligned with adjoining panels.
- E. Install panels with manufacturer's recommended gap for panel field and corner joints.
- F. Place trim on panel before fastening edges, if required.
- G. Fill channels in trim with sealant before attaching to panel.
- H. Install trim with adhesive and screws or nails as required.
- I. Seal gaps at floor, ceiling, and between panels with specified sealant to prevent moisture intrusion.
- J. Remove excess sealant as paneling is installed.

END OF SECTION

SECTION 09 90 00

PAINTING AND COATING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish all interior and exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
 - 1. Exposed surfaces of steel lintels and ledge angles.
 - 2. Interior walls and bottom of fountains.
 - 3. Mechanical and Electrical:
 - a. Refer to Mechanical and Electrical specifications for schedule of color coding of equipment, ductwork, piping, and conduit.
 - b. In finished areas, paint all insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.
 - c. In finished areas, paint shop-primed items.
 - d. Paint all exposed mechanical, plumbing, or electrical accessories on sloped roof areas, including that which is factory-finished.
- D. Do Not Paint or Finish the Following Items:
 - 1. Items fully factory-finished unless specifically so indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes.
 - 3. Items indicated to remain unfinished.
 - 4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
 - 5. Floors, unless specifically so indicated.
 - 6. Ceramic and other tiles.
 - 7. Brick, architectural concrete, cast stone, integrally colored plaster and stucco.
 - 8. Exterior insulation and finish system (EIFS).
 - 9. Glass.
 - 10. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

- A. Section 05 50 00 - Metal Fabrications: Shop-primed items.

1.03 REFERENCE STANDARDS

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on all finishing products, including VOC content.
- C. Samples: Submit two paper chip samples, 8-1/2 x 11 inch in size illustrating range of colors and textures available for each surface finishing product scheduled.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum 5 years experience.

1.06 MOCK-UP

- A. See Section 01 40 00 - Quality Requirements, for general requirements for mock-up.
- B. Provide panel, 12 feet long by 10 feet wide, illustrating special coating color, texture, and finish.
- C. Provide door and frame assembly illustrating paint coating color, texture, and finish.
- D. Locate where directed.
- E. Mock-up may remain as part of the work.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.08 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.
- D. Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.
- E. Minimum Application Temperature for Varnish Finishes: 65 degrees F for interior or exterior, unless required otherwise by manufacturer's instructions.
- F. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide all paint and coating products used in any individual system from the same manufacturer; no exceptions.
- B. Paints:
 - 1. Glidden Professional, a product of PPG Architectural Coatings:
www.gliddenprofessional.com.
 - 2. Benjamin Moore & Co: www.benjaminmoore.com.

3. PPG Architectural Finishes, Inc: www.ppgaf.com.
 4. Sherwin-Williams Company: www.sherwin-williams.com.
- C. Primer Sealers: Same manufacturer as top coats.
- D. Block Fillers: Same manufacturer as top coats.
- E. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PAINTS AND COATINGS - GENERAL

- A. Paints and Coatings: Ready mixed, unless intended to be a field-catalyzed coating.
1. Provide paints and coatings of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 2. Supply each coating material in quantity required to complete entire project's work from a single production run.
 3. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.
- B. Primers: As follows unless other primer is required or recommended by manufacturer of top coats; where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.
1. Primers maybe tinted to 50 percent of finish color.
- C. Volatile Organic Compound (VOC) Content:
1. Provide coatings that comply with the most stringent requirements specified in the following:
 - a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
 2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.
- D. Chemical Content: The following compounds are prohibited:
1. Aromatic Compounds: In excess of 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
 2. Acrolein, acrylonitrile, antimony, benzene, butyl benzyl phthalate, cadmium, di (2-ethylhexyl) phthalate, di-n-butyl phthalate, di-n-octyl phthalate, 1,2-dichlorobenzene, diethyl phthalate, dimethyl phthalate, ethylbenzene, formaldehyde, hexavalent chromium, isophorone, lead, mercury, methyl ethyl ketone, methyl isobutyl ketone, methylene chloride, naphthalene, toluene (methylbenzene), 1,1,1-trichloroethane, vinyl chloride.

2.03 PAINT SYSTEMS - INTERIOR

- A. Paint CI-OP-3L - Concrete/Masonry, Opaque, Latex, 3 Coat:
1. One coat of block filler.
 2. Semi-gloss: Two coats of latex enamel.
- B. Paint CI-TR-2SA - Concrete, Transparent, Silicone Acrylic, Sealer, 2 Coat:
1. Gloss: Two coats of Sherwin Williams H&C Clear 23 Sealer or approved equal.
- C. Paint CI-OP-3E - Concrete/Masonry, Epoxy Enamel, 3 Coat:
1. One coat of catalyzed epoxy primer.
 2. Gloss: Two coats of catalyzed epoxy enamel.
- D. Paint MI-OP-3L - Ferrous Metals, Unprimed, Latex, 3 Coat:
1. One coat of latex primer.
 2. Semi-gloss: Two coats of latex enamel.

- E. Paint MI-OP-2L - Ferrous Metals, Primed, Latex, 2 Coat:
 - 1. Touch-up with latex primer.
 - 2. Semi-gloss: Two coats of latex enamel.
- F. Paint GI-OP-3L - Gypsum Board/Plaster, Latex, 3 Coat:
 - 1. One coat of alkyd primer sealer.
 - 2. Semi-gloss: Two coats of latex enamel.
- G. Paint FI-OP-2A - Fabrics/Insulation Jackets, Alkyd, 2 Coat:
 - 1. One coat of alkyd primer sealer.
 - 2. Flat: One coat of alkyd enamel.

2.04 ACCESSORY MATERIALS

- A. Accessory Materials: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required to achieve the finishes specified whether specifically indicated or not; commercial quality.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- C. Test shop-applied primer for compatibility with subsequent cover materials.
- D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
 - 1. Gypsum Wallboard: 12 percent.
 - 2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
 - 3. Concrete Floors and Traffic Surfaces: 8 percent.

3.02 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to coating application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or repair existing coatings that exhibit surface defects.
- D. Remove surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- E. Seal surfaces that might cause bleed through or staining of topcoat.
- F. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- G. Concrete and Unit Masonry Surfaces to be Painted: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.

- H. Gypsum Board Surfaces to be Painted: Fill minor defects with filler compound. Spot prime defects after repair.
- I. Asphalt, Creosote, or Bituminous Surfaces to be Painted: Remove foreign particles to permit adhesion of finishing materials. Apply latex based sealer or primer.
- J. Insulated Coverings to be Painted: Remove dirt, grease, and oil from canvas and cotton.
- K. Concrete Floors and Traffic Surfaces to be Painted: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.
- L. Aluminum Surfaces to be Painted: Remove surface contamination by steam or high pressure water. Remove oxidation with acid etch and solvent washing. Apply etching primer immediately following cleaning.
- M. Galvanized Surfaces to be Painted: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.
- N. Corroded Steel and Iron Surfaces to be Painted: Prepare using at least SSPC-SP 2 (hand tool cleaning) or SSPC-SP 3 (power tool cleaning) followed by SSPC-SP 1 (solvent cleaning).
- O. Uncorroded Uncoated Steel and Iron Surfaces to be Painted: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand or power tool wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Prime paint entire surface; spot prime after repairs.
- P. Shop-Primed Steel Surfaces to be Finish Painted: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
- Q. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

- A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- B. Apply products in accordance with manufacturer's instructions.
- C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- D. Apply each coat to uniform appearance.
- E. Sand wood and metal surfaces lightly between coats to achieve required finish.
- F. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- G. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.
- H. Label all fire and smoke walls in accordance with applicable Building Codes.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for general requirements for field inspection.

3.05 SCHEDULE - PAINT SYSTEMS

- A. Concrete, Concrete Block, Brick Masonry: Finish all surfaces exposed to view.
 - 1. Interior: CI-OP-3L, semi-gloss.
 - 2. Interior: Wet areas, CI-OP-3E.
 - 3. Interior: Floor as indicated, CI-TR-2SA.
- B. Gypsum Board: Finish all surfaces exposed to view.
 - 1. Interior Ceilings and Bulkheads: GI-OP-3L, semi-gloss.
 - 2. Interior Walls: GI-OP-3L, semi-gloss.
- C. Steel Doors and Frames: Finish all surfaces exposed to view; MI-OP-3L, gloss.
- D. Steel Fabrications: Finish all surfaces exposed to view.
 - 1. Exterior: ME-OP-3L, gloss; finish all surfaces, including concealed surfaces, before installation.
 - 2. Interior: MI-OP-3L, gloss.
- E. Shop-Primed Metal Items: Finish all surfaces exposed to view.
 - 1. Finish the following items:
 - a. Exposed surfaces of lintels.
 - b. Exposed surfaces of steel stairs and railings.
- F. Pipe and Duct Insulation Jackets: Finish all surfaces exposed to view; FI-OP-2L, flat.

END OF SECTION

SECTION 10 14 41

PLASTIC SIGNS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Raised letter plastic signs.

1.02 REFERENCES

- A. ANSI/ICC A117.1 - American National Standard for Accessible and Usable Buildings and Facilities; International Code Council; 2003.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate sign styles, lettering font, foreground and background colors, locations, overall dimensions of each sign.
- C. Samples: Submit two sample signs, 8 x 8 inch in size illustrating type, style, letter font, and colors specified; method of attachment.
- D. Manufacturer's Installation Instructions: Include installation template and attachment devices.

1.04 REGULATORY REQUIREMENTS

- A. Conform to applicable code and ANSI/CABO A117.1 for requirements for the physically handicapped.

1.05 DELIVERY, STORAGE, AND PROTECTION

- A. Package signs, labeled in name groups.
- B. Store adhesive attachment tape at ambient room temperatures.

1.06 ENVIRONMENTAL REQUIREMENTS

- A. Do not install signs when ambient temperature is lower than recommended by manufacturer.
- B. Maintain this minimum temperature during and after installation of signs.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Plastic Signs:
 - 1. Bayuk Graphic Systems, Inc.: www.bayukgraphics.com
 - 2. Advanced Sign Solutions: www.advancedsignsolutions.net
 - 3. Leeds Architectural Letters of Alabama, Inc.: www.leedsletters.com
 - 4. Sign International: www.signinternational.com
 - 5. Southwell Company: www.southwellco.com
 - 6. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 RAISED LETTER SIGNS

- A. Base Material: To be selected from solid color acrylic plastic, laminated with 1/8" matte clear acrylic, reverse painted:
 - 1. Total Thickness: 1/4 inch.

2. Size: As indicated on Drawings.
 3. Edges: Radiused
 4. Special Features: Type B signs only. Opening slot in edge of sign for name insert, behind matte clear acrylic lens.
- B. Raised Character Size and Style: Acrylic plastic, character adhered to base material:
1. Comply with applicable provisions of ANSI/ICC A117.1, including Braille.
 2. Character Color: To be selected.
 3. Character Thickness: 1/8 inch.
 4. Height: As shown on plans.
 5. Edges: Radiused.
 6. Character Font: Helvetica Bold.
 7. Character Case: Upper case only.

2.03 ACCESSORIES

- A. Mounting Hardware: Chrome screws, type and size appropriate for installation.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install signs after surfaces are finished, in locations indicated.
- C. Position signs as indicated on drawings.

END OF SECTION

SECTION 10 28 00

TOILET AND SHOWER ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Accessories for toilet rooms.
- B. Grab bars.

1.02 RELATED REQUIREMENTS

- A. Section 10 21 13.19 - Plastic Toilet Compartments.

1.03 REFERENCE STANDARDS

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.
- B. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2015.
- C. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.
- D. ASTM C1036 - Standard Specification for Flat Glass; 2011.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.
- C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

1.05 COORDINATION

- A. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Toilet Accessories:
 - 1. Bobrick Washroom Equipment, Inc.
 - 2. Bradley Corporation: www.bradleycorp.com.
 - 3. ASI: www.americanspecialties.com.
 - 4. Substitutions: Section 01 60 00 - Product Requirements.
- B. All items of each type to be made by the same manufacturer.

2.02 MATERIALS

- A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
- B. Keys: Provide two (2) keys for each accessory to Owner; master key lockable accessories.

- C. Stainless Steel Sheet: ASTM A666, Type 304.
- D. Stainless Steel Tubing: ASTM A269/A269M, Type 304 or 316.
- E. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.
- F. Adhesive: Two component epoxy type, waterproof.
- G. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.

2.03 FINISHES

- A. Stainless Steel: No. 4 Brushed finish, unless otherwise noted.
- B. Galvanizing for Items Other than Sheet: Comply with ASTM A123/A123M; galvanize ferrous metal and fastening devices.

2.04 TOILET ROOM ACCESSORIES

- A. Toilet Paper Dispenser: Furnished by Owner, installed by General Contractor at each toilet.
- B. Paper Towel Dispenser: Furnished by Owner, installed by General Contractor at locations designated on drawings.
- C. Soap Dispenser: Furnished by Owner, installed by General Contractor at locations designated on drawings.
- D. Mirrors: Stainless steel framed, 1/4 inch thick annealed float glass; ASTM C1036.
 - 1. Size: 18 inches x 36 inches and 18 inches by 60 inches as shown on the Drawings.
 - 2. Frame: 0.05 inch angle shapes, with mitered corners, and tamperproof hanging system; No.4 finish.
 - 3. Backing: Full-mirror sized, minimum 0.03 inch galvanized steel sheet and nonabsorptive filler material.
 - 4. Product: Model 780 manufactured by Bradley Corp. or approved equal.
- E. Grab Bars: Stainless steel, 1-1/2 inches outside diameter, minimum 0.05 inch wall thickness, nonslip grasping surface finish, concealed flange mounting; 1-1/2 inches clearance between wall and inside of grab bar.
 - 1. Length and configuration: As indicated on drawings.
 - 2. Product: 800 Series manufactured by Bradley Corp or approved equal.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify exact location of accessories for installation.
- C. Verify that field measurements are as indicated on drawings.

3.02 PREPARATION

- A. Deliver inserts and rough-in frames to site for timely installation.
- B. Provide templates and rough-in measurements as required.

3.03 INSTALLATION

- A. Install accessories in accordance with manufacturers' instructions in locations indicated on the drawings.
- B. Install plumb and level, securely and rigidly anchored to substrate.
- C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.
- D. Mounting Heights and Locations: As required by accessibility regulations and as indicated on drawings

END OF SECTION

SECTION 10 44 00

FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fire extinguishers.
- B. Fire extinguisher cabinets.
- C. Accessories.

1.02 REFERENCE STANDARDS

- A. NFPA 10 - Standard for Portable Fire Extinguishers; 2013.
- B. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

1.03 PERFORMANCE REQUIREMENTS

- A. Conform to NFPA 10.
- B. Provide extinguishers classified and labeled by Underwriters Laboratories Inc. for the purpose specified and indicated.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide extinguisher operational features.
- C. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

1.05 FIELD CONDITIONS

- A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Fire Extinguisher Cabinets and Accessories:
 - 1. JL Industries, Inc: www.jlindustries.com.
 - 2. Larsen's Manufacturing Co; Product Architectural Series, AL FS 2409-6R (with 2-1/2" trim rings and rounded edges), and AL 2409-6R (with 2-1/2" trim rings and rounded edges): www.larsensmfg.com.
 - 3. Potter-Roemer: www.potterroemer.com.
 - 4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 FIRE EXTINGUISHERS

- A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.

- B. Dry Chemical Type Fire Extinguishers: Cast steel tank, with pressure gage.
 - 1. Class: 4A-80B:C.
 - 2. Size: 10 pound.
 - 3. Finish: Baked enamel, red in color.
 - 4. All Fire Extinguishers must be certified on or after the date of substantial completion.
- C. Wet Chemical Type: Cast steel tank, with pressure gage.
 - 1. Class 2A:K.
 - 2. Size 6 Liters.
 - 3. Finish: Baked enamel, red in color.
 - 4. All Fire Extinguishers must be certified on or after the date of substantial completion.
 - 5. Quantity: One (1), to be located in room D106 Kitchen.

2.03 FIRE EXTINGUISHER CABINETS

- A. Fire Rated and Non Rated Cabinets for Class 4A-80B:C Extinguishers :
 - 1. Metal: Formed aluminum; 0.036 inch thick.
 - 2. Cabinet Configuration: Semi-recessed type.
 - a. Fire rated at locations as installed in fire rated walls. Rating shall match that of adjacent wall construction.
 - b. Sized to accommodate accessories.
 - c. Exterior nominal dimensions of 13 inch wide x 27-1/2 inch high x 6-1/2 inch deep.
 - d. Trim: Returned to wall surface, with 2-1/2 inch projection, 1-3/4 inch wide face.
 - e. Form cabinet enclosure with right angle inside corners and seams. Form perimeter trim and door stiles.
 - 3. Door: 0.036 inch thick, Solid type (no glass), reinforced for flatness and rigidity; latch. Hinge doors for 180 degree opening with continuous piano hinge. Provide nylon catch and fully recessed handle..
 - 4. Cabinet Mounting Hardware: Appropriate to cabinet. Pre-drill for anchors.
 - 5. Weld, fill, and grind components smooth.
 - 6. Finish of cabinet Exterior Trim and Door: Clear anodized aluminum.

2.04 ACCESSORIES

- A. Extinguisher Brackets: Formed steel, galvanized and enamel finished.
- B. Cabinet Signage: Engraved vertical lettering with black backfill to read "Fire Extinguisher".

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install cabinets plumb and level in wall openings, see drawings for installation height.
- C. Secure rigidly in place.
- D. Place extinguishers in cabinets and on wall brackets.
- E. Position cabinet signage at door front, hinge side.

END OF SECTION

SECTION 22 05 00

PLUMBING GENERAL PROVISIONS

PART 1 – GENERAL

1.1 DESCRIPTION

- A. The other Contract Documents complement the requirements of this Section. The General Requirements apply to the work of this Section.

1.2 SCOPE OF WORK

- A. The Work shall include the furnishings of systems, equipment, and materials specified in this Division and as required by Contract Documents to include: supervision, operation, methods, and labor for the fabrication, installation, start-up, and tests for the complete Plumbing installation.
- B. Drawings for the Work are diagrammatic, intended to convey the scope of the Work and to indicate the general arrangement and locations of the Work. Because of the scale of the Drawings, certain basic items such as pipe fittings, access panels, and sleeves may not be shown. This Contractor shall be responsible for confirming the fixtures, piping and equipment fit the space provided. The location and sizes for pipe fittings, sleeves, inserts, and other basic items required by code and other sections shall be coordinated and included for the proper installation of the work.
- C. Fixture and Equipment Specification may not deal individually with minute items required such as components, parts, controls, and devices which may be required to produce the equipment performance specified or as required to meet the equipment warranties. Where such items are required, they shall be included by the supplier of the equipment, whether or not specifically called for in the Contract Documents.
- D. Where the words "provide", "furnish", "include", or "install" are used in the Specification or on the Drawings, it shall mean to furnish, install, and test complete and ready for operation, the items mentioned. If an item is indicated in the Contract Documents, it shall be considered sufficient for including same in the work.
- E. Where noted on the Drawings or where called for in other Sections of the Project Manual, the Contractor for this Division shall install equipment furnished by Others, and shall make required service connections. Contractor shall verify with the supplier of the equipment the requirements for the installation.
- F. Coordinate with all trades in submittal of shop drawings. Shop drawings shall be prepared clearly indicating all applicable components. Space conditions shall be detailed to the satisfaction of all concerned trades, subject to review and final acceptance by the Engineer. In the event that the Contractor installs his work before coordinating with other trades or so as to cause any interference with work of other trades, the necessary changes shall be made in the work to correct the condition, at no additional cost to the Owner.

1.3 CODES AND STANDARDS

- A. Conform to latest edition of governing codes, ordinances, or regulations of city, county, state, or utility company having jurisdiction. Where local codes are not applicable, conform to Standard Plumbing Code; Standard Mechanical Code; International Fire Code, NFPA, and National Electrical Code.

1.4 CONTRACTOR'S QUALIFICATIONS

- A. The qualifications of the Plumbing Contractor for this project shall be as follows:
 - 1. The Contractor shall have been in the contracting business for the last five (5) consecutive years and under their current corporation name with 75% of the same corporate officers.
 - 2. The Contractor shall have successfully completed at least two projects of comparable size and scope within the past five (5) years.
 - 3. The Contractor's main office shall be located within 100 miles driving distance of the project. If the Contractor's office is located more than 100 miles from job site, the Contractor shall submit for approval, 10 working days prior to bidding the job, the name of the service company within a 100 mile radius of the job site, who will be responsible for any/all service required during the warranty period. In either case, the Contractor shall be responsible for having a qualified technician on the job site within 4 hours after receiving a service call.
 - 4. When requested, the contractor shall provide substantiating proof of these requirements.

1.5 FEES, PERMITS, AND INSPECTIONS

- A. Secure all permits and pay all fees required in connection with the Work.
- B. If there is a boiler included as a part of the project, the contractor shall obtain a State Boiler Permit. The permit application form may be obtained on line at [http://www.alalabor.state.al.us/PDFs/11-07 Revised/Boiler Install Permit Rev 112807.pdf](http://www.alalabor.state.al.us/PDFs/11-07%20Revised/Boiler%20Install%20Permit%20Rev%20112807.pdf). This contractor is responsible for coordinating the installation of all emergency shut-down switches at each exit door as required by code.
- C. Coordinate and provide such inspections as are required by the Authorities with jurisdiction over the site.
- D. Where applications are required for procuring of services to the building, prepare and file such application with the Utility Company. Furnish all information required in connection with the application in the form required by the Utility Company.

1.6 ACTIVE SERVICES

- A. Existing active services; water, gas, sewer, electric, are to be located and shall be protected against damage. Do not prevent or disturb operation of active services which are to remain. If active services are encountered which require relocation, make request to authorities with jurisdiction for determination of procedures. Where existing services are to be abandoned, they shall be terminated in conformance with requirements of the Utility or Municipality having jurisdiction.

1.7 SITE INSPECTION

- A. Contractor shall inspect the site to familiarize himself with conditions of the site which will affect his work and shall verify points of connection with utilities, routing of outside piping to include required clearances from any existing structures, trees or other obstacles.
- B. Extra payment will not be allowed for changes in the Work required because of Contractor's failure to make this inspection.

1.8 OPENINGS, CUTTING, AND PATCHING

- A. Coordinate the placing of openings in the new structure as required for the installation of the Plumbing Work.
- B. When additional patching is required due to failure to inspect work; then provide the patching required to properly close the openings, to include patch painting.
- C. When cutting and patching of the structure is made necessary due to failure to install piping, sleeves, or equipment on schedule, or due to failure to furnish, on schedule, the information required for the leaving of openings, then provide the cutting and patching as required.

1.9 WIRING FOR PLUMBING EQUIPMENT

- A. Division 26 shall provide power services for motors and equipment furnished by this Contractor to include safety disconnect switches, starters and final connections.
- B. Division 22 shall provide all motors and contactors for equipment furnished under this Division, except where they are an integral part of a motor control center which is provided under another Division.
- C. Provide internal wiring, alarm wiring including for fire protection and/or security, control wiring, and interlock wiring for equipment furnished, to include temperature control wiring.
- D. Coordinate with Division 26 all motors and other mechanical equipment which require electrical services. Provide schedule which shall include the exact location for rough-in, electrical load, size, and electrical characteristics for all services required.
- E. Where motors or equipment furnished require larger services or services of different electrical characteristics than those called for on the Electrical Drawings, this contractor shall coordinate with the electrical contractor and the Electrical Engineer to provide a larger service as required, the cost of which shall be the responsibility of this contractor.
- F. Electrical work provided under Division 22 shall conform to the requirements of Division 26.

1.10 SUBSTITUTIONS

- A. Any equipment submitted as "equal" to the basis of design shall be accompanied with a comparison letter from the vendor stating any differences from the equipment being submitted and the basis of design. A letter is also to be submitted from the vendor, on the vendor's letterhead, stating that the vendor has received a copy of the job specifications, all

addendums and any necessary drawing. For any type of "Country of Origin", ARRA, etc. requirement projects, compliance letters from the manufacturer shall be obtained ten working days prior to the bid.

- A. Substitutions for the scheduled and specified equipment shall only be done with the prior approval of the engineer, and shall be obtained in writing. Prior approvals shall be obtained no less than ten working days prior to the bid date. Prior approval shall not relieve the contractor of supplying equipment that meets the specifications, capacities, efficiencies, physical dimensions, etc.

1.11 PROTECTION

- A. Special care shall be taken for the protection of equipment furnished. Equipment and material shall be completely protected from weather elements, painting, plaster, etc. until the project is completed. Damage from rust, paint, scratches, etc. shall be repaired as required to restore equipment to original condition.
- B. Where the installation or connection of equipment requires work in areas previously finished by other Contractors, the area shall be protected and not marred, soiled, or otherwise damaged during the course of such work. Contractor shall arrange with the other Contractors for repairing and refinishing of such areas which may be damaged.
- C. When welding is required inside building, provide one man for a fire watch. Fire watch shall require adequate protection of existing surfaces and observance of lower floors where penetrations exist.

1.12 SUBMITTALS

- A. General
 - 1. Submit to Engineer shop drawings and product data required by the drawings and specifications.
 - 2. Contractor shall compile all data including but not limited to ductwork materials and construction details, ductwork layout, manufacturers catalog and product data, controls wiring diagrams and material data, piping, insulation, water treatment, and test and balance.
 - 3. Submit a minimum of 7 copies of data, more if required by the Architect.
- B. Submittal Requirements
 - 1. Prepare submittals compiled in a 3 ring, hard bound, loose leaf binder. The face of the binder shall be clearly marked with the project title and number, the name of the Owner, Architect, Engineer, General Contractor and this contractor.
 - 2. The first page inside the binder shall provide an index, numerically indicating all sections applicable to this submittal.
 - 3. Separate binders shall be provided for plumbing trade.
 - 4. Provide tab dividers for each section submitted. In the event an item appears on the drawings not specifically covered by the specifications, provide an additional numeric tab at the end of the index detailing the item and include the submittal data in the binder.
 - 5. All equipment included on the submittal sheets shall be marked to indicate the "Tag" name or number of the equipment as shown on the drawings. The equipment shall be high-lighted, where necessary, to clarify which items are being submitted.

6. For the piping submittals, when required, the contractor will be provided with an electronic copy of the plumbing floor plans. Piping layout submittals shall consist of one copy on a reproducible medium such as mylar. The drawings shall be on standard size sheets of 24" x 36" or 30" x 42". The reproducible copy shall be returned to the contractor with the engineers' approval stamp and comments.
7. Submit only complete project submittals. Partial submittals or submittals not complying with the above requirements shall be returned to the contractor unmarked and rejected.
8. In the interest of project expediency the contractor may pre-submit long lead items for pre-approval. However, the contractor shall not be relieved of including the same data as required by submittal binder and shall be included therein.
9. The Contractor may turn in submittals without control drawings if they require a longer production time. All other items shall be included.
10. Provide a tab for items not included and include an explanation of why item is not included in the submittal and the expected submittal date.
11. Review shop drawings and product data prior to submission to Engineer.
12. Verify field measurements, field construction criteria, catalog numbers, and similar data.
13. Coordinate each submittal with work of the project and Contract Documents.
14. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved by Engineer's review of submittals, unless Engineer gives written acceptance of specific deviations.
15. Notify Engineer in writing of deviations from requirements of Contract Documents at time submittals are made. A "deviation" shall be construed to mean a minor change to the sequence indicated on drawings or specification. A "deviation" is not intended to allow substitutions or product options.
16. Do not begin work which requires submittals until submittals have been returned with Engineer's stamp and initials or signature indicating review and approval. Materials and equipment that were installed prior to being not approved shall be removed and replaced with approved items at no additional cost to other parties.
17. Shop Drawings and/or submittals requiring resubmission to the Engineer due to non-compliance with the Contract Documents and/or incompleteness shall be thoroughly reviewed by the Contractor prior to delivery to the Engineer for review. The Contractor shall ensure the completeness and compliance of the submittal materials and shall reimburse the Engineer at their standard hourly billing rates for review of submittals/shop drawings beyond the second submission.
18. Attention is directed to the fact that Engineer's review is only to check for general conformance with the design concept of the project and general compliance with Contract Documents. No responsibility is assumed by Engineer for correctness of dimensions, details, quantities, procedures shown on shop drawings or submittals.
19. Omission in shop drawings of any materials indicated in Contract Drawings, mentioned in Specifications, or required for proper execution and completion of Work, does not relieve the Contractor from responsibility for providing such materials.
20. Approval of a separate or specified item does not necessarily constitute approval of an assembly in which item functions.

1.13 OPERATING AND MAINTENANCE MANUALS

A. General

1. Provide searchable CD in PDF format of all product data, and other information described in this Section for use in compiling operating and maintenance manuals.

2. Provide three up-to-date copies of shop drawings, product data, and other information described in this Section for use in compiling operating and maintenance manuals.
3. Provide legible submittals made by permanent reproduction copy equipment from typewritten or typeset originals.
4. Pre-punch 8-1/2 inch x 11 inch sheets for standard three ring binders.
5. Submit larger sheets in rolled and protected packages.

B. Compilation

1. The Contractor will receive shop drawings, brochures, materials lists, technical data of all types, warranties, guarantees, and other pertinent information and will assemble, catalog, and file information in loose-leaf, hardback three-ring binders.
2. Submittal Format: (Provide each of the following items, as applicable, for each required item or system. Requirements will vary, depending on the equipment. Refer to specific Specification section requirements.)
 - a. Item: (Use appropriate Section title.)
 - b. System Description: (Provide a detailed narrative description of each system, describing function, components, capacities, controls and other data specified, and including the following:
 - (1.) Number of.
 - (2.) Sizes.
 - (3.) Type of operation.
 - (4.) Detailed operating instructions, including start-up and shut-down of each system, with indications for position of all controls, as applicable.
 - (5.) Wiring Diagrams: (Complete wiring diagrams for internally wired components including controls.)
 - (6.) Operating Sequence: (Describe in detail.)
 - (7.) Manufacturers Data: (Provide catalog data sheets, specifications, nameplate data and parts list.)
 - (8.) Preventative Maintenance: (Provide manufacturer's detailed maintenance recommendations.)
 - (9.) Trouble Shooting: (Provide manufacturer's sequence for trouble-shooting procedures for operational problems.)
 - (10.) Extra Parts: (Provide a listing of extra stock parts furnished as part of the Contract.)
 - (11.) Warranties: (Provide specific manufacturer's warranty. List each component and control covered, with day and date warranty begins, date of expiration, and name, address and telephone number of person to contact regarding problems during warranty period.)

- (12.) Directory: (Provide names, addresses and telephone numbers of Contractor, its subcontractors, suppliers, installers and authorized service and parts suppliers. Format as follows:)

Contractor:
Address:
Telephone No.:
Person to Contact:

Subcontractor:
Address:
Telephone No.:
Person to Contact:

Installer:
Address:
Telephone No.:
Person to Contact:

Manufacturer:
Address:
Telephone No.:
Person to Contact:

Local Service Representative:
Address:
Telephone No.:
Person to Contact:

1.14 RECORD DRAWINGS

A. Detailed Requirements for Record Drawings

1. During the progress of the work, the Contractor shall require the job superintendent for the plumbing, air conditioning, heating, ventilating, and fire protection subcontractors to record on their field sets of drawings the exact locations, as installed, of all conduits, pipes, and ducts whether concealed or exposed which were not installed exactly as shown on the contract drawings.
2. The Contractor shall submit redline as-built drawings to the Engineer for review.
3. The Engineer shall authorize the Contractor to produce and distribute the redline as-built drawings in PDF format as follows:
 - a. One (1) computer disc (CD) to the Engineer.
 - b. One (1) CD to the Architect.
 - c. Three (3) hard copies full size
 - d. Two (2) CD to the Owner.

1.15 SUBSTITUTIONS AND PRODUCT OPTIONS

- A. For products specified only by reference standard, select product meeting that standard, by any manufacturer.

- B. For products specified by naming several products or manufacturers, select any one of products and manufacturers named which complies with specifications.
- C. For products specified by naming several products or manufacturers and stating "or equivalent", "or equal", or "or Engineer approved equivalent", or similar wording, submit a request for proposed substitutions for any product or manufacturer which is not specifically named; for review and approval by the Engineer.
- D. For products specified by naming only one product and manufacturer, there may be an option of an Engineer approval of a product of equal or greater quality or size.

1.16 SUBSTITUTION SUBMISSIONS

- A. Contractor's Base Bid shall be per contract documents.
- B. Submit separate request for each substitution. Support each request with:
 - 1. Complete data substantiating compliance of proposed substitution with requirements stated in contract documents:
 - a. Product identification, including manufacturer's name and address.
 - b. Manufacturer's literature; identify:
 - (1.) Product description.
 - (2.) Reference standards.
 - (3.) Performance and test data.
 - c. Name and address of at least two similar projects on which product has been used, and date of each installation.
 - d. Itemized comparison of the proposed substitution with product specified; list significant variations.
 - e. Data relating to changes in construction schedule.
 - f. Any effect of substitution on separate contracts.
 - g. List of changes required in other work or products.
 - h. Designation of availability of maintenance services, sources of replacement materials.
 - i. Provide certification of product compatibility with adjacent materials.
- C. Substitutions will not be considered for acceptance when:
 - 1. They are indicated or implied on shop drawings or product data submittals without a formal request from Contractor or his supplier prior to bid.
 - 2. Acceptance will require substantial revision of contract documents.
 - 3. In judgement of Engineer, do not include adequate information necessary for a complete evaluation.

4. Substitute products shall not be ordered or installed without written acceptance of Engineer.
5. Engineer will determine acceptability of proposed substitutions.

1.17 CONTRACTOR'S SUBSTITUTION RESPONSIBILITIES

- A. In making formal request for substitution, Contractor represents that:
 1. He has investigated proposed product and has determined that it is equivalent to or superior in all respects to that specified.
 2. He will provide same warranties or bonds for substitution as for product specified.
 3. He will coordinate installation of accepted substitution into the work, and will make such changes as may be required for the work to be complete in all respects. This includes revisions due to changes in electrical characteristics, physical size and weight, service requirements, service clearances, etc.
 4. He waives claims for additional costs caused by substitution which may subsequently become apparent.
- B. The contractor shall have included all costs associated with the substitution for the specified products or materials, and that no additional cost will be incurred by any other party in order to fully incorporate the substituted item(s).
- C. The contractor agrees to reimburse the Architect/Engineer for any architectural or engineering re-design that is required by the substitution to be fully incorporated. The reimbursement shall be at the Architect/Engineer's standard billing rate.

1.18 ENGINEER DUTIES

- A. Review Contractor's requests for substitutions with reasonable promptness.
- B. Notify Contractor in writing of decision to accept or reject requested substitution.

1.19 CONTRACTOR OBSERVATION DUTIES

- A. When the Contractor schedules an observation for the Engineer, all work for that observation, i.e., underground, above ceiling, or in walls prior to gypsum board installation, shall be completed. If the work is not complete and not ready for inspection, the Engineer will notify the Contractor that the inspection was not performed. The Contractor shall complete the work, and then re-schedule the inspection for the Engineer, for which the Contractor shall reimburse the Engineer at their normal hourly billing rates.
- B. Minimum Required inspections by Engineer:
 1. Underground utilities with appropriate test prior to covering pipe.
 2. In walls prior to gypsum board installation or installing insulation.
 3. Above ceiling: Prior to ceiling installation or installing insulation.
 4. Piping systems testing: When performed in smaller sections, the entire system will be required to be retested.
 5. TVI Inspection

1.20 TELEVISION INSPECTION (TVI)

- A. Existing Building Sanitary Sewer TVI. A TVI shall be performed to document that the existing system has no signs of previous damage is sufficient and for use in connection to the new steam blowdown waste piping system. The TVI shall be performed after the installation of the

new blowdown drain has been completed to the satisfaction of the Engineer. Prior to the TVI, the pipeline, including all appurtenances, shall be sufficiently cleaned to allow for complete visual inspection of the pipe. Prior to performing the TVI, the Contractor shall introduce enough water in the pipe segment(s) to fill all low sections and flow through the downstream pipe section. If any section of the pipe segment appears to be dry, additional water shall be introduced as described above. The Engineer shall verify the adequacy of water before any TVI is performed. The TVI shall begin within thirty (30) minutes of introducing water into the pipe segment, unless otherwise directed by the Engineer.

- B. CAMERA: The camera shall be specifically designed and constructed for sanitary or storm drain environment. The camera shall include TV camera with an automatic camera lighting system. There shall be no geometrical distortion of the image. The camera shall move through the pipeline in a downstream direction.
- C. The computer system shall be capable of digitally recording an MPEG file, a JPEG file, compile data in a standard database format, and print TVI Reports and graphics in accordance with these Specifications and the Contract. The system shall also be capable of recording, storing, and playing video and images of defects and other related significant visual information. The Contractor may submit the TVI report on either a compact disc (CD) or digital video disc (DVD) in MPEG-1 or MPEG-2 format, or as specified. The CD/DVD shall be in a format that is readable by the Engineer/Owners current computer system.
- D. New Construction TVI Report and Video: Upon completion of the TVI, the Contractor shall provide the Engineer/Owner with a final TVI Report prepared in accordance with these specifications. The report is to include only data from pipe segments meeting all acceptance criteria. The final TVI Report shall be submitted to the Engineer within five (5) Working Days of the pipe installation being found to be in compliance with these Specifications and the Contract documents.
- E. The final TVI Report shall include, at a minimum:
 - 1. A title page (header information) for each segment.
 - 2. A schematic plot of each segment showing observation and footages.
 - 3. MPEG video of each segment on CD or DVD. The disc(s) shall be presented in a hard plastic protective case.
 - 4. Survey data for each segment.
 - 5. A map of the pipeline which shows manhole numbers or cleanouts as applicable.
 - 6. A completed TVI Form or written certification "Proof of Compliance with the Contract", of these Specifications that the installation meets the acceptance criteria of these Specifications and the Contract documents.
- F. Poor picture quality, extended periods of inactivity, inappropriate language or idle chatter are not acceptable and will be grounds for rejection by the Engineer. The final TVI Report will become the property of the Engineer/Owner upon acceptance.
- G. The sanitary drain system will be reported if any of the following conditions exist:
 - 1. Sags greater than 1/2-inch in depth
 - 2. Standing water
 - 3. Offset joints
 - 4. Cracked pipes
 - 5. Infiltration
 - 6. Hanging gaskets (if cast iron)

1.21 FINISHING

- A. General: Prior to acceptance of the installation and final payment of the Contract, the Contractor shall perform the work outlined herein.

- B. Cleaning: At the conclusion of the construction, the site and structure shall be cleaned thoroughly of all debris and unused materials remaining from the mechanical construction. All closed off spaces shall be cleaned of all packing boxes, wood frame members, and other waste materials used in the mechanical construction.
- C. The entire system of piping and equipment shall be cleaned internally. The Contractor shall open all dirt pockets and strainers, completely blowing down as required and clean strainer screens of all accumulated debris.
- D. All tanks, fixtures, and pumps shall be drained and proven free of sludge and accumulated matter.
- E. All temporary labels, stickers, etc., shall be removed from all fixtures and equipment. (Do not remove permanent name plates, equipment model numbers, ratings, etc.). All equipment shall have affixed adjacent to the permanent nameplate, the unit identification on an engraved label with permanent adhesive.
- F. Plumbing fixtures, equipment, tanks, pumps, etc., shall be thoroughly cleaned.

1.22 TEST AND DEMONSTRATIONS

- A. Systems shall be tested and placed in proper working order prior to demonstrating systems to Owner.
- B. Prior to acceptance of the mechanical installation, demonstrate to the Owner or his designated representatives all essential features and functions of all systems installed, and instruct the Owner in the proper operation and maintenance of such systems. The contract shall allow for five (5) working days to perform the demonstrations.
- C. Provide necessary trained personnel to perform the demonstrations and instructions. Provide manufacturer's representatives for systems as required to assist with the demonstrations.
- D. Training shall include audio/video recording in DVD format turned over to the owner as part of closeout documents.
- E. Dates and times for performing the demonstrations shall be coordinated with the Owner.
- F. Upon completion of demonstrations, provide a certificate testifying that demonstrations have been completed. Certificate shall list each system demonstrated, dates demonstrations were performed, names of parties in attendance, and shall bear signatures of contractor and owner.

1.23 PAINTING AND IDENTIFICATION

- A. Touch-up paint where damaged on equipment furnished with factory applied finish, to match original finish.
- B. Provide engraved, laminated plastic tags for all equipment. Tags shall be attached with permanent adhesive.
- C. All support steel provided by the mechanical contractor shall be cleaning of all rust and dirt and painted with a coat of rust inhibiting primer. In addition, all steel installed outdoors shall also have a finish coat of weather resistant paint.

1.24 EXCAVATING, TRENCHING, AND BACKFILLING

- A. Provide excavation necessary for underground water piping, etc., and backfill such trenches and excavations after work has been installed and tested. Care shall be taken in excavating, that walls and footings and adjacent load bearing soils are not disturbed, except where lines must cross under a wall footing. Where a line must pass under footing, the crossing shall be made by the smallest possible trench to accommodate the pipe. Excavation shall be kept free from water by pumping if necessary. No greater length of trench shall be left open, in advance of pipe and utility laying, than that which is authorized.
- B. Trenches for piping and utilities located inside foundation walls and to point five (5) feet outside of the wall shall be not less than sixteen (16) inches nor more than twenty-four (24) inches wider than the outside diameter of the pipe to be laid. The widths of trenches for piping and utilities located more than five (5) feet outside of building foundation walls, other than for sewers, shall be governed by conditions found at the site.
- C. Bottoms of trenches shall be so shaped that when pipe is in place the lower fourth of the circumference for the full length of the barrel will be supported on compacted fill. Bell holes shall be dug so that no part of the weight of the pipe is supported by the bell but shall be no larger than necessary for proper jointing. All sewers and piping required for the structure shall be excavated to at least (6) inches below pipe invert.
- D. Immediately after testing and/or inspection, the trench shall be carefully backfilled with earth free from clods, brick, etc., to a depth one-half the pipe diameter and then firmly puddled and tamped in such a manner as not to disturb the alignment or joints of the pipe. Thereafter, the backfill shall be puddled and tamped every vertical foot.

1.25 CONCRETE WORK

- A. Provide concrete bases and housekeeping pads for all equipment installed at finish floor level. Concrete work shall be as specified in the applicable Civil/Site and Structural Sections. Vibration pads, equipment bases, pipe supports and thrust blocks shall be provided by this Contractor.
- B. Provide equipment anchor bolts and coordinate their proper installation and accurate location.

1.26 ACCESS PANELS

- A. Provide access panels where required and not shown on the drawings for installation by the drywall or masonry Contractor. Access panels shall be as specified in the applicable architectural section. All access panel locations which allow access to equipment shall be approved by the Architect/Engineer.

1.27 SLEEVES

- A. Sleeves passing through non-fire rated walls and partitions shall be Schedule 10 black steel.
- B. Sleeves passing through load bearing walls, concrete beams, foundations, footings, and waterproof floors shall be Schedule 40 galvanized steel pipe or cast iron pipe.

- C. Sleeves passing through non-load bearing walls, concrete beams, foundations, footings, and waterproof floors shall be Schedule 40 PVC or cast iron
- D. Sleeves for insulated piping shall be of sufficient internal diameter to take pipe and insulation and to allow for free movement of pipe. Waterproof sleeves shall be of sufficient internal diameter to take pipe and waterproofing material.
- E. In finished areas where pipes are exposed, sleeves shall be terminated flush with wall, partitions, and ceilings, and shall extend 1/2" above finished floors. Extend sleeves 1" above finished floors in areas likely to entrap water.
- F. Pipe to wall penetration closures for underground pipe penetrations of walls shall be "Link-Seal" as manufactured by Thunderline Corporation, or equal.

1.28 ESCUTCHEONS

- A. Provide chrome plated escutcheons at each sleeved opening into finished and exposed exterior spaces. Escutcheons shall fit around insulation or around pipe when not insulated; outside diameter shall cover sleeve. Where sleeve extends above finished floor, escutcheon shall be high cap type and shall clear sleeve extension. Secure escutcheons or plates to sleeve but not to insulation with set screws or other approved devices.

1.29 INSULATION PROTECTION

- A. Where exposed insulated piping extends to floor, provide sheet metal guard around insulation.

1.30 ANCHORING OF EQUIPMENT

- A. All equipment located on floor slab, that is not mounted on wheels and is capable of being moved shall be secured to the floor with anchor bolts. A minimum of two bolts are required per each piece of equipment and bolts shall be of sufficient size to prevent equipment from overturning.

1.31 ISOLATION OF EQUIPMENT

- A. All equipment shall be installed with isolating service valves. Unions or flange fittings shall be provided for removal of the isolated equipment.

1.32 PROTECTION OF ELECTRICAL EQUIPMENT

- A. Water, waste & vent, or rainleader piping shall not be installed in electrical or communication rooms or directly above electrical equipment.

1.33 CONNECTIONS FOR FIXTURES AND EQUIPMENT UNDER ANOTHER SECTION OR BY OWNER

- A. Rough all equipment requiring connection to systems provided under this Division. Verify requirements and current locations before proceeding with work.
- B. Make all connections to equipment furnished under another Section or by owner as required to obtain complete and working systems.

1.34 SYSTEM GUARANTEE

- A. Work required under this Division shall include one-year guarantee. Guarantee by Contractor to Owner is to replace for Owner any defective workmanship or material which has been furnished under contract at no cost to the Owner for a period of one year from substantial completion. Guarantee shall also include all reasonable adjustments of system required for proper operation during guarantee period. Guarantee shall not include normal preventative maintenance services or filters.
- B. At "Demonstration", one-year guarantee provision by Contractor shall be explained to Owner.
- D. All sealed hermetic refrigeration systems shall be provided with five-year factory warranty from substantial completion.

1.35 ADJUSTING

- A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
- B. Operate and adjust disposers, emergency eye wash/showers, hot-water dispensers and controls. Replace damaged and malfunctioning units and controls.
- C. Adjust water pressure at faucets and flushometer valves to produce proper flow and stream.
- D. Replace washers and seals of leaking and dripping faucets and stops.
- E. Install fresh batteries in sensor-operated mechanisms.

1.36 CLEANING

- A. At completion of all work, fixtures, exposed materials and equipment shall be cleaned with manufacturers' recommended cleaning methods and materials. Do the following:
 - 1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
 - 2. Remove sediment and debris from drains.
- B. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.

1.37 FINAL ACCEPTANCE

- A. Provide protective covering for installed fixtures and fittings, including but NOT limited to bathtub semi-flexible high impact plastic protective covers with deep fluted sidewalls with non-skid foam pas to absorb shock and prevent scratches.
- B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.
- C. Before final acceptance, the Plumbing Contractor shall furnish a certificate of inspection and final approval from the plumbing Inspector to the Owner and be in accordance with the latest revisions of the applicable codes and the Approved Plumbing Drawings and Specifications. Contractor shall also furnish booklet of test, sterilization compliance and backflow devices certificates.

END OF SECTION

SECTION 22 05 05

PLUMBING DEMOLITION

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Remove: Equipment, piping, insulation, controls, ductwork, etc. as indicated on the drawings.

1.2 EXISTING CONDITIONS

- A. Contractor shall visit site prior to bidding; the contractor shall become familiar with the requirements and intent of the drawings.
- B. There will be no allowances made for failure of the contractor to familiarize themselves with the extent of work required under the specifications or drawings.

1.3 SALVAGED MATERIALS OR EQUIPMENT

- A. Equipment and materials shall be removed from the jobsite at no additional expense to the owner.
- B. All equipment indicated on the drawings shall be turned over to the owner.
- C. Any material posing a hazard shall be removed from the jobsite immediately.

PART 2 - EXECUTION

2.1 GENERAL

- A. Contractor shall submit a plan for approval by the Architect for phasing of demolition to minimize utility outages and interference with other trades and occupied portions of the building.
- B. Contractor shall coordinate utility outages with the General Contractor, Owner and Architect by providing three days written notice of times and locations of utility outages and anticipated time of restoration.

2.2 PROTECTION OF EXISTING TO REMAIN

- A. Provide tarps, plywood, and any other protectionary devices to protect existing finishes, furniture, appliances, equipment, etc.
- B. Damages to any afore mentioned shall be replaced by this contractor at no cost to the owner.

2.3 PROHIBITED METHODS

- A. Jack Hammers shall not be used without the written approval of the Architect. The Architect reserves the right to withdraw approval for the use of jack hammers at any time if their use create excessive noise and/or vibration as deemed by the Architect.

- B. Explosives of any type shall not be used.
- C. Burning shall not be used as a means of demolition and/or disposal. Cutting torches shall not be considered as burning.

2.4 DUST CONTROL

- A. Provide tarps, temporary walls, etc. as required to prevent the spread of dust through the building unnecessarily.

END OF SECTION

SECTION 22 05 32

PLUMBING SUPPORTS AND ANCHORS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Pipe and equipment hangers, supports, and associated anchors.
- B. Equipment bases and supports.
- C. Sleeves and seals.
- D. Flashing and sealing equipment and pipe stacks.

1.2 WORK FURNISHED BUT INSTALLED UNDER OTHER SECTIONS

- A. Furnish hanger and support inserts sleeves for placement into formwork.

1.3 SUBMITTALS

- A. Submit shop drawings and product data for all items listed under this section.
- B. Indicate hanger and support framing and attachment methods.

PART 2 - PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

- A. Hangers for Pipe Sizes 1/2 to 8 inches: Carbon steel, adjustable, clevis, clevis type with galvanized plating.
- B. Multiple or Trapeze Hangers: Steel channels, minimum 2-1/2" wide and 1/8" thick, with welded spacers to distribute pipe weight evenly over the span of the trapeze, hanger rods and cast iron rollers and stand for pipes sizes 6 inches and over.
- C. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
- D. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp; adjustable steel yoke and cast iron roll for hot pipe sizes 6 inches and over.
- E. Vertical Support: Steel riser clamp.
- F. Floor Support for Pipe Sizes to 4 Inches and All Cold Pipe Sizes: Cast iron adjustable pipe saddle, locknut nipple, floor flange, and concrete pier or steel support anchored to floor.
- G. Un-insulated Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
- H. Shield for Insulated Piping 1 1/4 Inches and Smaller: 16 gage galvanized steel saddle over insulation in 180 degree segments, minimum 12 inches long per pipe support.

- I. Shield for Insulated Water Piping 1 1/2 Inches and Larger: Rigid non-conducting blocking in 180 degree segments, 16 inch minimum length with block thickness the same as insulation thickness and with an inner contour of the supporting pipe. Install with 16 gage galvanized steel saddle per pipe support.
- J. Shields for Vertical Copper Pipe Risers: Sheet lead.

2.2 HANGER RODS

- A. Steel Hanger Rods: Galvanized threaded both ends, threaded one end, or continuously threaded. Rods shall be sized as listed in the Pipe Support Schedule.

2.3 FLASHING

- A. Metal Flashing: galvanized steel.
- B. Lead Flashing: 5 lb/sq ft sheet lead for waterproofing; one lb/sq ft sheet lead for soundproofing.
- C. Flexible Flashing: 47 mil thick sheet butyl; compatible with roofing.
- D. Caps: Steel, 20 gage minimum; 16 gage at fire resistant elements.

2.4 SLEEVES

- A. Sleeves for Pipes Through Non-fire Rated Floors: Form with Schedule 10 black steel pipe.
- B. Sleeves for Pipes Through Non-fire Rated Walls, Footings, and Potentially Wet Floors: Form with schedule 10 steel pipe.
- C. Sleeves through beams shall be Schedule 40 steel; only in locations approved by the Structural Engineer.
- D. Sleeves through beams shall be Schedule 40 steel; only in locations approved by the Structural Engineer.
- E. Sleeves for floor or wall penetrations at rated assemblies shall conform to Specifications Section 220560.

2.5 FABRICATION

- A. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
- B. Design hangers without disengagement of supported pipe.

2.6 FINISH

- A. Prime coat steel rods, hangers, clamps, bolts, washers & nuts, accessories and supports at interior spaces that will be exposed and painted. All other hangers including exterior supports shall be galvanized, pre-galvanized or hot-dipped and primed & painted as directed by Engineer and Architect. Supports exposed in corrosive areas (Pool equipment rooms, chlorine atmosphere, etc.) will require additional protection of supporting materials as conditions dictate including stainless steel and aluminum.

- B. Finish coat in exposed areas and exterior shall be selected by Architect.

PART 3 - EXECUTION

3.1 PIPE HANGERS AND SUPPORTS

- A. Support horizontal piping as follows:

PIPE SUPPORT SCHEDULE					
Pipe Size	Support Spacing				Hanger Rod Diameter
	Sched 40 Black Steel	Copper	PVC	Cast Iron Soil Pipe	
1/2"	-	5'-0"	4'-0"	-	3/8"
3/4"	7'-0"	5'-0"	4'-0"	-	3/8"
1"	7'-0"	6'-0"	4'-0"	-	3/8"
1-1/4"	7'-0"	7'-0"	4'-0"	-	3/8"
1-1/2"	9'-0"	8'-0"	4'-0"	-	3/8"
2"	10'-0"	8'-0"	4'-0"	5'-0"	3/8"
2-1/2"	10'-0"	9'-0"	4'-0"	5'-0"	1/2"
3"	10'-0"	10'-0"	4'-0"	5'-0"	1/2"
4"	10'-0"	10'-0"	4'-0"	5'-0"	1/2"
6"	10'-0"	10'-0"	4'-0"	5'-0"	5/8"
8"	10'-0"	10'-0"	4'-0"	5'-0"	7/8"
10"	10'-0"	10'-0"	4'-0"	5'-0"	7/8"

Note: Rods may be reduced one size for double rod hangers, with 3/8" being the

- B. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
- C. Place a hanger within 12 inches of each horizontal elbow.
- D. Use hangers with 1-1/2 inch minimum vertical adjustment.
- E. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.
- F. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub. Support vertical piping at maximum distances shown in horizontal schedule.
- G. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
- H. Support riser piping independently of connected horizontal piping.
- I. All hangers, hanger rods, supports, etc. shall be double-nutted.

3.2 EQUIPMENT BASES AND SUPPORTS

- A. Provide equipment bases of concrete type.

- B. Provide templates, anchor bolts, and accessories for mounting and anchoring equipment.
- C. Construct support of steel members. Brace and fasten with flanges bolted to structure.
- D. Provide rigid anchors for pipes after vibration isolation components are installed.

3.3 FLASHING

- A. Provide flexible flashing and metal counter-flashing where piping and ductwork penetrate weather or waterproofed walls, floors, and roofs.
- B. Flash vent and soil pipes projecting 3 inches minimum above finished roof surface with lead worked one inch minimum into hub, 8 inches minimum clear on sides with 24 x 24 inches sheet size. For pipes through outside walls, turn flanges back into wall and caulk, metal counter-flash and seal.
- C. Flash floor drains in floors with topping over finished areas with lead, 10 inches clear on sides with minimum 36 x 36 inch sheet size. Fasten flashing to drain clamp device.
- D. Seal floor, and mop sink drains watertight to adjacent materials.
- E. Provide acoustical lead flashing around ducts and pipes penetrating equipment rooms, installed in accordance with manufacturer's instructions for sound control.

3.4 SLEEVES

- A. In finished areas where pipes are exposed, sleeves shall be terminated flush with wall, partitions, and ceilings, and shall extend 1/2" above finished floors. Extend sleeves 1" above finished floors in areas likely to entrap water. Caulk sleeves full depth and provide floor plate.
- B. Install chrome plated steel escutcheons at finished surfaces
- C. Install stainless steel escutcheons at exterior surfaces.

END OF SECTION

SECTION 22 05 53 - PLUMBING IDENTIFICATION

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Identification of domestic cold, hot & recirculating water, non-potable water, service valves, natural gas, sanitary drain, sanitary vent, compressed air, emergency rain leader and rain leader piping systems as identified in Section 3.2-B

1.2 SUBMITTAL

- A. Submit samples and manufacturer's installation instructions for all plumbing identification products used.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. **EXTERIOR Pipe Markers:** Pipe markers shall be Outdoor grade acrylic plastic with UV inhibitors seals in and protects graphics, snap around material for sizes up to 8" OD. Pipes larger than 8" shall be flat strap around markers fastened to pipes with heavy duty nylon ties. Color coded background, color of legend letter size and length of letter size and length of color field shall conform completely with the latest edition of ANSI A13.1. Markers shall indicate direction of flow. Legends shall be alternately reversed and repeated for viewing from any angle. Markers shall be factory formed for the installed diameter. Markers shall be Seton Ultra-Mark Snap-Around High Performance or approved equal. Pipe Markers, see 3.2 B schedule for color code requirements of pipe markers. Provide directional arrows for each service.
- B. **INTERIOR Pipe Markers:** Pipe markers shall be cylindrically coiled printed plastic sheets, snap around material for sizes up to 5.75" OD, pipes larger than 5.75" shall be Flat strap around markers fastened to pipes with heavy duty nylon ties. Color coded background, color of legend letter size and length of letter size and length of color field shall conform completely with the latest edition of ANSI A13.1. Markers shall indicate direction of flow. Legends shall be alternately reversed and repeated for viewing from any angle. Markers shall be factory formed for the installed diameter. Markers shall be Seton Setmark or approved equal. Pipe Markers, see 3.2 B schedule for color code requirements of pipe markers. Provide directional arrows for each service.
- C. **Ceiling Markers:** Markserv MS900 self-adhesive vinyl, 0.0032" thick PVC with permanent pressure-sensitive acrylic adhesive for use of identifying valve locations above acoustical tile ceilings 7/8" diameter, 7 colors available - yellow, green, blue, orange, black, red and white. Fire protection water color to be orange with white number. Markers shall be numbered consecutively with standard 3/16" characters. Markers shall be installed on metal grid of lay-in ceilings and located within 24" of valve above ceiling. Markers shall be Markserv, Seton or equal.
- D. **Metal Tags:** Brass with 1/2 inch high black filled numbers and/or letters, minimum 1-1/2 inch diameter, brass link chain and hooks.
- E. **Plastic Nameplates (Interior Applications):** Laminated three-layer plastic with engraved white letters on black background color.

- F. Aluminum Nameplates (Exterior Application): .020 engraved aluminum plates with white letters on black background color. Plates shall be secured with optional 3M adhesive and two retaining screws shall be provided with each plate. Plates shall be 3" x 1" minimum size.

PART 3 - EXECUTION

3.1 GENERAL

- A. All markers to be installed on a clean finished pipe or insulated surface. These markers shall be installed on piping above ceilings.

3.2 PIPING

- B. Piping shall be identified at maximum 10 feet intervals, at each side of wall penetration, and at each valve. Piping in exposed areas may be identified at maximum 20' intervals. Piping identification shall include type of service and direction of flow.
- C. Piping above ceiling shall be marked by the following schedule
 - 1. Domestic Cold Water - White letters on Green, Seaton Style No. M3991.
 - 2. Domestic Hot Water - Black letters on Yellow, Seaton Style No. M3993.
 - 3. Hot Water Recirculating - Black letters on Yellow, Seaton Style No. M4012.
 - 4. Sanitary Drain - White letters on Green, Seaton Style No. M4085.
 - 5. Sanitary Vent - White letters on Green, Seaton Style No. M4095.

3.3 VALVES

- A. Valves in main and branch piping shall be identified with metal tags chained to the valve.
- B. Provide valve chart and schedule in aluminum frame with clear plastic shield. Install at location as directed.
- C. All valves locations shall be marked below the ceiling with color coded markers i.e. color dot on ceiling grid. Colored marker shall be submitted for approval.

3.4 EQUIPMENT

- A. Large interior equipment such as water heaters and pumps, etc., shall be identified with plastic laminated nameplates.
- B. Control panels and major control components not located at control panels shall be identified with plastic nameplates.
- C. Large exterior equipment shall be identified with aluminum nameplates.

END OF SECTION

SECTION 22 05 60

PLUMBING THROUGH PENETRATION FIRE STOPPING

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Provide fire stopping for the following through penetrations:
 - 1. Domestic hot, cold and hot water recirculation water, rain leaders, emergency rain leaders, sanitary waste and vent and acid waste & vent when applicable, compressed air, and gas pipe.

1.02 REFERENCES

- A. Underwriters Laboratories (UL)
- B. American Society for Testing and Materials (ASTM)

1.03 CONTRACTOR REQUIREMENTS

- A. This work shall be performed by a contractor trained in the installation or application of systems similar in complexity to those required for this project. The contractor shall have at least 5 years experience with through penetration fire stopping systems and shall have completed a least 5 comparable scale projects using these systems.

1.04 SUBMITTALS

- A. Product data including the following:
 - 1. Manufacturers specifications and technical data
 - 2. Detailed specification of construction and fabrication installation instructions
- B. Shop drawings
 - 1. For each standard application of penetration item and surface being penetrated provide a manufacturers UL approved system cut sheet identifying the UL system number, UL classified devices or materials to be used, other materials to be used, anchorages, sleeves, annular space requirements and sizes, dimensions and locations of all items.
 - 2. For each non-standard application, provide a manufacturer's qualified engineering judgment and drawing. The drawing shall indicate those items specified in "A" above.
 - 3. All UL approved systems shall be selected based on their "F" rating. All systems shall provide the same ratings as the rating of the floor or wall being penetrated, as shown on the plans.
- C. Qualifications

PLUMBING THROUGH PENETRATION FIRE STOPPING

1. Provide list of past projects indicating past experience.
2. Provide statement from manufacturer that installer has to be trained in the proper method of installing fire stop systems.

D. Guarantee

1. Submit copies of written guarantee agreeing to repair or replace joint sealers which fail in joint adhesion, co-adhesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, or general durability or appear to deteriorate in any other manner not clearly specified by submitted manufacturer's data as an inherent quality of the material for the exposure indicated. The guarantee period shall be one year from date of substantial completion.

1.05 STORAGE

- A. Coordinate delivery with scheduled installation date, comply with manufacturers maximum storage requirements. Store materials in a clean, dry, ventilated location. Protect from soiling, abuse, moisture and freezing.

1.06 PROJECT CONDITIONS

- A. Contractor shall visit the job site prior to bid, to verify wall and floor types to be penetrated. Fire ratings of walls are indicated on the plans. Ratings of the floors are assumed to be two (2) hours unless otherwise indicated on the Architectural Plans.
- B. Contractor shall coordinate with the other trades for any penetrating items (pipe, conduit, etc.) that have to be routed differently than shown on the plans. Contractor shall provide fire stopping for all rerouted items whether different UL approved systems or additional materials are required.

PART 2 - PRODUCTS

2.01 THROUGH PENETRATION FIRE STOPPING

- A. Acceptable manufacturers and products shall be those listed in the UL fire resistance directory for the UL system involved.
- B. All systems and devices shall be asbestos free.
- C. Systems or devices listed in the UL. Fire resistance directory under categories XHCR and XHEZ may be used, providing that it conforms to the construction type, penetration type, annular space requirements and fire rating involved in each separate instance and that the system be symmetrical for wall applications.
- D. Fill, void or cavity materials shall be as classified under category XHHW in the UL fire resistance directory.
- E. Forming materials shall be as classified under category XHKU in the UL fire resistance directory.

- F. All fire-stopping products shall be from a single manufacturer.

PART 3 - EXECUTION

3.01 GENERAL

- A. Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.
- B. Verify barrier penetrations are properly sized and in suitable condition for application of materials.
- C. Do not proceed until unsatisfactory conditions have been corrected.
- D. Clean surfaces to be in contact with penetration seal materials, of dirt, grease, oil, loose materials, rust, or other substances that may affect proper fitting, adhesion, or the required fire resistance.

3.02 INSTALLATION

- A. Install penetration seal materials in accordance with printed instructions of the U.L. Fire Resistance Directory and in accordance with manufacturer's instruction.
- B. Where floor openings without penetrating items are more than four inches in width and subject to traffic or loading, install fire stopping materials capable of supporting same loading as floor.
- C. Protect materials from damage on surfaces subject to traffic.
- D. Place rock wool or other approved non-flammable material in annular space around fire dampers before installation of damper's anchoring flanges, which are installed in accordance with fire damper manufacturers' recommendations.
- E. Where large openings are created in walls or floors to permit installation of pipes, ducts, cable tray, bus duct or other items, close unused portions of opening with fire stopping material tested for the application. See U.L. Fire Resistance Directory and Section 3.06 of this document.
- F. Where rated walls are constructed with horizontally continuous air space, double width masonry, or double stud frame construction, provide vertical, 12 inch wide fiber dams for full thickness and height of air cavity at maximum 15 foot intervals.

3.03 ADJUSTING AND CLEANING

- A. Clean up spills of liquid components.
- B. Neatly cut and trim materials as required.
- C. Remove equipment, materials and debris, leaving area in undamaged, clean condition.

3.04 FIELD QUALITY CONTROL

- A. Examine penetration sealed areas to ensure proper installation before concealing or enclosing areas.
- B. Keep areas of work accessible until inspection by applicable code authorities.
- C. Perform under this section patching and repairing of fire stopping caused by cutting or penetration by other trades.

END OF SECTION

SECTION 22 07 10

INSULATION FOR PLUMBING SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Work of this section shall include the thermal insulation for the following plumbing systems that may or may not be present on this project:
 - 1. Domestic cold water, domestic hot water.
- B. This work shall be performed by a competent insulation contractor whose primary business is the installation of insulation systems and who has been in this business for a minimum of five years. The Insulation Contractor shall be independent from the Plumbing Contractor.

1.2 SUBMITTALS

- A. Provide submittals consisting of product literature for each insulation type, finish type and equipment served. Provide submittals on method of installation for each type of insulation used.
- B. Product samples and installation samples are required and shall be provided at the discretion of the engineer. Samples may include but are not limited to, 90° Ells, 45° Ells, valves and sections of pipe.
- C. Provide submittals consisting of Insulation Contractor's qualifications
- D. Mockups: Before installing insulation, build mockups for each type of insulation and finish listed below to demonstrate quality of insulation application and finishes. Build mockups in the location indicated or, if not indicated, as directed by Engineer. Use materials indicated for the completed Work. Piping Mockups:
 - 1. One 3 foot section of NPS 2 straight pipe with a joint.
 - 2. One each of a 90-degree threaded, flanged, & sweat elbow.
 - 3. One NPS 2 or smaller valve and one NPS 2-1/2 or larger valve.
 - 4. Each type of support hanger to be used including hanger saddle and rigid insulation as specified.
 - 5. One threaded strainer and one flanged strainer with removable portion of insulation

PART 2 - PRODUCTS

2.1 THERMAL INSULATION

- A. All insulating systems shall be tested on a composite basis in accordance with ASTM E-84, NFPA 255 and UL 723. All material shall be finished with surfaces having a maximum flame spread rating of 25 and a maximum smoke developed rating of 50 and under ASTM E-84.
- B. Interior piping Rigid Fiberglass - .23K Factor, 3.5 To 5.5 PCF size dependent density, minimum 4.3 R value, 0°F to 1000°F operating temperature, flame spread rating 25, maximum smoke developed rating 50 & fungi resistant jacket. Insulation shall be Owens Corning - Fiberglass ASJ/SSL-II with positive closure system, or prior approval.

- C. Interior fittings on 1/2 and 3/4 inch pipes and accessories may use job built mitered fittings of similar material as piping. Fittings on piping 1 inch and larger will use molded preformed fiberglass fittings sized for the fitting or device being insulated. All fittings and devices being insulated shall be covered with a preformed, white, snap-on type, molded PVC jacket cover. Stainless steel tack fasteners hold the cover together at the overlapping throat seam. Matching white, pressure sensitive tape seals and finishes the fitting and adjacent pipe insulation joint. Molded covers shall be equal to Certainteed Snap Form Fitting System. Fittings and accessories to be covered include, but not limited to, 45 and 90-degree elbows, tees, reducers, increasers, valves, check valves & unions.
- D. Above ground exterior piping shall be equal to Foamglass - .33K factor suitable for 900°F, 8.5 # density per square foot. Equal to Pittsburgh Corning - Strata - Fab system with ASJ jacket.
- E. Fittings for above ground exterior piping shall be machine formed, routed and fitted for specific size fitting and of same material as in D.
- F. Below ground exterior piping shall be of same materials as D except without ASJ jacket.
- G. Below ground exterior fittings shall be of same material as in D except without ASJ jacket.
- H. Closed cell, flexible elastomeric thermal insulation, black in color, supplied in unslit tubing, equal to Armaflex AP 2000.
- I. Closed cell, flexible elastomeric thermal sheet insulation, 1 inch thick, black in color.
- J. Semi-rigid fiberglass board, 3 lb density, thermal conductivity compliance ASTM C 165, 650°F temperature limit, 1 1/2" thick. High temperature fiberglass bonded to a flexible jacketing. Jacketing is to be laminated of white Kraft and aluminum foil, reinforced with fiberglass and chemically treated for fire and smoke safety. Equal to Manville Pipe and Tank Insulation.

2.2 INSULATION FINISH MATERIALS

- A. White all Service Jacket(ASJ).
- B. Glass fabric equal to Foster Mast-A-Fab.
- C. Smooth aluminum jacketing, 0.016-inch thickness for interior and 0.032 inch thickness for exterior use. Equal to Pabco.
- D. Aluminum fittings for elbows, tees and devices, precision formed, smooth and mar-free finish, 0.024 inches thick. Equal to Pabco.
- E. Roofing Felt, 15 lb.
- F. Black asphaltic cutback mastic for underground or outdoor use. Equal to Foster C.I. Mastic 60-25.

2.3 ADHESIVES

- A. An air-drying contact adhesive specifically designed for joining seams and ends of Armaflex AP-2000 in Specification Section 2-2.1 I. Equal to Armstrong 520 Adhesive.

2.4 FINISHES

- A. A white elastomeric, UL classified outdoor grade, vinyl mastic for finished outdoor insulation. Water based latex enamel; equal to WB Armaflex Finish.

PART 3 - EXECUTION

3.1 WORKMANSHIP

- A. All materials shall be applied by workmen skilled in this trade. Unsightly work shall be cause for rejection.
- B. Mechanical fasteners shall be used whenever possible to assure permanent construction.
- C. Materials shall be applied only after systems have been tested and all surfaces are clean and dry.
- D. Cellular glass block supports or other suitable non-compressible insulation material equal in thickness to the insulation and 12 inches in length shall be installed at hangers to eliminate through-metal conductance. Provide 16 GA, 180 degree, galvanized sheet metal saddles in lengths as detailed on the drawings.
- E. All insulation shall be vapor sealed. All joints, laps, breaks, and faults in vapor barriers of insulations covering cold surfaces, shall be thoroughly sealed.
- F. Insulation that becomes wet for any reason shall be removed, replaced and resealed at the expense of this Contractor.
- G. Piping systems requiring testing to be witnessed by the Engineer shall not be insulated until such systems have been tested and approved.
- H. Do not insulate any moving parts; valve handles, expansion tanks or backflow preventers.

3.2 APPLICATION

- A. Insulation Thickness Application Schedule

NOMINAL PIPE SIZE	INTERIOR	EXTERIOR ABOVE GRADE	BELOW GRADE/SLAB
1/2" - 1"	1"	1-1/2"	1"
1 1/4" - 2 1/2"	1"	1 1/2"	1"
3" and above	1 1/2"	2"	1 1/2"

- B. Rigid fiberglass insulation for interior domestic cold, hot & recirculating
- Piping
All insulation shall be butted together and securely stapled in place with outward clinching staples on 3" centers on the lapping seams. Factory provided laps of ASJ tape of same type as jacket on insulation shall be used on butt joints as per (Part 2-2.1-B).
 - Fittings
Fittings shall be molded fiberglass with snap on PVC jacket and matching white tape

- on adjacent pipe insulation as per (Part 2-2.1-C).
3. Piping in concrete masonry walls (CMU): All insulation shall be as per (Part 2-2.1.H) with Armacell fabricated fittings. Provide AP Armaflex Insulation tape and/or Armaflex adhesives as required for joints and fittings as recommended by manufacturer. Provide Armafix pipe hangers when required for supports.

C. Rain Leaders and/or Emergency Rain Leaders

1. Insulation Thickness Application Schedule

NOMINAL PIPE SIZE	EXPOSED CONDITIONED SPACE	EXPOSED NON-CONDITIONED SPACE	CONCEALED WITHIN BLDG. INSULATION	CONCEALED OUTSIDE BUILDING INSULATION
3" and 4"	1"	1 1/2"	1"	2"
6" to 10"	1"	1 1/2"	1"	2"
12" to 16"	1 1/2"	2"	1 1/2"	2 1/2"
18" to 24"	2"	2 1/2"	2"	2 1/2"

2. Rain leaders and emergency rain leaders are to be completely insulated including all portions of horizontal and vertical piping to point beyond last elbow where piping transitions downward to below slab or below grade, then the last section of vertical pipe must be insulated 24" minimum in vertical. Insulation will continue up to the roof drain hub joint. The roof drain hub and pan and any area surrounding the roof drain exposed shall be insulated by this contractor.
3. Piping
All insulation shall be butted together and securely stapled in place with outward clinching staples on 3" centers on lapping seams. Factory provided laps of ASJ tape of same type as jacket on insulation shall be used on butt joints as per (Part 2-2.1-B).
4. Fittings
Fittings shall be molded fiberglass with snap on PVC jacket and matching white tape on adjacent pipe insulation as per (Part 2-2.1-C).
5. Roof drain hubs and pans to be insulated per (Part 2-2.1-I) Miter cut the insulation to fit and glue into place.
6. At ends of pipe insulation, bevel the insulation 30 degrees and seal with two coats Childers CP-30.

D. Traps on condensate receiving floor drains above grade.

1. Wrap traps on hub and floor drains per (Part 2-2.1 I). Insulation shall be cut and formed to the contours of the hub and wrapped around pipe. Factory adhesive shall be used to seal the mitered joints and connection.

E. Storage tanks

1. Hot water storage tanks shall be wrapped with semi-rigid fiberglass board as per (Part 2-2.1 J). Wrap the insulation around the tank to verify the length to be joined for an overlap. Cut the insulation and strip off a 3" wide strip for the overlap. Wrap the insulation around the tank and verify that the insulation is butted. Attach the 3" wide overlap with outward clinching staples spaced 3 inches O.C. Cut neatly for all

penetrations and seal off any tears, joints or staples with ASJ jacket tape of same materials.

- F. Hot water piping below grade
1. Underground hot water pipe and fitting shall use the following schedule of sizes (see Part 3-3.2 A).
 2. Provide Foamglass insulation for underground hot water piping as per (Part 2-2.1 F). Underground piping insulation shall be applied over a clean dry surface. Provide 22 gage galvanized wire at 12" O.C. Cover impregnated felt and stagger joints at midpoint. Apply sealant at joints, laps and seams. Secure felt with wire at 12" O.C. with 22 gage galvanized wire. Apply tack coat over felt at not less than 4 gal. per 100 square feet. Embed cloth membrane into wet tack coat. Smooth membrane to avoid wrinkles and overlap seams at least 2". Apply a finish coat at 8 gallons per 100 square feet making certain that membrane is fully covered. Allow 8 hours of drying time before any piping is covered.
 3. Underground fittings shall be installed as described above. Provide materials as per (Part 2-2.1 G).
- G. Cold, hot water, hot water re-circulating and non-potable water piping above exterior grade exposed and concealed.
1. Above grade exterior cold and hot water shall be insulated with Foamglass as per (Part 2-2.1 D). Fittings shall be as in (Part 2-2.1 E).
 2. Piping
All insulation shall be applied over a clean dry surface. Factory provided laps of ASJ tape of same type as jacket on insulation shall be used on butt joints. All laps and penetrations shall be sealed with a vapor barrier mastic finish.
 3. Fittings
Fitting insulation shall be covered with two coats of vapor barrier mastic with an intermediate layer of glass fabric.
 4. All above grade exterior piping shall be covered with aluminum jacketing. Aluminum shall be applied to a clean dry surface. Overlap butt joints 4" and apply 1/2" wide bands of aluminum on 8" O.C. and at each end of fittings. On exterior piping, the longitudinal seam shall be located at the bottom center of piping and turned 1/4" down for a drip edge. All joints on exterior piping shall be made water tight with suitable silicone caulking. Caulking is to be applied to joints prior to bands being installed.
- H. All interior exposed piping and fittings located in manufacturing areas, mechanical rooms, etc. below 8'0" AFF shall be wrapped with aluminum jacketing as per (Part 2-2.2 C and D). Provide 1/2" wide clinching aluminum bands located at a maximum of 8" O.C.

3.3 MISCELLANEOUS

- A. This contractor will contact the engineer prior to start of all phases of work as follows:
1. Installation of underground insulation.
 2. Exterior above grade installation.
 3. Interior insulation installation.
- B. The engineer will ascertain the continuation of work subject to the requirements aforementioned.

END OF SECTION

SECTION 22 11 10

DOMESTIC WATER PIPING

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. The following described work, materials and equipment shall be furnished and installed as shown on the Drawings and as herein specified.

1. All domestic water service and piping to all fixtures and equipment.

1.2 REFERENCES

- A. All plumbing installation and fabrication shall be in accordance with applicable State and Local Plumbing Codes.

1.3 SUBMITTALS

- A. Submit catalog data for all materials listed under this section and per basic mechanical requirements. Include submittal data on related specifications also.
- B. Materials installed without review or after rejection shall be replaced by this contractor with acceptable items at the Engineer's direction.
- C. All materials shall be new, without defect, first line quality unless specifically noted or specified otherwise.
- D. The supplier, by submitting, certifies the materials and equipment to be satisfactory for the application involved.
- E. Contractor further agrees that if deviations, discrepancies or conflicts between submittals and specifications are discovered either prior to or after submittals are processed by the engineer, the design drawings and specifications shall control and be followed.

PART 2 - PRODUCTS

2.1 DOMESTIC WATER PIPING SYSTEM

- A. Buried, Exterior:
1. Copper Pipe, 3 1/2" and smaller: Type K hard drawn copper per ASTM B-88. Fittings: Wrought copper or cast brass. Joints: hard temper with brazed joints. Provide poly wrap on buried piping.
 2. Ductile Iron Pipe (D.I.P.), 4" and larger: Cement lined, per ANSI/AWWA C151/A21.51. Joints: Shall be push on or mechanical type as indicated on drawings.
- B. Buried Below Slab:
1. Copper Pipe, 1" and smaller: Type K soft drawn copper per ASTM B-88 terminate 12" AFF. Fittings and joints shall not be permitted below slab.

2. Copper Pipe. 1-1/4" and larger: Type K hard drawn copper per ASTM B-88. Fittings: Wrought copper or cast brass. Joints: All joints below slab shall be hard temper with brazed joints. Provide poly wrap on buried piping.
3. Copper Pipe: Type K hard drawn copper per ASTM B-88. Fittings: Wrought copper or cast brass. Joints: All joints below slab shall be hard temper with brazed joints. This is ONLY to occur at connection to existing cold water, all other piping to be soft without joints below slab
4. Install yellow warning tapes directly over piping. Use warning tape over ferrous piping and detectable warning tape over nonferrous piping as applicable.

C. Above Grade:

1. Copper Pipe: Type L hard drawn copper per ASTM B-88. Fittings: Wrought copper or cast brass. Joints: Lead-free, tin-silver solder. Pipes greater than 3" shall have flanged connections at ALL valves and equipment.

Notes:

1. Mechanically formed and brazed TEE connections will not be allowed on copper water piping.
2. Copper press fittings on above grade copper piping will be allowed. System shall be Rigid Tool Company "Pro-Press" system ProPress Fittings: Bronze or copper shall conform to the material requirements of ASME B16.18 or ASME B16.22, NSF/ANSI 61-G when used in a potable water systems and ICC LC-1002. Pro-Press fittings shall have either an EPDM, FKM, or HNBR sealing element and Smart Connect (SC) feature. 1/2-inch thru 2" shall have a press on each side of the sealing element identified by the double press. 2-1/2-inch thru 4-inch shall have a 420 stainless steel grip ring, PBT separator ring, and either EPDM, or FKM sealing element. Sealing elements shall be verified for the intended use.
3. Pro-Press fittings shall not be exposed on finish side of wall.

- D. All solder joints shall be soldered with an approved listed solder. Acid core solder shall not be used.

2.2 DOMESTIC WATER SPECIALTIES

NOTE: ALL SPECIALTIES & VALVES SHALL BE 100% LEAD FREE.

- A. Water Hammer Arrestors (SA): ANSI A112.26.1; sized in accordance with PDI WH-201, pre-charged suitable for operation in temperature range -100 to 300 degrees F and maximum 250 psig working pressure; Model Z-1700 manufactured by Zurn or approved equal by Josam & Wade.
- B. Thermal Expansion Tanks: Provide as indicated on the Drawings. Amtrol Model ST Extrol or approved equal. Size shall be as indicated in the fixture schedule.
- C. Gauge Cocks shall be polished brass valves with 1/4" NPT female connections and handles. Valves shall be suitable for 125 psi. Acceptable Manufacturers: Tetric No. 865 or equal by Marsh.
- D. Pressure gauges shall have type 316 stainless steel tube and stainless steel rotary movement. The gauge case shall be stainless steel. Windows shall be glass or clear

acrylic. Gauges shall have 4" dials with white faces and black graduations. Scales shall have a minimum arc of 260 degrees. Gauges shall be accurate to within 1% of the full scale reading over at least the middle half of the span. The accuracy over the remainder of the scale shall not exceed 2%. Gauge ranges shall be selected so that the normal operating point is approximately mid scale. Scales shall indicate psi. All gauges shall be provided with a pulsation damper, snubber, restrictor or similar device to dampen pulsation surges (use of the gauge cock for this purpose is not acceptable). Gauges shall have 1/4" NPT bottom outlets. Weiss style NF4S-2 or equal by Terrice.

- E. Thermometers shall be adjustable angle type with separable matching socket. Thermometers shall have cast aluminum cases with baked enamel finish, red reading mercury tubes with black scale graduations, and glass or acrylic plastic covers. Scales shall be a minimum of 9 inches with appropriate ranges for indicating temperatures at least 25% above and below normal readings. Sockets shall have stem length suitable for pipe receiving thermometer. Sockets and stems shall be brass, fully adjustable with 360 deg. movement. Sockets on insulated pipes shall have lagging extensions of adequate length to clear insulation. Weiss No. A9VS or equal by Terrice.
- F. Service valves 1/2" thru 4" shall be full port 1/4 turn lead free ball valves, two piece construction, threaded end connection, with PTFE seats and seals, adjustable stem packing gland, stem o-ring and steel handle with vinyl sleeve. 1/2" through 2" valves shall be pressure rated at 600 psi WOG and 150 psi WSP. Valves shall be, Nibco model T-FP-600-LF, Kitz series AKTAFN Code 868 or approved equal

2-1/2" through 3" valves shall be pressure rated at 600 WOG and 150 psi WSP. Valves shall be, Nibco model T-FP-600-LF, Kitz series AKSZAN Code 858 or approved equal.

All ball valves shall be furnished with valve handle extensions.

Service Valve Connections:

1. Provide valves suitable to connect to adjoining piping as specified for pipe joints. Use pipe size valves.
2. Thread pipe sizes 4" inches and smaller.
3. Flange pipe sizes larger than 4 inches.
4. Solder or screw to solder adapters for copper tubing.

Exterior valves 3" and larger and interior valves 4" and larger shall be Mueller no. A-2360-16 NRS gate valve, epoxy coated iron body with encapsulated iron wedge, bronze stem & triple O-ring stuffing box. Exterior valves will have a 2" square nut operator. Interior valves will have a wheel handle. Equal valves by M & H and American Darling will be considered. Install the exterior valve with a two piece adjustable cast iron roadway box with cast iron removable lid. Lettering on the lid shall read "Water".

- G. Check valves shall be class 150 bronze body horizontal swing Wye-type with renewable seat and disc, screw cap, threaded end connections, pressure rated at 300 psi non-shock working pressure. Valves shall be Kitz series AK150YR (code #29), Nibco model T-433 or Stockham model B-321.
- H. Strainers shall be bronze body with tapped retainer cap and closure plug, threaded end connections, 20 mesh strainer screen, pressure rated at 400 psi WOG and 125 psi WSP. Strainers shall be Watts series 777SI, Wilkins model YSBR100 or Spirax Sarco model BT.

- I. Piping inside chase areas shall be supported with bracketing system equal to Sioux Chief Grid Iron series. System shall include but not be limited to a center span bracket, two end bracket clamps and necessary retaining brackets to support the copper piping. Where piping is supported off the vent system, the vent piping shall be bracketed to the inside chase wall. Stainless steel clamps shall be incorporated into the support system when connections are made to the PVC piping.
- J. Escutcheon plates shall be sized for the piping or for the outside diameter of the piping insulation, if applicable. Waste escutcheons inside cabinets or exposed below sinks or lavatories shall be bell type escutcheons sized to cover the hub and fit flush with wall. Split ring escutcheons will not be allowed.
- K. Valves installed underground for service, isolation or valved and capped pipes for future extension shall be made accessible with a valve box. Valve boxes and lids shall be fabricated from a fiberglass reinforced polymer concrete. The boxes and lids shall be non-conductive and shall not be affected by UV light, moisture, freezing and sub soil chemicals. Valve boxes shall be straight wall type with extensions as necessary to provide access down to the valve. Flared wall type will not be accepted. Valve box lids shall be capable of being bolted down; street rated where applicable, and shall be provided with stainless steel bolts and captive nuts. The valve boxes shall be equal to CDR Systems Incorporated.

2.3 P & T RELIEF PIPING

- A. Above Slab:
 - 1. Copper Pipe: Type L hard drawn copper per ASTM B-88. Fittings: Wrought copper or cast brass. Joints: Lead-free, tin-silver solder.
 - 2. Relief piping terminating outside the area of the installed water heater shall be installed with an air gap. The air gap shall be Watts model 909, 1" in-line type, and installed at the water heater below the T & P relief valve.

2.4 PRIMER DRAIN PIPING

- A. Above Slab:
 - 1. Copper Pipe: Type L hard drawn copper per ASTM B-88. Fittings: Wrought copper or cast brass. Joints: Lead-free, tin-silver solder.
- B. Below Slab:
 - 1. Copper Pipe: Type L roll type copper with no fittings or joints below slab.

PART 3 - EXECUTION

3.1 GENERAL

- A. Obtain exact centerline rough-in dimensions between partitions or walls from the Architectural Drawings. Work shall be roughed-in so that all exposed piping will be straight and true without bends or off-sets. Water supplies shall connect through walls with stops and chrome plated escutcheons with setscrews.

3.2 DOMESTIC WATER PIPING SYSTEM

- A. Provide a complete system of domestic water piping including interior and exterior work as indicated.
- B. Piping shall be accurately cut to measurements established at the project site, worked into place without springing or forcing, run as directly as possible, run parallel or perpendicular to building lines, located as indicated on the Drawings and supported as specified elsewhere. Parallel piping shall be grouped together as much as practical. Piping shall be supported as high as practical. Piping not located in mechanical rooms shall be concealed unless noted otherwise.
- C. Piping shall be run as directly as possible, avoiding all unnecessary fittings and joints. Changes in routing of piping due to field conditions shall be at the expense of this Contractor.
- D. Contractor shall provide for expansion and contraction of piping systems. Expansion and contraction of piping shall not impart excess stress or strain on the building, pipe fittings, joints or connections to equipment.
- E. Piping shall be installed with sufficient spacing between fittings, valves, flanges, etc. so as to allow insulation fittings to be installed without trimming or modification.
- F. Provide sleeves for all piping penetrations of grade beams, floors above grade and walls. Sleeves for insulated piping above grade shall be sized for the insulation diameter. Annular space between the insulation and sleeve shall be sealed or fire caulked as detailed on the drawings. Sleeves for piping through walls below grade shall be sized for use of compressible rubber link seals unless noted otherwise.
- G. Piping thru slabs on grade shall be protected with 1/2" thick closed cell flexible foam insulation minimum 6 inches above and below slab. Wrap all pipes below slab in an approved poly jacketing material.
- H. Piping installed below grade shall have a minimum of 24" cover. Pipes shall be coated with two coats of bituminous paint.
- I. Provide solid type stainless steel escutcheon plates at each exposed piping penetration of walls and ceilings and inside cabinets at water and waste penetrations. Escutcheon plates for insulated piping shall be sized for the insulation diameter. Split ring escutcheons will not be allowed. Waste escutcheons inside cabinets or exposed below sinks or lavatories shall be bell type escutcheons sized to cover the hub and fit flush with wall.
- J. All piping shall be installed to allow complete draining, slope as required. Provide drain valves at all low points where fixtures cannot be used to drain piping. Provide hose bibb with 3/4" hose connection, vacuum breaker/backflow preventer and service valve at the water main entrance.
- K. Provide shutoff valves at each branch from main. Provide shutoff valves for each fixture group to minimize interruption of service for maintenance and repair. Provide an exterior main shutoff valve and valve box as indicated on drawings. Provide area shut-off valves as necessary to facilitate testing and isolation of piping where tested and approved pipes are put into service.
- L. Piping thru metal studs shall be isolated from metal to metal contact with plastic bushings specifically designed for the application.

- M. Provide water hammer arrestors on all hot and cold water branch lines. Arrestors shall be sized for the fixture unit load installed on the branch line and shall be accessible for inspection and/or replacement, provide access panels as required. Water hammer arrestors shall be located at the end of the branch line between the last two fixtures served. When the branch line exceeds 20' in length, an additional water hammer arrestor shall be used. Each water hammer arrestor in this case shall be sized for half the total fixture unit load on the branch line and the location of the second water hammer arrestor shall be midway along the branch line. On a branch line that serves a single piece of equipment, the water hammer arrestor shall be located as close to equipment as possible.
- N. All stubouts and exposed piping shall be rigidly supported to eliminate movement.
- O. This Contractor shall complete all equipment connections to the domestic water piping system. Provide shutoff valves and unions for each connection.
- P. Connections to water heaters and connections between ferrous and copper pipe shall be made with dielectric unions or flanges. Joints between plastic and metallic pipe shall be made with transition fittings for the specified purpose.

3.3 TRAP PRIMER DRAINS

- A. Provide a complete system of drains as indicated on the floor plans from the primer assembly to the floor drain/hub drain connections.
- B. Piping below slabs shall be installed in the gravel bedding below the concrete flooring and held as level as possible. Piping to be coated or sleeved as indicated in Section 3.02-G.

3.4 TESTING

- A. All piping shall be tested before being insulated or concealed in any manner. Where leaks or defects develop, required corrections shall be made and tests repeated until systems are proven satisfactory.
- B. Water piping systems shall be subjected to a hydrostatic test of one hundred twenty five pounds minimum or 1 1/2 times operating pressure whichever is greater. The system shall be proven tight after a twenty-four (24) hour test.
- C. All rainwater leaders, soil waste and vent piping shall be subjected to a hydrostatic test of not less than a 10-foot head. Piping shall be tested for not less than 4 hours, prior to installing fixtures. Underground piping shall be tested before backfilling.
- D. VENT TEST as required by Engineer:
The final test of the completed drainage and vent system shall be visual and in sufficient detail to determine compliance with the provisions of this code except that the plumbing shall be subjected to a smoke test where necessary for cause. Where the smoke test is utilized, it shall be made by filling all traps with water and then introducing into the entire system a pungent, thick smoke produced by one or more smoke machines or introducing a white/gray non-toxic smoke emitter. When the smoke appears at stack openings on the roof, the stack openings shall be closed and a pressure equivalent to a 1-inch water column shall be held for a test period of not less than 15 minutes. This method may be used at rough-in prior to gyp board installation for testing vents in lieu of hydrostatic

testing at Engineers discretion, except that plugs will be used at stacks to isolate system where traps have not been installed. Contractor should follow Inspection Department required methods and/or procedures should they differ.

- E. Provide test report in booklet form showing all field test performed to prove compliance with the specified performance criteria. Booklet shall be submitted prior to submitting for final payment. Booklet shall include the following
 - 1. SYSTEM TESTED (sanitary) (domestic water) (rain leaders)
 - 2. Date of test
 - 3. Test medium
 - 4. Persons present
 - 5. Pressure tested
 - 6. Lines tested and location
 - 7. Length of time test pressure was held
 - 8. Pressure drop
 - 9. Water pressure at most remote and highest location
 - 10. Residual chlorine
- F. This Contractor shall conduct all specified tests until approved by the Engineer. All tests shall be repeated until approved by the Engineer. Piping systems shall not be covered or otherwise concealed until tests inspections have been made and approvals obtained. This Contractor shall notify the Engineer four days prior to testing to allow for scheduling.

3.5 STERILIZATION OF DOMESTIC WATER PIPING SYSTEM

- A. Thoroughly flush for a minimum of two hours and then drain the domestic water piping prior to sterilizing by the following method or other methods satisfactory to the Engineer and the Authority Having Jurisdiction.
- B. Fill piping with a solution containing 50 ppm of available chlorine. Open and close all valves to thoroughly distribute solution thru all piping. Allow solution to stand for 24 hours then test for residual chlorine at the ends of the lines. If less than 25 ppm is indicated, repeat the sterilization process. When tests show at least 25 ppm of residual chlorine, flush out the system until all traces of chlorine are removed. Open and close all valves in system several times during flushing period.
- C. The Engineer reserves the right to test the water again at any time prior to final acceptance of the work and if found to be unsafe bacteriologically, to require the Contractor to rechlorinate the system until the water is proven equal to that supplied by the public system.
- D. Contractor shall arrange for laboratory testing for a bacteriological examination of potable water system at various locations. The samples shall be tested to meet requirement of city and shall not be of less quality than provided by city. Submit copy from testing agency prior to submitting for final payment.
- E. Minor work such as repairs or replacement of single fitting or valve, pre-clean and disinfect by immersion in solution of 300 ppm chlorine for 1 hour.

3.6 FINAL ACCEPTANCE

- A. Before final acceptance, the Plumbing Contractor shall furnish a certificate of inspection and final approval from the plumbing Inspector to the Owner and be in accordance with

the latest revisions of the applicable codes and the Approved Plumbing Drawings and Specifications. Contractor shall also furnish booklet of test, sterilization compliance and backflow devices certificates.

END OF SECTION

DOMESTIC WATER PIPING

SECTION 22 13 10

SANITARY WASTE PIPING SYSTEM

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. The following described work, materials and equipment shall be furnished and installed as shown on the Drawings and as herein specified.
 - 1. All sanitary sewer piping and equipment shown throughout the building and extension of the sanitary sewer to the indicated termination point.

1.2 REFERENCES

- A. All plumbing installation and fabrication shall be in accordance with applicable State and Local Plumbing Codes.

1.3 SUBMITTALS

- A. Submit catalog data and shop drawings for all materials and equipment listed under this section and per basic mechanical requirements. Include submittal data on related specifications also.
- B. Materials or equipment installed without review or after rejection shall be replaced by this contractor with acceptable items at the Engineer's direction.
- C. All materials and equipment shall be new, without defect, first line quality unless specifically noted or specified otherwise.
- D. The supplier, by submitting, certifies the materials and equipment to be satisfactory for the application involved.
- E. Contractor further agrees that if deviations, discrepancies or conflicts between submittals and specifications are discovered either prior to or after submittals are processed by the engineer, the design drawings and specifications shall control and be followed.

PART 2 - PRODUCTS

2.1 SANITARY WASTE PIPING SYSTEM

- A. Buried, Exterior & Below Slab:
 - 1. Cast Iron Pipe: ASTM A-74 spun service weight. Fittings: Cast iron. Joints: Hub-and-spigot, compression type with ASTM C-564 neoprene gaskets. Piping and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute and listed by NSF International.
 - 2. PVC Pipe and Fittings: Schedule 40 per ASTM D-1785 / ASTM D-2665. Joints: Solvent weld per ASTM D-2855 with solvent per ASTM D-2564.

Foam Core will not be allowed on drain, waste and vent systems.

B. Existing to new pipe connections on straight pipe:

1. Transition couplings for pipe sizes 2" - 12" shall be of ductile iron construction. Couplings shall be of the wide range type to fit Steel, Cast Iron, Ductile Iron, PVC, HDPE and Asbestos-Cement with only a change of gaskets. Coupling sleeves shall be 5" in length on 2" - 2-1/2" nominal sizes, 6" in length on nominal sizes 3" - 12". Ductile Iron couplings shall be JCM 210, 211, 212, or approved equal. JCM 200 Series Ductile Couplings are ANSI/NSF Standard 61 and Standard 61 Annex G Certified. JCM 200 Series Couplings meet or exceed the ANSI/AWWA C-219 Standard as applicable. Fittings are rated for 150 PSI working pressure

Gaskets: Styrene-Butadiene Rubber (SBR). Compounded for use with water, salt solutions, mild acids and bases; has excellent abrasion resistance. Per ASTM D-2000. Standard temperature range from -40o to 150oF constant, maximum intermittent 180 F.

Bolts: 5/8" Corrosion resistant, high strength low alloy oval neck track head bolts per ASTM A242/ANSI 21.11/AWWA C111 and heavy hex nuts per A563 or equal, stainless steel 18-8 type 304 or 316. Epoxy Coated Alloy Hardware, Powercron 590-534 black cationic electrocoat.

C. Above Slab, Interior:

1. Cast Iron Pipe: ASTM A-888 spun service weight and Cispil Standard 301. Cast iron fittings and joints shall be no hub. Piping and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute and listed by NSF International.
2. Cast Iron Piping Coupling: Shall be with a type 304 corrugated stainless steel shield, type 304 stainless steel retaining bands with 3/8" worm gear hex head socket and ASTM C 564 molded one-piece rubber sealing sleeve. Coupling for 1-1/2" to 4" pipes shall be minimum 3" width with 4 retaining bands. Couplings for 5" and larger shall be minimum 4" width with 6 retaining bands.

Couplings shall be Husky type SD2000, Mission Heavy Weight Couplings type C-HW or Star Heavy Duty series. Couplings shall be per ASTM C 1540 and FM 1680 Class 1.

3. PVC Pipe and Fittings: Schedule 40 per ASTM D-1785 / ASTM D-2665. Joints: Solvent weld per ASTM D-2855 with solvent per ASTM D-2564. Foam Core will not be allowed on drain, waste and vent systems.

Notes:

1. This contractor shall provide/install cast iron pipe at all fire rated assemblies, return air plenums, and all kitchen areas below slab and below grade grease waste as shown on drawings, this includes exterior piping extended to grease interceptors, and where indicated on the drawings for sound purposes. All grease waste vent piping shall be PVC as specified above unless located in rated walls. This contractor shall coordinate with Architectural and Mechanical drawings.
2. Waste and vent piping installed inside a turned down slab condition at the building perimeter, at column footings, through or under footings or

foundation walls shall be sleeved with schedule 40 cast iron pipe 2 pipe sizes larger than the sized waste / vent pipe. Coordinate with the Architectural and Structural drawings for locations.

3. Where sleeves cannot be provided due to vent at wall, provide relieving arch. One method would be provide 1 inch thick Armaflex insulation around pipe at wall where vent extends up thru CMU to allow for settlement (do not grout).

2.2 SANITARY WASTE SPECIALTIES

- A. WCO: Wall cleanouts: Cast iron piping shall be cast iron ferrules with no-hub joints, cadmium plated cast iron counter sunk plugs and stainless steel or paintable access cover per general notes on drawings. Access panels are only required when labeled WCO/AP on plans.
- B. Trap guard (see floor drains under sanitary specialties): ProSet Systems, Inc, flexible elastomeric PVC material molded into shape of duck's bill, open on top with curl closure at bottom. Compliance: ASME A112.6.3, NSF/ANSI 14, CSA B 79. Coordinate with floor/hub drain being specified and size of throat. Install per manufacturers recommendations.
- C. Cleanouts: Cleanouts shall be the same nominal size as the pipe served up to 4" and not less than 4" for line sizes greater than 4". Cleanouts shall be as specified in Section 2.1 Plumbing Fixtures

PART 3 - EXECUTION

3.1 GENERAL

- A. Obtain exact centerline rough-in dimensions between partitions or walls from the Architectural Drawings. Work shall be roughed-in so that all exposed piping will be straight and true without bends or off-sets.
- B. All rough-in sanitary sewer piping shall be properly plugged or capped in a manner approved by the Engineer.

3.2 SANITARY WASTE PIPING SYSTEM

- A. Provide a complete system of sanitary sewer drain, waste and vent piping including interior and exterior work as indicated.
- B. Piping up to 2" shall be sloped at least 1/4 inch per foot. Piping 3" thru 6" shall be sloped at least 1/8 inch per foot. Piping 8" and larger shall be sloped at least 1/16 inch per foot.
- C. Buried piping below slab and exterior of building perimeter shall be laid in minimum 4 inches of bedding below and 6" above pipe, and sloped as specified herein. Bedding shall be accurately and uniformly graded. Bedding shall be crushed stone equal to Alabama Highway Department #9 crushed stone. Bedding shall be free of organic material. Backfill below floor slabs shall be No. 57 crushed stone full depth from top of bedding to bottom of slab.
- D. Provide cleanouts as required by Code and as indicated on the Drawings. Cleanouts for piping 4" and smaller shall be line size. Cleanouts for piping 6"

and larger shall be 4". Provide dual exterior cleanouts within 5 feet of building. Interior cleanouts in floors shall be flush with finished floors. Interior cleanouts in walls shall be above the flood level of plumbing fixtures. Exterior cleanouts in unpaved areas and areas paved with other than concrete shall be set in concrete pads flush with finished grade as detailed on the drawings.

- E. Vents through roof shall be a minimum of 3 inches in diameter and shall terminate at least 12 inches above the roof. Vents thru roof shall be located on least visible side were applicable. See plans for other sizes.
- F. This Contractor shall be responsible for locating vents at least 15 feet from Outside Air intakes, offset vents as required.
- G. Drainage piping shall be installed with hubs upstream of each pipe section. Provide reducing fittings where different sizes of pipe are to be connected. Bushings shall not be used. Provide longsweep fittings, sanitary tees and combination wyes with 1/8 bends as applicable.
- G. All rough-in soil, waste, vent and storm piping shall be properly plugged or capped in a manner approved by the Engineer.
- I. Escutcheons shall be provided on wall penetrations as indicated in Section 22 11 10, Domestic Water Piping System.
- J. Interior wall cleanouts shall have stainless steel wall covers sized for the cleanout and covering the wall opening. Cleanout covers shall be installed flush with the wall.
- K. Back to back water closets shall be installed with double combination wye with 1/8 bend. Double sanitary tees and double fixture fitting shall not be used.

3.3 TESTING

- A. All piping shall be tested before being insulated or concealed in any manner. Where leaks or defects develop, required corrections shall be made and tests repeated until systems are proven satisfactory.
- B. All soil waste and vent piping shall be subjected to a hydrostatic test of not less than a 10-foot head. Piping shall be tested for not less than 4 hours, prior to installing fixtures. Underground piping shall be tested before backfilling.
- C. VENT TEST as required by Engineer:
The final test of the completed drainage and vent system shall be visual and in sufficient detail to determine compliance with the provisions of this code except that the plumbing shall be subjected to a non-toxic smoke test where necessary for cause. Where the smoke test is utilized, it shall be made by introducing into the entire system a pungent, thick smoke produced by one or more smoke machines or introducing a white/gray non-toxic smoke emitter. When the smoke appears at stack openings on the roof, the stack openings shall be closed and a pressure equivalent to a 1-inch water column shall be held for a test period of not less than 15 minutes. This method will be used at rough-in prior to gyp board installation for testing vents in lieu of hydrostatic testing at Engineers discretion. Plugs will be used at stacks to isolate the system where fixture traps will be

installed and at all closet bends below water closets. Contractor should follow Inspection Department required methods and/or procedures should they differ.

3.4 CLEANING

- A. At completion of all work, fixtures, exposed materials and equipment shall be thoroughly cleaned.

3.5 FINAL ACCEPTANCE

- A. Before final acceptance, the Plumbing Contractor shall furnish a certificate of inspection and final approval from the plumbing Inspector to the Owner and be in accordance with the latest revisions of the applicable codes and the Approved Plumbing Drawings and Specifications. Contractor shall also furnish booklet of test and backflow devices certificates.
- B. Provide test report in booklet form showing all field test performed to prove compliance with the specified performance criteria. Booklet shall be submitted prior to submitting for final payment. Booklet shall include the following
 - 1. SYSTEM TESTED (sanitary)
 - 2. Date of test
 - 3. Test medium
 - 4. Persons present
 - 5. Pressure tested
 - 6. Lines tested and location
 - 7. Length of time test pressure was held
 - 8. Pressure drop
- C. This Contractor shall conduct all specified tests until approved by the Engineer. All tests shall be repeated until approved by the Engineer. Piping systems shall not be covered or otherwise concealed until tests inspections have been made and approvals obtained. This Contractor shall notify the Engineer four days prior to testing to allow for scheduling.

END OF SECTION

SECTION 22 42 10

PLUMBING FIXTURES

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. The following described work, materials and equipment shall be furnished and installed as shown on the Drawings and as herein specified.
 - 1. All plumbing fixtures, accessories and trims as shown on the Drawings and as herein specified.

1.02 REFERENCES

- A. All plumbing installation and fabrication shall be in accordance with applicable State and Local Plumbing Codes.

1.03 SUBMITTALS

- A. Submit catalog data and shop drawings for all materials and equipment listed under this section and per basic mechanical requirements. Include submittal data on related specifications also.
- B. Materials, fixtures, or equipment installed without review or after rejection shall be replaced by this contractor with acceptable items at the Engineer's direction.
- C. All materials, equipment, and appliances shall be new, without defect, first line quality unless specifically noted or specified otherwise.
- D. The supplier, by submitting, certifies the materials and equipment to be satisfactory for the application involved.
- E. Contractor further agrees that if deviations, discrepancies or conflicts between submittals and specifications are discovered either prior to or after submittals are processed by the engineer, the design drawings and specifications shall control and be followed.

PART 2 - PRODUCTS

2.01 PLUMBING FIXTURES - GENERAL

- A. General: Provide all plumbing fixtures complete with trim required, and connect in a manner conforming to the local Building Code. Certain fixtures may be furnished by others under other sections of these Specifications. Provide rough-in and final connections including all valves, traps, specialties, etc. required.
- B. Provide traps for all waste connections where not furnished with the equipment and stop cocks or valved shut-offs for all water connections to all sinks and other items of equipment. All exposed pipe and metal, including that within cabinets,

shall be chrome plated cast brass with the same gauge thickness as the specified trap. Stainless steel bell escutcheons shall be installed covering the hub connections below sinks and lavatories and extend to the wall or back of cabinet for a tight fit.

C. Quality and Type of Fixtures:

1. Plumbing fixtures, carriers, etc. are specified by manufacture and model numbers for the purpose of establishing type and quality. Equals must be pre approved by the Engineer. Pre approval submittals must be received by this office no later than 10 working days before the job bids.

2.02 FIXTURE SCHEDULE

- P-1 Water Closet (ADA Accessible): Kohler Highcrest K-4302, 16-1/2" high, 1.60 gal/flush, white, floor mounted, elongated, top spud, 2-1/4" fully glazed trap-way & bolt caps. Install with Olsonite model 95SSCT solid plastic open front seat with stainless steel self-sustaining check hinge. Flush valve shall be Sloan Royal model 111-1.60 GPF manual flush valve with cast wall flange with set screw, and solid ring pipe support. Provide Urethane reinforced wax bowl ring with sleeve. Provide closet flange with adjustable stainless steel ring.
- P-2 Lavatory (ADA Compliant): Kohler K-1729, 20" x 18-1/4" vitreous china wall hung lavatory with overflow, drilled for concealed arm carrier systems. Install with Kohler K-15598 single lever, ceramic disc faucet with vandal resistant ADA compliant lever and aerator. Strainer shall be model K-7131-A offset grid drain with overflow. Trap shall be Kohler K-8998, 17 gauge trap cast brass chrome plated with cleanout. Zurn Z8804LR standard stop supply kit, two chrome plated, solid brass angle stops, two 12" chrome plated copper lavatory risers complete with two chrome plated steel flanges. Provide Zurn model Z1231 concealed arm carrier. Provide Plumberex Pro-Extreme series molded vinyl covering, white finish with reusable snap clip fasteners for supplies, stops and trap.
- P-3A Existing IMC/Teddy Model ADA-WSSEC Handwash Lavatory is to be removed from the Decatur High School Culinary Classroom by the Plumbing Contractor installed where indicated on the drawings. The Plumbing Contractor shall remove the existing push button faucet and install a new sensor faucet. Faucet shall be Sloan model EBF-187-4-ADM, battery powered sensor operated with .5 gpm aerator. Installed with the Handwash shall be Kohler K-8998 17 gauge trap cast brass chrome plated with cleanout. Zurn Z8804LR standard stop supply kit, two chrome plated, solid brass angle stops, two 12" chrome plated copper lavatory risers complete with two chrome plated steel flanges. Insulate the water and waste pipes below the lavatory with Plumberex Pro-Extreme series molded vinyl covering, white finish with reusable snap clip fasteners
- P-3B Handwash Lavatory (ADA Accessible): Advanced Tabco model 7-PS-61, 17-1/4" x 15-1/4" overall dimensions with 14" x 10" x 5" deep bowl, 304 stainless steel wall hung with wall mounting brackets, 1-1/2" stainless steel basket drain with strainer plate & splash mounted gooseneck sensor operated faucet with AC/DC control module and AA batteries. Install with off-set drain connection, Kohler K-8998 17 gauge trap cast brass chrome plated with cleanout. Zurn Z8804LR standard stop supply kit, two chrome plated, solid brass angle stops, two 12" chrome plated copper lavatory risers complete with two chrome plated steel flanges. Insulate the water and waste pipes below the lavatory with Plumberex

Pro-Extreme series molded vinyl covering, white finish with reusable snap clip fasteners.

- P-4 Bi-Level Electric Water Cooler (ADA Accessible water cooler and standard water cooler with Bottle Filling Station): Elkay model LZSTL8WSSP, left hand high, wall mounted, 120 volt, 370 watts, 4.0 FLA, 8 gallons per hour cold water, with filtration system model EWF-172, bottle filling station, stainless steel basin & shroud and flexiguard bubblers. Install with 17 gauge cast brass chrome plated trap and Zurn model Z8802-LR-PC supply and stop. Unit mounting height shall be as selected by the Architect. Anchor the cooler firmly to the wall at top and bottom with anchor bolts. Refrigeration system shall have a 5-year warranty. One (1) additional replacement filters shall be furnished with each cooler on the project. Coordinate with the Electrical Contractor for the electrical connection to be inside the cabinet. Unit mounting height shall be as selected by the Architect and as the upper crutch accessible ADA height.
- P-5 Sink: Elkay model LR1918, 19" x 18" overall dimension with 16" x 11-1/2 x 7-1/2" deep bowl, 18 gauge stainless steel, self-rimming, counter mounted, fully undercoated, 8" three hole drill. Install with Kohler model K-10430 hi-arc mixing faucet, single lever with spray, K-8801 strainer with tail piece, 17 gauge cast brass chrome plated trap with cleanout & Zurn Z-8804-LR-LK supplies with stops. Coordinate hub connection for connection to the PVC to be tight to the wall for concealment by the bell escutcheon.
- P-6 Laundry Tray: Fiat model SF-1-W, 23" x 22" x 14" deep molded structural cellular plastic, wall mounted laundry tray optional wall filler, wall support brackets and integrally molded drain with stopper. Mixing faucet to be Kohler model K-7404-5A 4" center set faucet with wing handles, ceramic disc valves, polished chrome finish. Install with 17-gauge cast brass chrome plated trap with cleanout & Zurn Z-8804-LR-LK supplies with stops.
- P-7 Kitchen Sink (Existing): Existing sink, faucet supplies and stops shall remain and be re-used. The Plumbing Contractor shall furnish and install a 17 gauge cast brass chrome plated trap and waste as indicated as shown in the drawings.
- P-8 Culinary Two Compartment Sink (Existing): Existing two compartment sink shall be removed from the current location by the Owner and made available to the Plumbing Contractor. The Plumbing Contractor shall receive the sink and install it where indicated on the drawings. The installation shall include new Zurn Z-8825-LR-LK supplies with stops. Remove and replace the existing drain piping. Install 2" type K rigid copper piping from strainer drains connections to floor sink
- P-9 Culinary Three Compartment Sink with Disposer (Existing): Existing three compartment sink with disposer shall be removed from the current location at Decatur High School Culinary Classroom by the Plumbing Contractor installed in the locations where indicated on the drawings. The installation shall include new Zurn Z-8825-LR-LK supplies with stops. Remove and replace the existing drain piping. Install 2" type K rigid copper piping from strainer drains connections to floor sink
- P-10 Culinary Three Compartment Sink (Existing): Existing two compartment sink shall be removed from the current location by the Owner and made available to the Plumbing Contractor. The Plumbing Contractor shall receive the sink and install it where indicated on the drawings. The installation shall include new Zurn Z-8825-

LR-LK supplies with stops. Remove and replace the existing drain piping. Install 2" type K rigid copper piping from strainer drains connections to floor sink.

- P-11 Washing Machine Supply and Drain: Existing washer hub drain shall be removed and replaced with a new Oatey model 38540, high impact polystyrene recessed wall box with faceplate, with 2" drain & 1/2 " hot and cold 1/4 turn ball valves with integral water hammer arrestors. Hot and cold water piping shall be modified as necessary for connection to the new drain assembly.
- P-12 Floor Drain: Zurn no. ZN-415-SZ, cast iron threaded fully adjustable 4" drain body with flashing collar, bottom outlet, invertible membrane clamp and adjustable collar with seepage slots with 6" x 6" square nickel bronze strainer and deep seal trap. Construction cover shall be provided by the manufacturer to protect the drain assembly during construction. The strainer shall be installed after construction and cleaning is complete. Strainers installed prior to completion of construction that have accumulations of construction debris will be replaced. Floor drain shall be furnished with a ProSet Systems Trap Guard
- P-13 Floor Drain: Zurn no. ZN-415-6SS, cast iron threaded fully adjustable 4" drain body with flashing collar, bottom outlet, invertible membrane clamp and adjustable collar with seepage slots. Install with type ZS400SS 6" x 6" square stainless steel strainer and deep seal trap. Construction cover shall be provided by the manufacturer to protect the drain assembly during construction. The strainer shall be installed after construction and cleaning is complete. Strainers installed prior to completion of construction that have accumulations of construction debris will be replaced. Floor drain shall be furnished with a ProSet Systems Trap Guard.
- P-14 Floor Sink: Floor Sink: Zurn model ZN-1902-KC-4-32, 4" bottom outlet drain connection, 12" x 12" x 10" deep, cast iron body with acid resisting porcelain enamel coating, drainage flange with weep hole and clamp, full grate cover with center drainage opening and aluminum dome strainer.
- P-15 Dishwasher (Existing): Existing dishwasher shall be removed from the current location at Decatur High School Culinary Classroom by the Plumbing Contractor installed in the locations where indicated on the drawings. The Plumbing Contractor shall furnish and install all piping required for the installation new service valves and drain. Install 2" type K rigid copper piping from dishwasher drain connection floor sink. The existing solenoid valves and accessories installed with the dishwasher shall be relocated with the dishwasher and installed. The hot water supply shall include the installation of a service valve, check valve, Watts model LFU5B-Z3 pressure reducing valve and discharge pressure gauge. Coordinate with the manufacturer's data for the preferred operating pressure
- P-16 Water Heater: Rheem Triton sealed-combustion/condensing gas-fired model GHE100SS-200(A), 100 gallon, 199,000 Btu/hr. natural gas input, 97% thermal efficiency, 3 pass heat exchanger, Integrated BACnet LCD display control system with self-diagnostics, LeakGuard leak detection system, integral condensate neutralization, direct spark ignition, 2" foam insulated, vacuum breaker and CSA/ASME rated T&P relief valve. Install water heater with polypropylene venting, power vent and optional wall venting concentric kit and as detailed on the drawings. Installed with the water heater shall be an Amtrol model ST-12 Expansion Tank.

- P-17 Hot Water Circulation Pump: Grundfos model UP26-96BF, Bronze body, 1/12 hp, 115/1/60, 5 GPM at 10' head pressure. Control from a pipe mounted immersion aquastat and interlock with building control system (See Mechanical Drawings "Sequence of Operation"). Install assembly per manufacturer's requirements.
- P-18 Grease/Solid Interceptor: Proceptor model GMC 1000 UPC, fiberglass assembly, 1000 gallons liquid capacity, 782 gallon grease capacity and 125 solids capacity. Tank shall be provided with 2 factory access manways to grade, cast iron cover for H2O traffic loading and 4" inlet and outlet connections. Tank shall be installed in accordance with the factory installation procedures, including but not limited to a pea gravel base, concrete anti-floatation pad with retaining rods, approved sand or pea gravel backfill and reinforced concrete pad at the manway frame and lids. Lids to be installed a minimum of 2" above the grade level with the concrete pad tapering from the edge of the lid to flush with grade. Terminate with specified exterior cleanout. Vents to be connected and routed per manufacturer's recommendations and as shown on the drawings. Complete shop drawing of the installation shall be submitted and approved prior to the installation. Downstream of the interceptor shall be an observation well. See details on the drawings for requirements.
- P-19 Exterior Wall Hydrant: Woodford model PB65, polished brass, anti-siphon vacuum breaker, brass valve body with hemispherical seating surface, stainless steel stem, loose key operator, 3/4" inlet with 360° rotation and inside wall clamp. Hydrant shall be housed inside a tamper resistant brass box. Install tight to wall and caulk weather tight. Coordinate operating rod depth with wall thickness and building insulation location.
- P-20 Interior Wall Hydrant: Woodford model MB24-1/2 modular body stainless steel wall box with tee key lock and model 24P 1/2" faucet with anti-siphon vacuum break, air gap, polycarbonate wheel handle and 3/4" threaded hose connections.. Install tight to wall and caulk water tight.
- P-21 Roof Hydrant: Woodford model RH2-MS, freezeless hydrant with an ASSE 1052 double check valve backflow preventer, 3/4" hose connection, 1" NPT female inlet, 1-1/4" galvanized pipe casing, under deck mounting system with 2° shim, EPDM boot cover and 1/8" drain. See Plumbing Notes for the drain system routing to exterior wall and grade.
- P-22 Shampoo Sink: Shampoo sink shall be furnished by the Owner and installed by Plumbing Contractor. The Plumbing Contractor shall review all of the provided installation guidelines prior to rough-in the fixture. The Plumbing Contractor shall furnish and a 17 gauge cast brass chrome plated drain with Zurn model Z1176 hair interceptor and Zurn Z-8804-LR-LK supplies with stops.
- P-23 Shampoo Sink (ADA): Shampoo sink shall be furnished by the Owner and installed by Plumbing Contractor. The Plumbing Contractor shall review all of the provided installation guidelines prior to rough-in the fixture. The Plumbing Contractor shall furnish and a 17 gauge cast brass chrome plated drain with Zurn model Z1176 hair interceptor and Zurn Z-8804-LR-LK supplies with stops.
- P-24 Pedicure Station: Pedicure station will be furnished by others. The Plumbing Contractor shall furnish and install hot and cold water piping to the underside of

the unit with service valves and stainless steel braided flexible water service lines to the hot and cold water connections. Drain shall be to Zurn model ZN-1901-KC-4-32 floor sink, 3" bottom outlet drain connection, 12" x 12" x 8" deep, cast iron body with acid resisting porcelain enamel coating, anchor flange with seepage holds and clamping collar flange, full grate cover with center drainage opening and aluminum dome strainer. Coordinate installation with the manufacturers' optional location below the chair. Provide full size PVC piping from the chair waste connections to inside the floor sink through the grate center opening.

- P-25 Ice Machine Supply: Manitowoc Artic Pure model AR-10000, 1 micron single filter assembly, 14,000 gallon capacity for 0 to 600 lbs. of ice per day with pressure gauge and wall mounting frame. Furnished with the filter assembly shall be 4 spare filters. Plumbing Contractor shall be responsible for furnishing the 3/8" copper tubing connector between the filter housing and ice machine
- P-26 Floor Cleanout: Zurn no. ZN-1400-BP, 4" adjustable floor cleanout with polished nickel bronze top in a coated cast iron ferrule with bronze cleanout plug. Top of the assembly shall be mounted flush with the floor
- P-27 Exterior Cleanout: Zurn model ZN1400-K-BP, coated cast iron adjustable body with anchor flange, heavy-duty scoriated secured cleanout cover and internal bronze plug. Install to the listed waste pipe with a Mission Flex-Seal no-hub coupling with stainless steel connector bands. Assembly shall be inside a formed concrete pad per details on the drawings.
- P-28 Mop Sink: Fiat model TSB-100, 24"x 24" x 12" deep pre-cast terrazzo sink, with stainless steel caps on all curbs, 3" deep seal trap, model 1453-BB stainless steel strainer, model QDC quick drain connector, model MSG-2424 stainless steel wall guard, model 889-CC three-mop hanger & model 832-AA 30" long flexible hose with hose mounting bracket. Seal the sink to the wall and floor with no. 833-AA silicone sealant prior to installing the stainless steel wall guard. Install with Speakman no. S-5811-4WH ceramic cartridge type mixing faucet with wall support, 4" wing handles, vacuum breaker, screw driver stops and threaded hose outlet. Mount the mixing faucet 42" above the floor and as detailed on the drawings. Mount the mop hanger 5' above the floor on the opposite wall of the faucet or as directed by the Architect.

PART 3 - EXECUTION

3.01 GENERAL

- A. Obtain exact centerline rough-in dimensions between partitions or walls from the Architectural Drawings. Work shall be roughed-in so that all exposed piping will be straight and true without bends or off-sets. Water supplies shall connect through walls with stops and chrome plated escutcheons with setscrews. Where fixtures are without supporting legs or carriers secure wall hangers to bolts welded to 3/16" steel plates, mounted against walls within chases.
- B. Where backs of fixtures join wainscoting or tile, they shall be ground flat and the joints made close. Run bead of white caulking compound around back of fixture at outside edge before final setting. When fixture is set, wipe compound so that joint is sealed. Remove excess compound with solvent. Caulking compound shall be Porter "Brilliant White", Pittsburgh Glass, Sherwin-Williams, or equal.

- C. All rough-in sanitary sewer piping shall be properly plugged or capped in a manner approved by the Engineer.
- D. Mount fixtures to the heights above finished floor as indicated on the Architectural drawings.

3.02 ADJUSTING

- A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
- B. Operate and adjust disposers, hot-water dispensers and controls. Replace damaged and malfunctioning units and controls.
- C. Adjust water pressure at faucets and flushometer valves to produce proper flow and stream.
- D. Replace washers and seals of leaking and dripping faucets and stops.
- E. Install fresh batteries in sensor-operated mechanisms

3.03 CLEANING

- A. At completion of all work, fixtures, exposed materials and equipment shall be cleaned with manufacturers' recommended cleaning methods and materials. Perform the following:
 - 1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
 - 2. Remove sediment and debris from drains.
- B. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.

3.04 PROTECTION

- B. Provide protective covering for installed fixtures and fittings.
- C. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Architect/Engineer.

3.05 FINAL ACCEPTANCE

- A. Before final acceptance, the Plumbing Contractor shall furnish a certificate of inspection and final approval from the plumbing Inspector to the Owner and be in accordance with the latest revisions of the applicable codes and the Approved Plumbing Drawings and Specifications. Contractor shall also furnish booklet of test, sterilization compliance and backflow devices certificates.

END OF SECTION

SECTION 23 05 00

MECHANICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The other Contract Documents complement the requirements of this Section. The General Requirements apply to the work of this Section.

1.02 SCOPE OF WORK

- A. The Work shall include the furnishings of systems, equipment, and materials specified in this Division and as required by Contract Documents to include: supervision, operation, methods, and labor for the fabrication, installation, start-up, and tests for the complete mechanical installation.
- B. Drawings for the Work are diagrammatic, intended to convey the scope of the Work and to indicate the general arrangement and locations of the Work. Because of the scale of the Drawings, certain basic items such as pipe fittings, access panels, and sleeves may not be shown. This Contractor shall be responsible for selecting the equipment to fit the space provided. The location and sizes for ductwork, pipe fittings, sleeves, inserts, and other basic items required by code and other sections shall be coordinated and included for the proper installation of the work.
- C. Equipment Specification may not deal individually with minute items required such as components, parts, controls, and devices which may be required to produce the equipment performance specified or as required to meet the equipment warranties. Where such items are required, they shall be included by the supplier of the equipment, whether or not specifically called for in the Contract Documents.
- D. Where the words "provide", "furnish", "include", or "install" are used in the Specification or on the Drawings, it shall mean to furnish, install, and test complete and ready for operation, the items mentioned. If an item is indicated in the Contract Documents, it shall be considered sufficient for including same in the work.
- E. Where noted on the Drawings or where called for in other Sections of the Project Manual, the Contractor for this Division shall install equipment furnished by Others, and shall make required service connections. Contractor shall verify with the supplier of the equipment the requirements for the installation.
- F. Coordinate with all trades in submittal of shop drawings. Shop drawings shall be prepared clearly indicating all applicable components. Space conditions shall be detailed to the satisfaction of all concerned trades, subject to review and final acceptance by the Engineer. In the event that the Contractor installs his work before coordinating with other trades or so as to cause any interference with work of other trades, the necessary changes shall be made in the work to correct the condition, at no additional cost to the Owner.

1.03 CODES AND STANDARDS

- A. Conform to latest edition of governing codes, ordinances, or regulations of city, county, state, or utility company having jurisdiction. Where local codes are not applicable, conform to

Standard Plumbing Code; Standard Mechanical Code; Standard Fire Prevention Code and National Electrical Code.

1.04 CONTRACTOR'S QUALIFICATIONS

- A. The qualifications of the Mechanical Contractor for this project shall be as follows:
 - 1. The Contractor shall have been in the mechanical contracting business for the last five (5) consecutive years and under their current corporation name with essentially the same corporate officers.
 - 2. The Contractor shall have successfully completed at least two projects of comparable size and scope.
 - 3. The Contractor's main office shall be located within 100 miles driving distance of the project. If the Contractor's office is located more than 100 miles from job site, the Contractor shall submit for approval, 10 working days prior to bidding the job, the name of the service company within a 100 mile radius of the job site, who will be responsible for any/all service required during the warranty period. In either case, the Contractor shall be responsible for having a qualified technician on the job site within 4 hours after receiving a service call.
 - 4. When requested, the contractor shall provide substantiating proof of these requirements.

1.05 FEES, PERMITS, AND INSPECTIONS

- A. Secure all permits and pay all fees required in connection with the Work.
- B. Coordinate and provide such inspections as are required by the Authorities with jurisdiction over the site.
- C. Where applications are required for procuring of services to the building, prepare and file such application with the Utility Company. Furnish all information required in connection with the application in the form required by the Utility Company.

1.06 ACTIVE SERVICES

- A. Existing active services; water, gas, sewer, electric, are to be located and shall be protected against damage. Do not prevent or disturb operation of active services which are to remain. If active services are encountered which require relocation, make request to authorities with jurisdiction for determination of procedures. Where existing services are to be abandoned, they shall be terminated in conformance with requirements of the Utility or Municipality having jurisdiction.

1.07 SITE INSPECTION

- A. Contractor shall inspect the site to familiarize himself with conditions of the site which will affect his work and shall verify points of connection with utilities, routing of outside piping to include required clearances from any existing structures, trees or other obstacles.
- B. Extra payment will not be allowed for changes in the Work required because of Contractor's failure to make this inspection.

1.08 OPENINGS, CUTTING, AND PATCHING

- A. Coordinate the placing of openings in the new structure as required for the installation of the Mechanical Work.
- B. When additional patching is required due to failure to inspect work; then provide the patching required to properly close the openings, to include patch painting.
- C. When cutting and patching of the structure is made necessary due to failure to install piping, ducts, sleeves, or equipment on schedule, or due to failure to furnish, on schedule, the information required for the leaving of openings, then provide the cutting and patching as required.

1.09 WIRING FOR MECHANICAL EQUIPMENT

- A. Division 26 shall provide power services for motors and equipment furnished by this Contractor to include safety disconnect switches, starters and final connections.
- B. Division 23 shall provide all motors and contactors for equipment furnished under this Division, except where they are an integral part of a motor control center which is provided under another Division.
- C. Provide internal wiring, alarm wiring including for fire protection and/or security, control wiring, and interlock wiring for equipment furnished, to include temperature control wiring.
- D. Coordinate with Division 26 all motors and other mechanical equipment which require electrical services. Provide schedule which shall include the exact location for rough-in, electrical load, size, and electrical characteristics for all services required.
- E. Where motors or equipment furnished require larger services or services of different electrical characteristics than those called for on the Electrical Drawings, this contractor shall coordinate with the electrical contractor and the Electrical Engineer to provide a larger service as required, the cost of which shall be the responsibility of this contractor.
- F. Electrical work provided under Division 23 shall conform to the requirements of Division 26.

1.10 SUBSTITUTIONS

- A. Any equipment submitted as "equal" to the basis of design shall be accompanied with a comparison letter from the vendor stating any differences from the equipment being submitted and the basis of design. A letter is also to be submitted from the vendor, on the vendor's letterhead, stating that the vendor has received a copy of the job specifications, all addendums and any necessary drawings.
- B. Substitutions for the scheduled and specified equipment shall only be done with the prior approval of the engineer, and shall be obtained in writing. Prior approvals shall be obtained no less than ten working days prior to the bid date. Prior approval shall not relieve the contractor of supplying equipment that meets the specifications, capacities, efficiencies, physical dimensions, etc.

1.11 PROTECTION

- A. Special care shall be taken for the protection of equipment furnished. Equipment and material shall be completely protected from weather elements, painting, plaster, etc. until the

project is completed. Damage from rust, paint, scratches, etc. shall be repaired as required to restore equipment to original condition.

- B. Where the installation or connection of equipment requires work in areas previously finished by other Contractors, the area shall be protected and not marred, soiled, or otherwise damaged during the course of such work. Contractor shall arrange with the other Contractors for repairing and refinishing of such areas which may be damaged.
- C. When welding is required inside building, provide one man for a fire watch. Fire watch shall require adequate protection of existing surfaces and observance of lower floors where penetrations exist.

1.12 SUBMITTALS

- A. General
 - 1. Submit to Engineer shop drawings and product data required by the drawings and specifications.
 - 2. Contractor shall compile all data including but not limited to ductwork materials and construction details, ductwork layout, manufacturers catalog and product data, controls wiring diagrams and material data, piping, insulation, water treatment, and test and balance.
 - 3. Submit a minimum of 7 copies of data, more if required by the Architect.
- B. Submittal Requirements
 - 1. Prepare submittals compiled in a 3 ring, hard bound, loose leaf binder. The face of the binder shall be clearly marked with the project title and number, the name of the Owner, Architect, Engineer, General Contractor and this contractor.
 - 2. The first page inside the binder shall provide an index, numerically indicating all sections applicable to this submittal.
 - 3. Separate binders shall be provided for HVAC, plumbing and fire protection trades.
 - 4. Provide tab dividers for each section submitted. In the event an item appears on the drawings not specifically covered by the specifications, provide an additional numeric tab at the end of the index detailing the item and include the submittal data in the binder.
 - 5. All equipment included on the submittal sheets shall be marked to indicate the "Tag" name or number of the equipment as shown on the drawings. The equipment shall be high-lighted, where necessary, to clarify which items are being submitted.
 - 6. For the ductwork submittals, the contractor will be provided with an electronic copy of the mechanical floor plans. Ductwork layout submittals shall consist of one copy on a reproducible medium. The drawings shall be on standard size sheets of 24" x 36" or 30" x 42". The reproducible copy shall be returned to the contractor with the engineers' approval stamp and comments.
 - 7. Submit only complete project submittals. Partial submittals or submittals not complying with the above requirements shall be returned to the contractor unmarked and rejected.
 - 8. In the interest of project expediency the contractor may pre-submit long lead items for pre-approval. However, the contractor shall not be relieved of including the same data as required by submittal binder and shall be included therein.

9. The Contractor may turn in submittals without control drawings if they require a longer production time. All other items shall be included.
10. Provide a tab for items not included and include an explanation of why item is not included in the submittal and the expected submittal date.
11. Review shop drawings and product data prior to submission to Engineer.
12. Verify field measurements, field construction criteria, catalog numbers, and similar data.
13. Coordinate each submittal with work of the project and Contract Documents.
14. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved by Engineer's review of submittals, unless Engineer gives written acceptance of specific deviations.
15. Notify Engineer in writing of deviations from requirements of Contract Documents at time submittals are made. A "deviation" shall be construed to mean a minor change to the sequence indicated on drawings or specification. A "deviation" is not intended to allow substitutions or product options.
16. Do not begin work which requires submittals until submittals have been returned with Engineer's stamp and initials or signature indicating review and approval. Materials and equipment that were installed prior to being not approved shall be removed and replaced with approved items at no additional cost to other parties.
17. Shop Drawings and/or submittals requiring resubmission to the Engineer due to non-compliance with the Contract Documents and/or incompleteness shall be thoroughly reviewed by the Contractor prior to delivery to the Engineer for review. The Contractor shall ensure the completeness and compliance of the submittal materials and shall reimburse the Engineer at their standard hourly billing rates for review of submittals/shop drawings beyond the second submission.
18. Attention is directed to the fact that Engineer's review is only to check for general conformance with the design concept of the project and general compliance with Contract Documents. No responsibility is assumed by Engineer for correctness of dimensions, details, quantities, procedures shown on shop drawings or submittals.
19. Omission in shop drawings of any materials indicated in Contract Drawings, mentioned in Specifications, or required for proper execution and completion of Work, does not relieve the Contractor from responsibility for providing such materials.
20. Approval of a separate or specified item does not necessarily constitute approval of an assembly in which item functions.

1.13 OPERATING AND MAINTENANCE MANUALS

A. General

1. Provide three up-to-date copies of shop drawings, product data, and other information described in this Section for use in compiling operating and maintenance manuals.
2. Provide legible submittals made by permanent reproduction copy equipment from typewritten or typeset originals.
3. Pre-punch 8-1/2 inch x 11 inch sheets for standard three ring binders.
4. Submit larger sheets in rolled and protected packages.

B. Compilation

1. The Contractor will receive shop drawings, brochures, materials lists, technical data of all types, warranties, guarantees, and other pertinent information and will assemble, catalog, and file information in loose-leaf, hardback three-ring binders.

2. Submittal Format: (Provide each of the following items, as applicable, for each required item or system. Requirements will vary, depending on the equipment. Refer to specific Specification section requirements.)
 - a. Item: (Use appropriate Section title.)
 - b. System Description: (Provide a detailed narrative description of each system, describing function, components, capacities, controls and other data specified, and including the following:
 - (1.) Number of.
 - (2.) Sizes.
 - (3.) Type of operation.
 - (4.) Detailed operating instructions, including start-up and shut-down of each system, with indications for position of all controls, as applicable.
 - (5.) Wiring Diagrams: (Complete wiring diagrams for internally wired components including controls.)
 - (6.) Operating Sequence: (Describe in detail.)
 - (7.) Manufacturers Data: (Provide catalog data sheets, specifications, nameplate data and parts list.)
 - (8.) Preventative Maintenance: (Provide manufacturer's detailed maintenance recommendations.)
 - (9.) Trouble Shooting: (Provide manufacturer's sequence for trouble-shooting procedures for operational problems.)
 - (10.) Extra Parts: (Provide a listing of extra stock parts furnished as part of the Contract.)
 - (11.) Warranties: (Provide specific manufacturer's warranty. List each component and control covered, with day and date warranty begins, date of expiration, and name, address and telephone number of person to contact regarding problems during warranty period.)
 - (12.) Directory: (Provide names, addresses and telephone numbers of Contractor, its subcontractors, suppliers, installers and authorized service and parts suppliers. Format as follows:
Contractor:
Address:
Telephone No.:
Person to Contact:

Subcontractor:
Address:
Telephone No.:

Person to Contact:

Installer:
Address:
Telephone No.:
Person to Contact:

Manufacturer:
Address:
Telephone No.:
Person to Contact:

Local Service Representative:
Address:
Telephone No.:
Person to Contact:

1.14 RECORD DRAWINGS

A. Detailed Requirements for Record Drawings

1. During the progress of the work, the Contractor shall require the job superintendent for the plumbing, air conditioning, heating, ventilating, and fire protection subcontractors to record on their field sets of drawings the exact locations, as installed, of all conduits, pipes, and ducts whether concealed or exposed which were not installed exactly as shown on the contract drawings.
2. The Contractor shall submit redline as-built drawings to the Engineer for review.
3. The Engineer shall authorize the Contractor to produce and distribute the redline as-built drawings in PDF format as follows:
 - a. One (1) Computer Disc (CD) to the Engineer.
 - b. One (1) CD to the Architect.
 - c. Three (3) hard copies full size
 - d. Two (2) CD to the Owner.

1.15 SUBSTITUTIONS AND PRODUCT OPTIONS

- A. For products specified only by reference standard, select product meeting that standard, by any manufacturer.
- B. For products specified by naming several products or manufacturers, select any one of products and manufacturers named which complies with specifications.
- C. For products specified by naming several products or manufacturers and stating "or equivalent", "or equal", or "or Engineer approved equivalent", or similar wording, submit a request for proposed substitutions for any product or manufacturer which is not specifically named; for review and approval by the Engineer.
- D. For products specified by naming only one product and manufacturer, there may be an option of an Engineer approval of a product of equal or greater quality or size.

1.16 SUBSTITUTION SUBMISSIONS

- A. Contractor's Base Bid shall be per contract documents.
- B. Submit separate request for each substitution. Support each request with:
 - 1. Complete data substantiating compliance of proposed substitution with requirements stated in contract documents:
 - a. Product identification, including manufacturer's name and address.
 - b. Manufacturer's literature; identify:
 - (1.) Product description.
 - (2.) Reference standards.
 - (3.) Performance and test data.
 - c. Name and address of at least two similar projects on which product has been used, and date of each installation.
 - d. Itemized comparison of the proposed substitution with product specified; list significant variations.
 - e. Data relating to changes in construction schedule.
 - f. Any effect of substitution on separate contracts.
 - g. List of changes required in other work or products.
 - h. Designation of availability of maintenance services, sources of replacement materials.
 - i. Provide certification of product compatibility with adjacent materials.
- C. Substitutions will not be considered for acceptance when:
 - 1. They are indicated or implied on shop drawings or product data submittals without a formal request from Contractor or his supplier prior to bid.
 - 2. Acceptance will require substantial revision of contract documents.
 - 3. In judgement of Engineer, do not include adequate information necessary for a complete evaluation.
 - 4. Substitute products shall not be ordered or installed without written acceptance of Engineer.
 - 5. Engineer will determine acceptability of proposed substitutions.

1.17 CONTRACTOR'S SUBSTITUTION RESPONSIBILITIES

- A. In making formal request for substitution, Contractor represents that:
 - 1. He has investigated proposed product and has determined that it is equivalent to or superior in all respects to that specified.

2. He will provide same warranties or bonds for substitution as for product specified.
 3. He will coordinate installation of accepted substitution into the work, and will make such changes as may be required for the work to be complete in all respects. This includes revisions due to changes in electrical characteristics, physical size and weight, service requirements, service clearances, etc.
 4. He waives claims for additional costs caused by substitution which may subsequently become apparent.
- B. The contractor shall have included all costs associated with the substitution for the specified products or materials, and that no additional cost will be incurred by any other party in order to fully incorporate the substituted item(s).
- C. The contractor agrees to reimburse the Architect/Engineer for any architectural or engineering re-design that is required by the substitution to be fully incorporated. The reimbursement shall be at the Architect/Engineer's standard billing rate.

1.18 ENGINEER DUTIES

- A. Review Contractor's requests for substitutions with reasonable promptness.
- B. Notify Contractor in writing of decision to accept or reject requested substitution.

1.19 FINISHING

- A. General: Prior to acceptance of the installation and final payment of the Contract, the Contractor shall perform the work outlined herein.
- B. Cleaning: At the conclusion of the construction, the site and structure shall be cleaned thoroughly of all debris and unused materials remaining from the mechanical construction. All closed off spaces shall be cleaned of all packing boxes, wood frame members, and other waste materials used in the mechanical construction.
- C. The entire system of piping and equipment shall be cleaned internally. The Contractor shall open all dirt pockets and strainers, completely blowing down as required and clean strainer screens of all accumulated debris.
- D. All tanks, fixtures, and pumps shall be drained and proven free of sludge and accumulated matter.
- E. All temporary labels, stickers, etc., shall be removed from all fixtures and equipment. (Do not remove permanent name plates, equipment model numbers, ratings, etc.). All HVAC equipment shall have affixed adjacent to the permanent nameplate, the unit identification on an engraved label with permanent adhesive.
- F. Heating and air conditioning equipment, tanks, pumps, etc., shall be thoroughly cleaned and new filters or filter media installed.

1.20 TEST AND DEMONSTRATIONS

- A. Systems shall be tested and placed in proper working order prior to demonstrating systems to Owner.

- B. Prior to acceptance of the mechanical installation, demonstrate to the Owner or his designated representatives all essential features and functions of all systems installed, and instruct the Owner in the proper operation and maintenance of such systems. The contract shall allow for five (5) working days to perform the demonstrations.
- C. Provide necessary trained personnel to perform the demonstrations and instructions. Provide manufacturer's representatives for systems as required to assist with the demonstrations.
- D. Dates and times for performing the demonstrations shall be coordinated with the Owner.
- D. Upon completion of demonstrations, provide a certificate testifying that demonstrations have been completed. Certificate shall list each system demonstrated, dates demonstrations were performed, names of parties in attendance, and shall bear signatures of contractor and owner.
- E. Training shall include audio/video recording in DVD format turned over to the owner as part of closeout documents.

1.21 PAINTING AND IDENTIFICATION

- A. Touch-up paint where damaged on equipment furnished with factory applied finish, to match original finish.
- B. Provide engraved, laminated plastic tags for all equipment. Tags shall be attached with permanent adhesive.

1.22 EXCAVATING, TRENCHING, AND BACKFILLING

- A. Provide excavation necessary for underground water piping, etc., and backfill such trenches and excavations after work has been installed and tested. Care shall be taken in excavating, that walls and footings and adjacent load bearing soils are not disturbed, except where lines must cross under a wall footing. Where a line must pass under footing, the crossing shall be made by the smallest possible trench to accommodate the pipe. Excavation shall be kept free from water by pumping if necessary. No greater length of trench shall be left open, in advance of pipe and utility laying, than that which is authorized.
- B. Trenches for piping and utilities located inside foundation walls and to point five (5) feet outside of the wall shall be not less than sixteen (16) inches or more than twenty-four (24) inches wider than the outside diameter of the pipe to be laid. The widths of trenches for piping and utilities located more than five (5) feet outside of building foundation walls, other than for sewers, shall be governed by conditions found at the site.
- C. Bottoms of trenches shall be so shaped that when pipe is in place the lower fourth of the circumference for the full length of the barrel will be supported on compacted fill. Bell holes shall be dug so that no part of the weight of the pipe is supported by the bell but shall be no larger than necessary for proper jointing. All sewers and piping required for the structure shall be excavated to at least (6) inches below pipe invert.
- D. Immediately after testing and/or inspection, the trench shall be carefully backfilled with earth free from clods, brick, etc., to a depth one-half the pipe diameter and then firmly puddled and tamped in such a manner as not to disturb the alignment or joints of the pipe. Thereafter, the backfill shall be puddled and tamped every vertical foot.

1.23 CONCRETE WORK

- A. Provide concrete bases and housekeeping pads for mechanical equipment unless indicated otherwise. Concrete work shall be as specified in the applicable Civil/Site and Structural Sections. Vibration pads, equipment bases, pipe supports and thrust blocks shall be provided by this Contractor.
- B. Provide equipment anchor bolts and coordinate their proper installation and accurate location.

1.24 ACCESS PANELS

- A. Provide access panels where required and not shown on the drawings for installation by the drywall Contractor. Access panels shall be as specified in the applicable architectural section. All access panel locations which allow access to mechanical equipment shall be approved by the Architect/Engineer.

1.25 SLEEVES

- A. Sleeves passing through non-fire rated walls and partitions shall be Schedule 10 black steel.
- B. Sleeves passing through load bearing walls, concrete beams, foundations, footings, and waterproof floors shall be Schedule 40 galvanized steel pipe or cast iron pipe.
- C. Sleeves passing through non-load bearing walls, concrete beams, foundations, footings, and waterproof floors shall be Schedule 40 PVC or cast iron.
- D. Sleeves for insulated piping shall be of sufficient internal diameter to take pipe and insulation and to allow for free movement of pipe. Waterproof sleeves shall be of sufficient internal diameter to take pipe and waterproofing material.
- E. In finished areas where pipes are exposed, sleeves shall be terminated flush with wall, partitions, and ceilings, and shall extend 1/2" above finished floors. Extend sleeves 1" above finished floors in areas likely to entrap water.
- F. Pipe to wall penetration closures for underground pipe penetrations of walls shall be "Link-Seal" as manufactured by Thunderline Corporation, or equal.

1.26 ESCUTCHEONS

- A. Provide chrome plated escutcheons at each sleeved opening into finished and stainless steel to exposed exterior spaces. Escutcheons shall fit around insulation or around pipe when not insulated; outside diameter shall cover sleeve. Where sleeve extends above finished floor, escutcheon shall be high cap type and shall clear sleeve extension. Secure escutcheons or plates to sleeve but not to insulation with set screws or other approved devices.

1.27 INSULATION PROTECTION

- A. Where exposed insulated piping extends to floor, provide sheet metal guard around insulation.

1.28 ANCHORING OF EQUIPMENT

- A. All equipment located on floor slab, that is not mounted on wheels and is capable of being moved shall be secured to the floor with anchor bolts. A minimum of two bolts are required per each piece of equipment and bolts shall be of sufficient size to prevent equipment from overturning.

1.29 PROTECTION OF ELECTRICAL EQUIPMENT

- A. Water piping shall not be installed in electrical rooms or directly above electrical equipment.

1.30 CONNECTIONS FOR FIXTURES AND EQUIPMENT UNDER ANOTHER SECTION OR BY OWNER

- A. Rough all equipment requiring connection to systems provided under this Division. Verify requirements and current locations before proceeding with work.
- B. Make all connections to equipment furnished under another Section or by owner as required to obtain complete and working systems.

1.31 SYSTEM GUARANTEE

- A. Work required under this Division shall include one-year guarantee. Guarantee by Contractor to Owner to replace for Owner any defective workmanship or material which has been furnished under contract at no cost to the Owner for a period of one year from date of substantial completion. Guarantee shall also include all reasonable adjustments of system required for proper operation during guarantee period. Guarantee shall not include normal preventative maintenance services or filters.
- B. At "Demonstration", one-year guarantee provision by Contractor shall be explained to Owner.
- C. All sealed hermetic refrigeration systems shall be provided with five-year factory warranty from date of substantial completion

END OF SECTION

SECTION 23 05 05

MECHANICAL DEMOLITION

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Remove: Equipment, piping, insulation, controls, ductwork, etc. as indicated on the drawings.

1.02 EXISTING CONDITIONS

- A. Contractor shall visit site prior to bidding; the contractor shall become familiar with the requirements and intent of the drawings.
- B. There will be no allowances made for failure of the contractor to familiarize themselves with the extent of work required under the specifications or drawings.

1.03 SALVAGED MATERIALS OR EQUIPMENT

- A. Equipment and materials shall be removed from the jobsite at no additional expense to the owner.
- B. All equipment indicated on the drawings shall be turned over to the owner.
- C. Any material posing a hazard shall be removed from the jobsite immediately.

PART 2 - EXECUTION

2.01 GENERAL

- A. Contractor shall submit a plan for approval by the Architect for phasing of demolition to minimize utility outages and interference with other trades and occupied portions of the building.
- B. Contractor shall coordinate utility outages with the General Contractor, Owner and Architect by providing three days written notice of times and locations of utility outages and anticipated time of restoration.

2.02 PROTECTION OF EXISTING TO REMAIN

- A. Provide tarps, plywood, and any other protectionary devices to protect existing finishes, furniture, appliances, equipment, etc.
- B. Damages to any afore mentioned shall be replaced by this contractor at no cost to the owner.

2.03 PROHIBITED METHODS

- A. Jack Hammers shall not be used without the written approval of the Architect. The Architect reserves the right to withdraw approval for the use of jack hammers at any time if their use create excessive noise and/or vibration as deemed by the Architect.

- B. Explosives of any type shall not be used.
- C. Burning shall not be used as a means of demolition and/or disposal. Cutting torches shall not be considered as burning.

2.04 DUST CONTROL

- A. Provide tarps, temporary walls, etc. as required to prevent the spread of dust through the building unnecessarily.

END OF SECTION

SECTION 23 05 20

MOTOR STARTERS

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Provide motor starters for all mechanical motor driven equipment not provided with a starter or contactor.

1.02 SUBMITTALS

- A. Provide catalog cuts per Division 23 for all motor starters. Cut sheets shall be identified as to the equipment it serves, the horse power rating and accessories provided.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Supply motor starters when required for any equipment provided in Division 23. Starters shall be adequately sized for the motor.
- B. Provide labels for each starter.
- C. Provide starters with enclosures suitable for the associated environment, or as specified elsewhere in the documents.

2.02 MANUAL MOTOR STARTER

- A. Fractional Horsepower

Provide manually operated toggle switches equipped with melting alloy-type thermal overload protection. Utilize replaceable thermal units of one-piece construction which inhibit starter operation when removed or melted.

- B. Integral Horsepower

1. Provide starters equipped with bimetallic or melting alloy-type thermal overload protection, as required.
2. Provide with operating and indicating equipment as required.
3. Provide with under-voltage protection if required.

2.03 MAGNETIC MOTOR STARTERS

- A. Provide starters for full voltage starting, sized in accordance with NEMA standard horsepower ratings.
- B. Provide starters allowing for a maximum of four external auxiliary normally open or closed contacts.

- C. Provide starters with coils of molded construction, through NEMA size five. All coils shall be replaceable without removing the starter.
- D. Provide starters with bimetallic or melting alloy-type thermal overload protection. Utilize replaceable thermal units of one-piece construction which inhibit starter operation when removed or melted. Three phase starters shall use three thermal units.
- E. Provide starters with replaceable contacts. Contact replacement shall occur without starter or wire removal.
- F. Provide Hand/Off/Auto switches.
- G. Starters shall be manufactured by Culter-Hammer, or approved equals by Square D, ITE-Siemens, or General Electric.

PART 3 - EXECUTION

3.01 GENERAL

- A. Provide types of starters as required or specified elsewhere.
- B. Provide with control schemes as specified elsewhere.
- C. Provide overload protection elements sized to the full load current rating of the motor per the motor nameplate.
- D. Install floor mounted units on concrete housekeeping pads in rooms with concrete floors susceptible to flooding.

END OF SECTION

SECTION 23 05 21

VARIABLE FREQUENCY DRIVES

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Provide a variable frequency drive for each piece of equipment as noted in the equipment schedules on the drawings.
- B. Provide start-up service by the manufacturer for each variable frequency drive.

1.02 REFERENCES

Underwriter Laboratories (UL)
National Electrical Code (NEC)
National Electrical Manufacturers Association (NEMA)

1.03 SUBMITTALS

Submit shop Drawings for each variable frequency drive including all options. The shop drawings shall be identified as to which mechanical device it serves and the horse power rating.

PART 2 - PRODUCTS

2.01 VARIABLE FREQUENCY DRIVE

- A. Contractor shall provide a variable frequency drive (VFD) which is a pulse width modulated AC drive that generates a sine-coded, variable voltage/frequency; three phase output for control of any conventional squirrel cage induction motor.
- B. The input three phase power shall be rectified to a fixed DC voltage. Using pulse width modulation inverter technology, the DC voltage shall be processed to produce an output voltage waveform in a series of variable width pulses. The output current shall closely approximate a true sinusoidal waveform. Rectifier shall not cause a displacement power factor of less than .95 lagging under any speed and load condition.
- C. The VFD shall use a solid state full wave diode rectifier with metal oxide varistor protection for converting input power to DC voltage.
- D. The VFD shall have a DC bus to maintain a fixed DC voltage with filtering and short circuit protection as a DC supply to the output section.
- E. The DC bus shall be integrated with a diagnostic logic circuit to continuously monitor and protect power components. The control logic circuit board shall be the same for all size drives.
- F. The VFD output section shall utilize gate turn off devices switched in a manner to produce a voltage pulse width modulated sine coded output to the motor. A suitable carrier frequency shall be used to provide a low audible magnetic motor noise and high starting torque.
- G. The VFD shall have a digital operator keypad and display to provide the following local control

and readout functions in English:

1. Hand/Off/Auto
 2. Speed Command
 3. Reset Command
 4. Operating parameters
 5. Program/Run push-button
 6. Scroll buttons
 7. Enter button
 8. Diagnostic messages
- H. The VFD shall have an output current overload rating of 125% (minimum) of motor FLA for one minute
- I. The VFD shall have a starting current limit of 150% (minimum) and an adjustable running current range minimum of 50% to 125%
- J. The VFD shall be capable of restarting a rotating motor without tripping.
- K. The VFD shall have an inherent soft start function.
- L. The VFD shall have serial communication capability with a RS-232-C port.
- M. With a loss of frequency referenced input signal, the VFD shall default to 80% of the last speed.
- N. The VFD shall be rated to operate in an ambient temperature of 14 degree F to 100 degree F continuously.
- O. The VFD shall have a control input of 0-10 VDC (20K ohms minimum) and 4-20 MA (250 ohms).
- P. The VFD shall be provided with a NEMA 12 wall mounted style enclosure.
- Q. Provide bypass with automatic transfer.
- R. VFD's shall be Magnetek, Square D, or AC Tech and shall be suitable for the application.

PART 3 - EXECUTION

3.01 VARIABLE FREQUENCY DRIVE

- A. Install in accordance with manufacturers recommendations.
- B. Provide a fused disconnect/circuit breaker (by division 26) ahead of the VFD.
- C. Verify that all wiring is complete and terminated at correct terminals prior to start-up.

END OF SECTION

SECTION 23 05 30

EXPANSION COMPENSATION

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Flexible pipe connections.
- B. Expansion joints and compensators.
- C. Pipe loops, offsets, and swing joints.

1.02 REFERENCES

Conform to Standards of Expansion Joint Manufacturer's Association.

1.03 DESIGN CRITERIA

- A. Base expansion calculations on 50 degrees F installation temperature to 210 degrees F operating temperature for heating water systems and 140 degrees F operating temperature for domestic hot water systems, plus 30 percent safety factor for each service.

1.04 SUBMITTALS

- A. Submit shop drawings for all equipment specified under this section.
- B. Flexible pipe connector shop drawing data to include maximum allowable temperature and pressure rating, overall face-to-face length, live length, hose wall thickness, hose convolutions per foot and per assembly, fundamental frequency of assembly, braid structure and total number of wires in braid.
- C. Expansion joint shop drawings to include maximum allowable temperature and pressure rating, and maximum expansion compensation.

PART 2 - PRODUCTS

2.01 FLEXIBLE PIPE CONNECTIONS

- A. Flexible pipe connections for steel piping shall be constructed with stainless steel inner hose and braided exterior sleeve.
- B. Flexible pipe connections for copper piping shall be constructed with bronze inner hose and braided exterior sleeve.
- C. Flexible pipe connections shall be rated for minimum 125 psi WSP at 500 degrees F and 200 psi WOG at 250 degrees F.

2.02 CONNECTIONS

- A. Provide pipe connections suitable to connect to adjoining piping as specified for pipe joints. Use pipe sized units.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Provide flexible pipe connections at piping connections to equipment supported by vibration isolation.
- B. Install flexible pipe connections at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor other end.
- C. Provide structural work and equipment required to control expansion and contraction of piping, loops, piping offsets, and swing joints.
- D. Rigidly anchor piping to building structure where necessary. Provide pipe guides so that movement takes place along axis of pipe only.

END OF SECTION

SECTION 23 05 32

SUPPORTS AND ANCHORS

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Pipe, duct, and equipment hangers, supports, and associated anchors.
- B. Equipment bases and supports.
- C. Sleeves and seals.
- D. Flashing and sealing equipment and pipe stacks.

1.02 WORK FURNISHED BUT INSTALLED UNDER OTHER SECTIONS

- A. Furnish hanger and support inserts sleeves to Section for placement into formwork.

1.03 SUBMITTALS

- A. Submit shop drawings and product data for all items listed under this section.
- B. Indicate hanger and support framing and attachment methods.

PART 2 - PRODUCTS

2.01 PIPE HANGERS AND SUPPORTS

- A. Hangers for Pipe Sizes 1/2 to 4 inches: Carbon steel, adjustable, clevis type with galvanized plating.
- B. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods; cast iron roll and stand for hot pipe sizes 6 inches and over.
- C. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
- D. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp; adjustable steel yoke and cast iron roll for hot pipe sizes 6 inches and over.
- E. Vertical Support: Steel riser clamp with galvanized plating.
- F. Floor Support for Pipe Sizes to 4 Inches and All Cold Pipe Sizes: Cast iron adjustable pipe saddle, locknut nipple, floor flange, and concrete pier or steel support anchored to floor.
- G. Un-insulated Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
- H. Shield for Insulated Piping 1 1/4 Inches and Smaller: 18 gage galvanized steel saddle over insulation in 180 degree segments, minimum 12 inches long per pipe support.

- I. Shield for Insulated Water Piping 1 1/2 Inches and Larger: Rigid non-conducting insulation in 180 degree segments, 16 inch minimum length with block thickness the same as insulation thickness and with an inner contour of the supporting pipe. Install with 16 gage galvanized steel saddle per pipe support. See Detail for additional requirements. Wood is not an acceptable blocking material.

- K. Shields for Vertical Copper Pipe Risers: Sheet lead.

2.02 HANGER RODS

- A. Steel Hanger Rods: Galvanized threaded both ends, threaded one end, or continuously threaded.

2.03 FLASHING

- A. Metal Flashing: galvanized steel.
- B. Lead Flashing: 5 lb/sq ft sheet lead for waterproofing; one lb/sq ft sheet lead for soundproofing.
- C. Flexible Flashing: 47 mil thick sheet butyl; compatible with roofing.
- D. Caps: Steel, 20 gage minimum; 16 gage at fire resistant elements.

2.04 SLEEVES

- A. Sleeves for Pipes Through Non-fire Rated Floors: Form with schedule 80 PVC or Schedule 10 steel pipe.
- B. Sleeves for Pipes Through Non-fire Rated Walls, Footings, and Potentially Wet Floors: Form with schedule 10 steel pipe.
- C. Sleeves through beams shall be Schedule 40 steel; only in locations approved by the Structural Engineer.
- D. Sleeves for Round Ductwork: Form with galvanized steel. Size shall include an allowance for the insulation.
- E. Sleeves for Rectangular Ductwork: Formed or framed for the duct penetration including scheduled/specified insulation. See Detail for packing insulation and metal flashing
- F. Flanges shall be 20 gage galvanized steel.
- G. Sleeves for floor or wall penetrations at rated assemblies shall conform to Specifications Section 23 05 60.

2.05 FABRICATION

- A. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
- B. Design hangers without disengagement of supported pipe.

2.06 FINISH

- A. Prime coat steel hangers and supports at interior spaces. Exterior supports shall be galvanized or primed and painted as directed by Engineer and Architect.
- B. Finish coat in exposed areas and exterior shall be selected by Architect.

PART 3 - EXECUTION

3.01 PIPE HANGERS AND SUPPORTS

- A. Support horizontal piping as follows:

PIPE SUPPORT SCHEDULE					
Pipe Size	Support Spacing				Hanger Rod Diameter
	Sched 40 Black Steel	Copper	PVC	Cast Iron Soil Pipe	
1/2"	-	5'-0"	4'-0"	-	3/8"
3/4"	7'-0"	5'-0"	4'-0"	-	3/8"
1"	7'-0"	6'-0"	4'-0"	-	3/8"
1-1/4"	7'-0"	7'-0"	4'-0"	-	3/8"
1-1/2"	9'-0"	8'-0"	4'-0"	-	3/8"
2"	10'-0"	8'-0"	4'-0"	5'-0"	3/8"
2-1/2"	10'-0"	9'-0"	4'-0"	5'-0"	1/2"
3"	10'-0"	10'-0"	4'-0"	5'-0"	1/2"
4"	10'-0"	10'-0"	4'-0"	5'-0"	5/8"
6"	10'-0"	10'-0"	4'-0"	5'-0"	3/4"
8"	10'-0"	10'-0"	4'-0"	5'-0"	7/8"
10"	10'-0"	10'-0"	4'-0"	5'-0"	7/8"

Note: Rods may be reduced one size for double rod hangers, with 3/8" being the minimum diameter.

- B. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
- C. Place a hanger within 12 inches of each horizontal elbow.
- D. Use hangers with 1-1/2 inch minimum vertical adjustment.
- E. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.
- F. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.
- G. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
- H. Support riser piping independently of connected horizontal piping.
- I. All hangers, hanger rods, supports, etc. shall be double nutted.

3.02 EQUIPMENT BASES AND SUPPORTS

- A. Provide equipment bases of concrete type.
- B. Provide templates, anchor bolts, and accessories for mounting and anchoring equipment.
- C. Construct support of steel members. Brace and fasten with flanges bolted to structure.
- D. Provide rigid anchors for pipes after vibration isolation components are installed.

3.03 FLASHING

- A. Provide flexible flashing and metal counterflashing where piping and ductwork penetrate weather or waterproofed walls, floors, and roofs.
- B. Flash vent and soil pipes projecting 3 inches minimum above finished roof surface with lead worked one inch minimum into hub, 8 inches minimum clear on sides with 24 x 24 inches sheet size. For pipes through outside walls, turn flanges back into wall and caulk, metal counterflash and seal.
- C. Flash floor drains in floors with topping over finished areas with lead, 10 inches clear on sides with minimum 36 x 36 inch sheet size. Fasten flashing to drain clamp device.
- D. Seal floor, and mop sink drains watertight to adjacent materials.
- E. Provide acoustical lead flashing around ducts and pipes penetrating equipment rooms, installed in accordance with manufacturer's instructions for sound control.

3.04 SLEEVES

- A. In finished areas where pipes are exposed, sleeves shall be terminated flush with wall, partitions, and ceilings, and shall extend 1/2" above finished floors. Extend sleeves 1" above finished floors in areas likely to entrap water. Caulk sleeves full depth and provide floor plate.
- B. Install chrome plated steel escutcheons at finished surfaces.
- C. Install stainless steel escutcheons at finished exterior surfaces.

END OF SECTION

SECTION 23 05 34

VIBRATION ISOLATION

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Supply necessary equipment such as inertia bases, base rails, vibration isolators, etc. as required to prevent the transmission of excessive noise and vibration to other portions of the building from all HVAC equipment.

1.02 SUBMITTALS

- A. Submit shop drawings and product data for all materials listed under this section.
- B. Shop drawings shall indicate inertia bases, base rails, vibration isolators etc., with static and dynamic load on each. A professional engineer in the employ of the isolator manufacturer shall stamp shop drawings.
- C. Provide a schedule of vibration isolator type with location and load on each.
- D. Manufacturers installation instructions, indicating special procedures and setting dimensions.
- E. Manufacturers certificate, certifying that isolators are properly installed and adjusted to meet or exceed specified requirements.

PART 2 - PRODUCTS

2.01 VIBRATION ISOLATION EQUIPMENT AND METHODS

- A. Equipment vendors shall furnish the required isolation equipment and installation instructions with each piece of equipment.
- B. Manufacturers: Vibration Eliminator Co. is specified to establish the standard. Equals by Mason, Iso-flex and VMC will be considered.
- C. Contractor shall submit for approval of any equal isolation method/materials with supporting Documentation for approval by the engineer prior to order or placement.

2.02 VIBRATION ISOLATION

- A. The following equipment shall be provided with vibration isolation:

EQUIPMENT	TYPE ISOLATION/BASE	MINIMUM DEFLECTION
Chillers	NM	.35"
Cooling Towers	NP	Bolt to Steel W/ 5/8" Bolts
Reciprocating Air Compressors	S/I	.75
Base Mounted Pumps	S/I	.75
Air Handling Units External Motor & Drives	S/B	.75
Internal Motor & Drives (Unless Internally Isolated)	S/B	.75
Packaged AC Equipment Interior	NP	
Exterior	NP	
Utility Fans	S/B	.75
Suspended Fans	H	.75
Condensate Return Set	NP	Bolt to Housekeeping Pad W/ 5/8" Bolts
Boilers	NP	Bolt to Housekeeping Pad W/ 5/8" Bolts
Condensate Pumps	NP	Bolt to Housekeeping Pad W/ 5/8 Bolts

Provide seismic snubbing on all isolated equipment not directly bolted to slab.

- B. Materials and systems specified in this section shall be obtained from a single vibration isolation materials manufacturer. The isolation materials manufacturer shall be responsible for the proper selection of isolators to accomplish the specified minimum static deflections, for all spring and pad type isolators, based on the weight distribution of equipment to be isolated.
- C. The isolation materials manufacturer shall be responsible for the structural design of steel beam bases and concrete inertia bases for equipment scheduled to receive a supplementary base.
- D. The Contractor shall furnish the vibration isolation manufacturer a complete set of approved shop drawings, including operating weights and weight distribution. The isolation manufacturer shall then submit drawings for approval showing construction of specific devices to be used on this project including complete design of supplementary bases, tabulation of design data for each isolator including spring O.D.; free, operating and solid heights; and all other data to show that minimum static deflection requirements are met.

E. Isolator Types - Floor Mounted Equipment:

1. Type NP: Neoprene in-shear isolation pads with crossed double ribs and .25" deflection. Pads shall be molded using oil resistant 25,000 PSI tensile strength neoprene. Cork shall not be allowed.
2. Type NM: Double deflection neoprene mountings shall have minimum static deflection of 0.35". All metal surfaces shall be neoprene covered to avoid corrosion and have friction pads both top and bottom so they need not be bolted to the floor. Bolt holes shall be provided for those areas where bolting is required.
3. Type S:
 - a. Vertically restrained spring isolators with horizontal stiffness not less than 1.3 times the rated vertical spring stiffness. Spring O.D. shall be minimum of 0.8 times rated vertical operating height. Springs shall be selected to provide minimum static deflections tabulated and shall provide a 50 percent overload capacity before reaching a solid state.
 - b. Springs to include drilled and tapped steel top load plates, steel bottom load plate bonded to a 1/4 inch thick ribbed neoprene noise stop pad, steel leveling bolt, locknuts, and washers for attachment to supported equipment.

F. Base Types - Floor Mounted Equipment:

1. Type B: Welded structural steel bases with welded support brackets mounted as required to provide the lowest possible mounting height of supported equipment. Beams shall have minimum section depth of 8 percent of the longest span between support isolators, but not less than 6 inches. Anchor bolt holes shall be pre-located and drilled to accept isolated equipment.
2. Type I: Inertia bases shall consist of a concrete slab field cast into a prefabricated inertia based frame of welded steel channels with a depth greater than 8 percent of the longest span, but not less than 6 inches, or as indicated on the drawings. Frame to include 1/2" steel reinforcing rods on 8 inch centers each way, pre-located equipment anchor bolts fixed into position with steel bolt sleeves to allow minor adjustment. Inertia bases with Type S isolators shall have isolator support brackets welded into corners of the perimeter channel frame. Inertia bases for horizontally split case pumps shall also support the pipe elbows.

G. Hangers:

1. Type F: Shall consist of a Type NM isolator bonded to and encased in a welded steel bracket. Brackets to allow up to 15 degrees rod misalignment without metal to metal contact.
2. Type S: Shall consist of a Type S isolator mounted in a steel bracket as described for Type F.
3. Type H: Shall consist of a Type F isolator and a Type S isolator, in series, encased in a welded steel bracket as described for Type F.

H. Piping isolation, using Type H isolators, shall be for piping over 1 inch O. D. for a distance of 50 feet, or 100 diameters, or inside equipment rooms, from connected isolated equipment, whichever is greater.

I. Piping isolation, using Type F isolators, shall be for all piping over 2" diameter not isolated with Type H isolators.

- J. Seismic Snubbers: Each set of seismic snubbers shall restrain machinery motion in x, y and z directions. Snubbers shall be omni-directional type with factor set air gaps between 1/8-inch minimum and 1/4-inch maximum. Load capacity of each snubber at 50 percent neoprene element deflection shall be 1.0g minimum. Neoprene elements shall be 3/4-inch minimum thickness and replaceable. In lieu of snubbers and spring isolators, combination spring/snubbers may be used.

PART 3 - EXECUTION

3.01 VIBRATION ISOLATORS

- A. Install in accordance with manufacturer's instructions.
- B. Install isolation for motor driven equipment.
- C. Bases:
 - 1. Set steel bases for one inch clearance between housekeeping pad and base.
 - 2. Set concrete inertia bases for one inch clearance between housekeeping pad and base.
 - 3. Adjust equipment level.
- D. Install spring hangers without binding.
- E. On closed spring isolators, adjust so side stabilizers are clear under normal operating conditions.
- F. Prior to making piping connections to equipment with operating weights substantially different from installed weights, block up equipment with temporary shims to final height. When full load is applied, adjust isolators to load to allow shim removal.
- G. Provide pairs of horizontal limit springs on fans with more than 6.0 inch static pressure, and on hanger supported, horizontally mounted axial fans.
- H. Support piping connections to isolated equipment resiliently as follows:
 - 1. Select three hangers closest to vibration source for static deflection of isolated equipment; the first two hangers shall be the precompressed type. Select remaining isolators for 1/2 static deflection of isolated equipment.
- I. Connect wiring to isolated equipment with flexible hanging loop.

3.02 ACCEPTANCE

- A. The Contractor shall be responsible to take the necessary steps to insure that no equipment operates with excessive noise or vibration transmission.

END OF SECTION

SECTION 23 05 36

EQUIPMENT CURBS

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. Provide manufactured equipment curbs for all roof mounted equipment which is not provided with its own curb.
- B. Coordinate with General Contractor for the required steel installed below the curbs. Installation requirements of the curb to the steel shall be provided by the curb manufacturer on the roof curb shop drawings. Installation shall be done by the Mechanical Contractor.
- C. Coordinate with roof design and where sloped steel is provided, sloped curbs shall be submitted and installed.
- D. Curbs, attachments and equipment hold down clips shall be designed to be attached to the building structure steel rooftop equipment as a complete component to meet IBC 1609 wind load requirements by a Professional Engineer registered in Alabama. Calculations shall be submitted and sealed/signed by the Engineer. Coordinate with equipment manufacturer as required.
- E. Final roofing and flashing shall be done by the Roofing Contractor.

1.02 SUBMITTALS

- A. Provide manufacturer's product data and cut sheets.
- B. Shop drawing submittal:
 - 1. Provide shop drawings showing the physical size and/or slope of each curb.
 - 2. For curbs supporting multiple pieces of equipment, the shop drawings shall also show where each piece of equipment will be mounted and the clearances between them. The equipment shown, shall be the actual equipment being installed, with the dimensions from the shop drawings used for layout.
 - 3. The shop drawings shall indicate the curbs relationship to supporting walls and beams below along with sufficient data to accurately locate the curb on the roof.

PART 2 - PRODUCTS

2.01 EQUIPMENT CURBS

- A. The equipment curbs shall be constructed of reinforced galvanized steel with all welded components and four mitered corners.
- B. The curbs shall be flat sided without a cant strip. Curbs shall have a mounting flange for attaching to the roof.
- C. The curbs shall have factory installed 1 1/2" thick rigid fiberglass board insulation.
- D. The curbs shall have attached pressure treated wood nailers.

- E. The curbs shall have an attached solid plywood top and flashing cap extending to below the wood nailer.
- F. The curbs shall be shipped completely factory assembled.
- G. The curbs shall be designed to support the weight and size of the equipment shown on the drawing. When attached to the roof deck the curb shall extend a minimum of 12 inches above the roof surface.
- H. If indicated on drawings, the equipment curb cap shall include pipe curbs (Refer to section 23 05 37).
- I. When indicated on the plans the curbs shall be factory painted, color to be selected by architect.
- J. The equipment curbs shall be Pate Model PC-2 (sloped curb similar) or Creative Metals Model CSSF (Sloped curb similar).

PART 3 - EXECUTION

3.01 EQUIPMENT CURBS

- A. Contractor shall determine the location for the installation of the curbs for installation by the roofing contractor.
- B. Contractor shall be responsible for determining the overall height of the curb to be provided for each location. Minimum curb height shall be 12".
- C. Equipment curbs shall be installed level and in such a manner to prevent racking, twisting or other deformation.
- D. Equipment curbs shall be fully supported along their perimeter and at any cross bracing meant to be supported by the roof.
- E. Piping curbs, when indicated on the drawings, shall be installed in accordance with the manufacturer's recommendations and shall be completely sealed to prevent leaks.

END OF SECTION

SECTION 23 05 53

MECHANICAL IDENTIFICATION

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Identification of mechanical piping, ductwork and equipment.
- B. Painting of exposed mechanical piping.
- C. Painting of accessible, concealed mechanical piping.

1.02 SUBMITTALS

- A. Submit manufacturer's data, application instructions, surface preparation techniques and color samples for all paint products.
- B. Submit samples and manufacturer's installation instructions for all mechanical identification products.
- C. Submit valve chart and schedule including valve tag number, size, function, location and valve manufacturer's name and model number.
- D. Submit manufacturer's installation instructions.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Plastic Nameplates: Laminated three-layer plastic with engraved white letters on black background color.
- B. Metal Tags: Brass with 1/2 inch high black filled numbers and/or letters, minimum 1-1/2 inch diameter, brass link chain and hooks.
- C. Engraved Metal Tack Markers: For use of identifying valve locations above acoustical tile ceilings 7/8" diameter head, 7/16" insert point, 7 colors available - yellow, light green, light blue, orange, black, and white. Color to be selected by submittal. Markers shall be numbered consecutively with standard 3/16" characters. Seaton Style ECM or equal.
- D. Paint: Numbers for paint colors are referenced to Sherwin-Williams brand. Equivalent products by Glidden or Pratt and Lambert are acceptable.
- E. Stencil Paint: Semi-gloss enamel.
- F. Snap Around Pipe Markers: Outdoor grade acrylic plastic with UV inhibitors. Color-coded background, color of legend letter size and length of color field shall conform completely to the latest edition of ANSI A13.1. Markers shall indicate direction of flow. Legends shall be alternately reversed and repeated for viewing from any angle. Markers shall be factory formed for the installed diameter. Markers less than 6 inch diameter shall snap-on. Markers 6 inch diameter and larger shall be secured with stainless steel spring fasteners provided by

the marker manufacturer. Markers shall be Ultra Mark pipe markers by Seton or approved equal

PART 3 - EXECUTION

3.01 GENERAL

- A. Clean surfaces of all construction debris and dust to receive snap around pipe identification markers. These markers shall be installed on piping above ceilings with permanent straps where size requires.
- B. Prepare surfaces in accordance with Section 099100 for painting.
- C. Plastic nameplates shall be installed with corrosion resistant mechanical fasteners.
- D. Metal tags shall be installed with corrosion resistant brass chain.
- E. Engraved metal markers should be identified on as-built drawings.
- F. Stenciling shall produce neat, high contrast markings. Sizes of markings shall be per the following schedule:

Outside Diameter of Insulation or Pipe	Length of Color Field	Size of Markings
3/4" - 1-1/4"	8"	1/2"
1-1/2" - 2"	8"	3/4"
2-1/2" - 6"	12"	1-1/4"
8" - 10"	24"	2-1/2"
Over 10"	32"	3-1/2"
Ductwork and Equipment	--	2-1/2"

3.02 PIPING

- A. Piping shall be identified at maximum 20 feet on center in areas without ceilings and 10' on center in areas with ceilings, at each side of each wall penetration, at each valve and at each connection to equipment. Piping identification shall include type of service and direction of flow.
- B. Exposed mechanical piping shall be painted with gloss enamel paint and identified per the following schedule:

<u>Type of Service</u>	<u>Markings(color)</u>	<u>Piping Color</u>
Compressed Air, 120 psig	A-120 (Black)	Yellow
Natural Gas	Natural Gas (Black)	Yellow
LP Gas	LP Gas (Black)	Yellow

Notes:

- 1. Maximum air pressure shall be listed in the markings. 120 psig has been given as an example.

2. Natural and LP gas shall be identified as low pressure and high pressure. On high pressure, the pressure shall be listed.
 3. Piping exposed in finished rooms shall be painted to match room finish.
- C. Refrigerant lines shall be labeled using pipe markers.

3.03 VALVES

- A. Valves in main and branch piping shall be identified with metal tags.
- B. Provide valve chart and schedule in aluminum frame with clear plastic shield. Install at location as directed.

3.04 DUCTWORK

- A. Ductwork shall be identified with stenciled painting. Identify as to air handling unit number, and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.

3.05 EQUIPMENT

- A. Large equipment such as chillers, boilers, cooling towers, base mounted pumps, fans, etc., shall be identified with stenciled painting.
- B. Air handling units, fans, etc., shall be identified using plastic nameplates.
- C. Small equipment such as in-line pumps shall be identified with metal tags.
- D. Starters for mechanical equipment shall be labeled with the corresponding equipment designation using plastic nameplates.
- E. Control panels, gauges, instruments and major control components not located at control panels shall be identified with plastic nameplates.

END OF SECTION

SECTION 23 05 60

THROUGH PENETRATION FIRE STOPPING

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Provide fire stopping for the ALL through penetrations:
 - 1. Refrigerant piping
 - 2. Conduit for wiring and controls
 - 3. Ductwork, except where not required to meet UL listing due to fire damper.
 - 4. Condensate drains.
 - 5. Compressed air piping.

1.02 REFERENCES

- A. Underwriters Laboratories (UL)
- B. American Society for Testing and Materials (ASTM)

1.03 CONTRACTOR REQUIREMENTS

- A. This work shall be performed by a contractor trained in the installation or application of systems similar in complexity to those required for this project. The contractor shall have at least 2 years experience with through penetration fire stopping systems and shall have completed a least 5 comparable scale projects using these systems.

1.04 SUBMITTALS

- A. Product data including the following:
 - 1. Manufacturers specifications and technical data
 - 2. Detailed specification of construction and fabrication installation instructions
- B. Shop drawings
 - 1. For each standard application of penetration item and surface being penetrated provide a manufacturers UL approved system cut sheet identifying the UL system number, UL classified devices or materials to be used, other materials to be used, anchorages, sleeves, annular space requirements and sizes, dimensions and locations of all items.
 - 2. For each non-standard application, provide a manufacturer's qualified engineering judgment and drawing. The drawing shall indicate those items specified in "1.1A" above.
 - 3. All UL approved systems shall be selected based on their "F" rating. All systems shall provide the same ratings as the rating of the floor or wall being penetrated, as shown on the plans.

C. Qualifications

1. Provide list of past projects indicating past experience.
2. Provide statement from manufacturer that installer has to be trained in the proper method of installing fire stop systems.

D. Guarantee

1. Submit copies of written guarantee agreeing to repair or replace joint sealers which fail in joint adhesion, co-adhesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, or general durability or appear to deteriorate in any other manner not clearly specified by submitted manufacturer's data as an inherent quality of the material for the exposure indicated. The guarantee period shall be one year from date of substantial completion.

1.05 STORAGE

- A. Coordinate delivery with scheduled installation date, comply with manufacturers maximum storage requirements. Store materials in a clean, dry, ventilated location. Protect from soiling, abuse, moisture and freezing.

1.06 PROJECT CONDITIONS

- A. Contractor shall visit the job site prior to bid, to verify wall and floor types to be penetrated. Fire ratings of walls are indicated on the plans. Ratings of the floors are assumed to be two (2) hours unless otherwise indicated on the Architectural Plans.
- B. Contractor shall coordinate with the other trades for any penetrating items (pipe, conduit, etc.) that have to be routed differently than shown on the plans. Contractor shall provide fire stopping for all rerouted items whether different UL approved systems or additional materials are required.

PART 2 - PRODUCTS

2.01 THROUGH PENETRATION FIRE STOPPING

- A. Acceptable manufacturers and products shall be those listed in the UL fire resistance directory for the UL system involved.
- B. All systems and devices shall be asbestos free.
- C. Systems or devices listed in the UL. Fire resistance directory under categories XHCR and XHEZ may be used, providing that it conforms to the construction type, penetration type, annular space requirements and fire rating involved in each separate instance and that the system be symmetrical for wall applications.
- D. Fill, void or cavity materials shall be as classified under category XHHW in the UL fire resistance directory.
- E. Forming materials shall be as classified under category XHKU in the UL fire resistance directory.

- F. All fire-stopping products shall be from a single manufacturer.

PART 3 - EXECUTION

3.01 GENERAL

- A. Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.
- B. Verify barrier penetrations are properly sized and in suitable condition for application of materials.
- C. Do not proceed until unsatisfactory conditions have been corrected.
- D. Clean surfaces to be in contact with penetration seal materials, of dirt, grease, oil, loose materials, rust, or other substances that may affect proper fitting, adhesion, or the required fire resistance.

3.02 INSTALLATION

- A. Install penetration seal materials in accordance with printed instructions of the U.L. Fire Resistance Directory and in accordance with manufacturer's instruction.
- B. Where floor openings without penetrating items are more than four inches in width and subject to traffic or loading, install fire stopping materials capable of supporting same loading as floor.
- C. Protect materials from damage on surfaces subject to traffic.
- D. Place rock wool or other approved non-flammable material in annular space around fire dampers before installation of damper's anchoring flanges, which are installed in accordance with fire damper manufacturers' recommendations.
- E. Where large openings are created in walls or floors to permit installation of pipes, ducts, cable tray, bus duct or other items, close unused portions of opening with fire stopping material tested for the application. See U.L. Fire Resistance Directory and Section 2.01 of this document.
- F. Where rated walls are constructed with horizontally continuous air space, double width masonry, or double stud frame construction, provide vertical, 12 inch wide fiber dams for full thickness and height of air cavity at maximum 15 foot intervals.

3.03 ADJUSTING AND CLEANING

- A. Clean up spills of liquid components.
- B. Neatly cut and trim materials as required.
- C. Remove equipment, materials and debris, leaving area in undamaged, clean condition.

3.04 FIELD QUALITY CONTROL

- A. Examine penetration sealed areas to ensure proper installation before concealing or enclosing areas.
- B. Keep areas of work accessible until inspection by applicable code authorities.
- C. Perform under this section patching and repairing of fire stopping caused by cutting or penetration by other trades.

END OF SECTION

SECTION 23 05 90

TESTING, ADJUSTING AND BALANCING

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Provide all labor, equipment and instrumentation necessary to perform the testing, adjusting and balancing (TAB) of heating, ventilating and air conditioning (HVAC) systems which shall include, but not be limited to:
 - 1. Supply air systems
 - 2. Transfer air systems
 - 3. Exhaust air systems
 - 4. Outside air
 - 5. Mixed air
 - 6. Adjustment of controls and equipment as required for proper operation of systems
 - 7. Air leakage testing of ductwork
 - 8. Heat transfer equipment
 - 9. Adjust all systems to maintain building pressure design

1.02 REFERENCES

- A. Associated Air Balance Council (AABC)
- B. National Environmental Balancing Bureau (NEBB)
- C. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
- D. Sheet Metal and Air Conditioning Contractor's Association (SMACNA)

1.03 CONTRACTOR'S QUALIFICATIONS

- A. The TAB Contractor shall be an independent contractor from the Mechanical Contractor.
- B. The TAB Contractor shall be certified by either AABC or NEBB.

1.04 THE TAB AGENDA

- A. The TAB Contractor shall prepare a TAB agenda for review and approval by the Engineer. The TAB Agenda shall be provided during the submittal process. The TAB Contractor shall not commence work until the TAB Agenda has been approved by the Engineer.
- B. The Agenda shall include the following detailed narrative procedures, system diagrams and forms for test results.
 - 1. Specific standard procedures required and proposed for each system. Additional procedures for variable flow systems shall be developed by the TAB Contractor and included for review and approval.

2. Specific test forms for recording each TAB procedure and additional test forms for any variable flow systems shall be developed by the TAB Contractor and submitted for review and approval.
3. System diagrams for each air and water system. Diagrams may be single line. In addition to the information recorded for standard AABC or NEBB procedures, report the following information:
 - a. Air handling units: Prepare profile and show design and actual CFM (outside air, return air, supply air). Measure and record each mode (minimum OA and 100% OA) where economizer cycle is specified. Record pressure drops of all components (coils, heat recovery devices, filters, sound attenuators, louvers, dampers, fans) and compare with design values. Pressure profile and component pressure drops are performance indicators and are not to be used for flow measurements. Set and record purge air flow for heat recovery wheels. Record temperatures of outside air, return air, mixed air and supply air.
 - b. Duct distribution systems: Prepare pressure profiles from the air handling units to the extremities of the system. As a minimum, show pressures at each floor, main branch, and air flow-measuring device. Make pitot tube traverses of all trunk lines and major branch lines where required for analysis of distribution system. Air flow measuring devices installed in ductwork may be utilized. Record residual pressures at inlet of volume controlled terminals at ends of system. Show actual pressures at all static pressure control points utilized for constant or variable flow systems.
 - c. Variable flow systems (air & water): Include specific test forms provisions for measuring and reporting CFM (supply, return, exhaust, outside), GPM (primary, secondary), system pressures, motor loads, other pertinent data, at full unthrottled capacity and at design (100 percent) flows. Record additional flow, pressure, and motor loads for supply and return/exhaust system capacities in 10 percent increments down to a minimum attainable by the system to verify fan tracking and control. Modulate Systems by varying the supply temperature of the medium or other approved means.
 - d. Water systems: Record system fill pressures and expansion tank (level, pressure, and temperature) conditions. Record shut-off heads for all pumps and compare with pump curves to determine if correct pump impellers have been installed. Record entering and leaving water temperatures for all coils, chillers, boilers, heat exchangers, cooling towers, etc., and the ambient temperatures for all chillers, boilers, cooling towers, etc.
4. Specific test forms for recording sound and vibration measurements.

1.05 SUBMITTALS

- A. The TAB Contractor shall submit the following items prior to commencing work. All submittals shall be bound in a binder complete with cover sheet, index, and tabs separating specific sections of the submittal.
 1. The TAB agenda as detailed in paragraph 1.03-A
 2. Warranty information
 3. TAB Contractor qualifications including TAB Engineer and company experience on similar projects

4. Submit project supervisor and qualifications
 5. Submit TAB equipment and last date of calibration
- B. After completion of all TAB procedures and before warranty period commences, submit complete test reports as provided for by the prior approved TAB agenda, for Engineer review and approval. Where test results differ from specified design conditions, indicating a contract deficiency, include explanatory comments and possible resolutions in the report. After review by the Engineer, the TAB Contractor shall make any adjustments deemed necessary by the Engineer.
- C. Final report shall be submitted for acceptance and record. Submit six (6) copies of final reports.

1.06 WARRANTY

- A. For a period of one year after substantial completion, the TAB Contractor shall, at the request of the Engineer, return to the project to retest and/or rebalance any problem areas. This shall be done within ten (10) working days at no additional expense to the Owner or the Engineer. The purpose of this is to correct a problem, not to retest/rebalance revisions made by the Owner.
- B. During the first year after acceptance by the Owner, the TAB Contractor shall return to the project during the peak heating and cooling seasons to rebalance the applicable hydronic systems to maintain the required discharge air and water temperatures. The T&B report shall be amended to reflect the results.

PART 2 - EQUIPMENT (NOT APPLICABLE)

PART 3 - EXECUTION

3.01 GENERAL

- A. The TAB Contractor shall review and become thoroughly familiar with the job site when the erection of the building is in the early stages. An additional visit shall be made when the rough-in is complete. Prior to any closing in of ductwork and piping, verify that all fittings, dampers, control devices, test devices and valves are properly located and installed.
- B. The TAB Contractor shall examine each air and hydronic distribution system to verify that it is free from obstructions. The TAB Contractor shall determine that all dampers, registers and valves are in a set or full open position; that strainers are clean; that moving equipment is lubricated; and that the required filters are clean and functioning. The TAB Contractor shall request that the installing contractor perform air adjustments necessary for proper functioning of the system.
- C. The TAB Contractor shall use test instruments that have been calibrated within a time period recommended by the manufacturer (no more than 6 months) and have been checked for accuracy prior to the start of the testing, adjusting and balancing.
- D. The TAB Contractor shall verify that all equipment performs as designed and specified. The TAB Contractor shall adjust all variable type drives, volume dampers, control dampers, balancing valves, control valves, etc., as required by the TAB work.

- E. Coordinate TAB procedures with all construction requirements for the project so that usable increments of finished work may be accepted for beneficial occupancy. Systems serving partially occupied phases of the project may require balancing for each phase prior to final balancing.
- F. Allow sufficient time in construction schedule for TAB prior to final inspection for the project.
- G. Conduct final TAB after system has been completed and is in full working order. Put all HVAC systems into full operation and continue operation of the systems during each working day of TAB. Accomplish TAB in accordance with the Agenda approved by the Engineer.

3.02 AIR BALANCE

- A. Place all interactive systems in operation with all filters installed and automatic control systems completed and operating. Artificially load air filters by partial blanking or other means to produce air pressure drop midway between the clean and dirty condition. Set/reset room thermostats as necessary to check heating and cooling function, and maximum/minimum flow rates for factory set air terminal units and adjust units if not correct.
- B. Balance systems to design ratings. Adjust fan speeds to provide design flows, including system diversities, at actual system pressures. Coordinate with mechanical contractor to provide additional sheaves and belts as required to achieve design CFM. Coordinate VAV balancing, including supply and return fan volume controls, with the controls Contractor and set supply fan static pressure control as low as practicable and still maintain required pressure at the remote terminal units.
- C. Make pitot tube traverses of all trunk lines and major branches when required to determine proper proportioning of air flows. Air flow measuring devices, where installed, may be utilized for this purpose.
- D. Record pressure drop readings across all major system components and significant drops within duct systems.
- E. Adjust air systems with doors leading outside closed. Balance individual rooms simulating occupied conditions. (Windows and doors closed, etc.)
- F. Log air flows for occupied and unoccupied conditions.
- G. Make flow and pressure measurements at each terminal device, and each supply, return, or exhaust diffuser. Adjust each air outlet unit within plus or minus 10 percent of design requirements, but total air for each system shall be not less than shown. Adjust grilles and diffusers to minimize drafts in all areas. Maintain the building pressure relationships between different zones.
- H. Adjust outside air and return air quantities for all systems to within plus or minus 10 percent. Total supply air quantity for any system shall be not less than shown.
- I. Adjust exhaust systems to CFM requirements.
- J. Test function of automatic dampers and operation of air terminal units. Check all controls for proper operation.

3.03 HEAT TRANSFER EQUIPMENT DATA

- A. For all heat transfer equipment, which for the purposes of this specification section shall include coils, chillers, boilers, heat exchangers, cooling towers, evaporative coolers, humidifiers, etc.

The following data shall be measured and included in the TAB report:

1. Ambient conditions, dry bulb, wet bulb, relative humidity
2. Entering air wet bulb and dry bulb
3. Entering relative humidity
4. Leaving air wet bulb and dry bulb
5. Leaving air relative humidity
6. Entering water temperature
7. Leaving water temperature
8. Water flow
9. Air pressure drops (inches) and water pressure drops (feet)

3.04 AIR LEAKAGE TESTING OF DUCTWORK

- A. Ductwork leakage shall be tested in accordance with SMACNA manual, "HVAC Air Duct Leakage Test Manual", latest edition.

3.05 HYDRONIC BALANCE

- A. Perform final hydronic balance after all systems have been flushed, cleaned, and filled.
- B. Hydronic balance includes performance readings on all pumps, coils, heat exchangers, and flow measuring devices. Adjust pump flows to actual system heads by adjustment of balancing valves. Flow measuring devices take precedence over pump head readings. Record discrepancies for evaluation.
- C. Report pressure drop readings across all major system components both for flow determination and deviations between actual and design values.
- D. Record on flow diagrams the flows and pressures obtained in each of the various circuits and modes of operation. Designate the manual rebalancing effort that is necessary for optimum operations. Measure flows in primary and secondary pumping systems when operating independently and jointly. Measure and record flows and power consumption of variable flow systems at maximum flow conditions and in increments of 10 percent reductions to a minimum system condition.

END OF SECTION

SECTION 23 07 10

DUCTWORK INSULATION

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Work of this section shall include providing the thermal insulation for mechanical systems and shall include the following principal items:
 - 1. Supply, Return, Outside, and Relief Air ductwork concealed.
 - 2. Supply, Return, Outside, and Relief Air ductwork exposed.
 - 3. Supply, Return, Outside, and Relief Air ductwork concealed outside of building insulation envelope attic/crawlspace.
 - 4. Exhaust Air ductwork concealed.
 - 5. Exhaust Air ductwork exposed.
 - 6. Lined ductwork.
 - 7. Exterior exposed ductwork.
- B. Not all of the insulation types specified herein may be required on this project. The contractor is only to provide those insulation types required for the applications on this project.
- C. This work shall be performed by a competent insulation contractor whose primary business is the installation of insulation systems and who has been in this business for a minimum of five years.
- D. Ductwork shown on the drawings with application specific insulation shall be followed with that application as identified in these specifications.

1.02 SUBMITTALS

- A. Submittals and product literature for each insulation type, finish type, and equipment served. Provide submittals on method of installation for each type of insulation used.

1.03 DEFINITIONS

- A. The following definitions apply to this specification section only and are intended to help clarify insulation applications:
 - 1. Concealed: above ceilings, in attics or crawlspaces and in spaces not accessed easily through a door.
 - 2. Exposed: visible from an occupiable space that is easily accessible through a door. This would include mechanical rooms.
 - 3. Interior: inside the exterior building skin, not exposed to weather.
 - 4. Exterior: outside of the exterior building skin, exposed to weather.
 - 5. Outside of building insulation: inside of the exterior building skin, protected from the weather, but in an un-insulated space that is not heated or cooled.

PART 2 - PRODUCTS

2.01 THERMAL INSULATION

- A. All insulating systems shall be tested on a composite basis in accordance with NFPA and UL 723 and shall have a maximum flame spread rating of 25 and a maximum smoke developed rating of 50 under ASTM E-84. Fire rated barriers wrap to be as required per NFPA.
- B. Insulation Types:
1. FIBERGLASS BLANKET

Made of flame - attenuated glass fibers, bonded with a thermosetting resin. Reinforced with fiberglass scrim facing laminated to UL rated kraft. FSK facing, .02 perms, .00035" foil thickness per ASTM E-96, procedure A. 2" thick, 1.00 PCF, 7.6 R value, 6.1 R value installed. Equal to CertainTeed SoftTouch Type 100.
 2. RIGID FIBERGLASS

3 lb. density, .23 k factor. Inorganic glass fibers bonded by a thermosetting resin with an FSK jacket in compliance with NFPA 90A AND 90B standards. Equal to CertainTeed CertaPro CB300, 3 lb density, 8.7 R value, 2" thick with FSK jacket.
 3. FIBERGLASS BLANKET

Made of flame - attenuated glass fibers, bonded with a thermosetting resin. Reinforced with fiberglass scrim facing laminated to UL rated kraft. FSK facing, .02 perms, .00035" foil thickness per ASTM E-96, procedure A. 3" thick, 3/4 lb., 9.6 R value, 8.0 R Value Installed. Equal to CertainTeed SoftTouch Type 75.
 4. SEMI RIGID FIBERGLASS BOARD

2-1/2 lb. density, thermal conductivity compliance ASTM C 518, 850 degrees F temperature limit, 1 1/2" thick. High temperature fiberglass bonded to a flexible jacketing. Jacketing is a laminate of white kraft and aluminum foil, reinforced with fiberglass, chemically treated for fire and smoke safety. Equal to CertainTeed CrimpWrap.
 5. DUCT LINER

Acoustical and thermal insulation manufactured from long textile, type glass fibers firmly bonded together with a thermosetting resin. Air stream surface is coated to protect against air erosion. Up to 250 degrees F (ASTM C 411), NFPA 90A and 90B, ASTM C 1071. Air stream surface to contain an EPA registered antimicrobial agent to aid in the prevention of fungal and bacterial growth and shall not promote or support the growth of mold, fungi or bacteria. Liner shall be CertainTeed ToughGard R Rotary Duct Liner or approved equal.
Interior Duct Systems: Type 150, 1" thick, 0.24 K value, 4.2 R value for up to 6,000 FPM velocity.
Exterior Duct System: Type 150, 2" thick, 0.24 K value, 8.3 R value for up to 6,000 FPM velocity
 6. RIGID FIBERGLASS

Rigid board type insulation with resin bonded glass fibers with a white ASJ jacket in compliance with NFPA 90A AND 90B standards. Complies with ASTM 1071. Thermal performance determined by ASTM C177 or ASTM C518. Insulation shall be CertainTeed CertaPro CB300, 3 lb. /ft. density, 1.5" thick, .23 k factor, 6.5 R value or approved equal.

- C. Weather Barrier Mastics
 - 1. An emulsion type material compounded of selected and processed bitumens and mineral fillers. Equal to INSULKOTE ET and INSULKOTE PRIMER E.
- D. Duct Tape
 - 1. FSK, glass fiber impregnated with foil facing, 4"wide, 25/50, ASTM E-84.
 - 2. Same as number 1 except with a white ASJ jacket.
- E. Adhesives
 - 1. Water based adhesives for attaching low density fibrous insulation and duct liner to metal. Service temperature limits-20 degrees F to 250 degrees F, UL MJAT-2, ASTM C 916, type 11, NFPA 90A and 90B. Equal to Foster Quick Tack Adhesive 85-60. Adhesive shall not support mold or mildew growth.

PART 3 - EXECUTION

3.01 WORKMANSHIP

- A. All materials shall be applied by Workmen skilled in this trade. Unsightly work shall be cause for rejection.
- B. Mechanical fasteners shall be used whenever possible to assure permanent construction.
- C. Materials shall be applied only after systems have been tested and all surfaces are clean and dry.
- D. All insulation of cold surfaces shall be vapor sealed. All joints, laps, breaks and faults in vapor barriers of insulation covering cold surfaces shall be thoroughly sealed.
- E. Insulation that becomes wet for any reason shall be removed, replaced and resealed at the expense of this Contractor.

3.02 APPLICATION

- A. Interior, Concealed Square or Round Ductwork

Use FIBERGLASS BLANKET as per Part 2, 2.01, B-1. For square ducts with any one dimension not greater than 24". Insulation shall be wrapped around ducts and secured with outward clinching staples at 4 inches o.c. Ducts 24 inches and greater shall have insulation additionally secured with stick clips on 18 inch centers or with 4 inch wide bands of adhesive applied on 18 inch centers. Insulation shall be lapped a minimum of 4" and all seams and penetrations shall be sealed with FSK Duct tape as per Part 2, 2.01, D-1.
- B. Rectangular, Interior Supply, Return, Outside Relief and Exhaust Air Ductwork, Exposed.

Use FIBERGLASS BOARD insulation as per Part 2, 2.01, B-6, and shall be applied to ducts with mechanical fasteners such as stick cups or weld pins at 12 inch centers. Install fiberglass board in full pieces. Joints and seams shall be covered with 4" tape as per Part 2, 2.01, D-1. Where standing seams or angle supports exceed insulation thickness an

additional layer of board will be used.

- C. Round, Interior Supply, Return, Outside Air, Exhaust and Relief Ductwork Exposed.

Round ductwork use SEMI RIGID FIBERGLASS BOARD as per Part 2, 2.01, B-4. Flexible fiberboard shall be applied to ducts with outward clinching staples. Make any fabrication cuts to accommodate the proper fitting of the insulation before stapling. Joints, seams and any penetrations shall be sealed with matching tape.

- D. Exterior, Exposed Ductwork

Use FIBERGLASS LINER as per Part 2, 2.1, B-5 for exterior duct.

Installation shall be as listed in 3.02 for internally lined duct. Construction of the duct shall be with Ductmate 35 Connection Systems. See Specification 23 31 10 Galvanized Sheet Metal Ductwork.

- E. Supply, Return, Outside Air, Relief or Exhaust Ductwork Outside of Building Insulation

Use FLEXIBLE FIBERGLASS INSULATION as per Part 2, 2.01, B-3. Ductwork shall be wrapped and secured with outward clinching staples at 4 inches o.c. Ducts 24" and wider shall have the insulation additionally secured with stick on clips on 18" centers. Insulation shall be lapped 4" and all seams and penetrations shall be vapor sealed with FSK tape (Part 2, 2.01, D-1).

- F. Supply, Return, Outside Air, Relief and Exhaust Ductwork Indicated on the Plans to be Lined.

Use DUCT LINER (Part 2, 2.01, B-5), and (Part 2, 2.01, E-1). Liner shall be attached to metal using adhesive covering 90% of the metal. Adhesive shall comply with ASTM C 916. All edges of liner facing the direction of airflow and not receiving metal nosing shall be coated with adhesive. Liner shall be neatly butted without gaps at transverse joints and shall be coated with adhesive at such joints.

Liner shall be folded and compressed in the corners of rectangular duct sections or shall be cut and fit to assure butted edge overlapping. Longitudinal joints in duct liner shall not occur except at the corners of ducts unless the size of the duct and standard liner product dimensions make such necessary.

Interior widths of duct not exceeding 8" do not require mechanical fasteners in addition to adhesive.

Interior widths of duct exceeding 8" will require mechanical fasteners as follows:

<u>Velocity</u>	<u>Transversely Around Perimeter</u>	<u>Longitudinally</u>
2500 fpm & below	At 4" from corners and at intervals not exceeding 12"	At 3" from transverse joints and at intervals not exceeding 18"
2501 fpm to 6000 fpm	At 3" from corners and at intervals not exceeding 6"	At 3" from transverse joints and at intervals not exceeding 16"

Mechanical fasteners will be applied with an approved mechanical fastening system. Hand driven pins with hammers will not be approved. Weld pins or "Grip Nails" or equal. Fasteners shall not compress the insulation more than 1/8" based on the nominal thickness of the insulation.

Longitudinal joints in liner shall be coated with adhesive at velocities over 2500 fpm.

Metal nosing that is either channel or zee profile or is integrally-formed from the duct wall shall be securely installed over transversely oriented liner edges facing the air stream at fan discharge and at any interval of lined duct preceded by unlined duct. In addition, where velocities exceed 4000 fpm metal nosing shall be used on upstream edges of liner at every transverse joint.

Where dampers, turning vane assemblies or other devices are placed inside of lined duct or fittings, the installation must not damage the liner or cause erosion of the liner. The use of metal hat sections or other buildout means is optional; when used, buildouts shall be secured to the duct wall with bolts, screws, rivets or welds.

Any damage to the air stream surface must be repaired by coating the damaged area with adhesive or coating designed for duct liner application. Adhesive or coating shall meet requirements of ASTM C 916

3.03 MISCELLANEOUS

- A. Ductwork indicated on the drawings to be internally lined shall not be insulated externally.
- B. All insulating systems described herein shall conform to the latest edition of SMACNA and will comply with NFPA-90A, 90B, 30; TIMA AHC-101; ASTM C390, C167, C553, E84, C177, C423, C411, C916, D903, D93, D1151; ASHRAE; ACGIH; Tested for UL 181.
- C. The engineer will reserve the right to accept or reject any and all work not in compliance with the aforementioned. The engineer will be contacted for inspection during any of the following operations:
 - 1. During installation of any ductwork wrapping.
 - 2. During the installation of ductwork that has been lined.

END OF SECTION

SECTION 23 07 38

INSULATION FOR REFRIGERANT PIPING

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Work of this section shall include providing the thermal insulation for mechanical systems and shall include the following principal items:
 - 1. Refrigerant suction line on all systems.
 - 2. Liquid lines where required by the manufacturer.
- B. This work shall be performed by a competent insulation contractor whose primary business is the installation of insulation systems and who has been in this business for a minimum of five years.

1.02 SUBMITTALS

- A. Submittals and product literature for each insulation type, finish type and equipment served, shall be required. Provide submittals on method of installation for each type of insulation used.
- B. Product samples and installation samples are required and shall be provided at the discretion of the engineer.

PART 2 - PRODUCTS

2.01 THERMAL INSULATION

- A. All insulating systems shall be tested on a composite basis in accordance with NFPA and UL 723 and shall have a maximum flame spread rating of 25 and a maximum smoke developed rating of 50 under ASTM E-84.

2.02 INSULATION TYPES

- A. Closed cell, flexible elastomeric thermal insulation, black in color, supplied in unslit tubing. Equal to Armaflex AP 2000.
- B. Closed cell, elastomeric thermal insulation tape. Commonly supplied in 2" X 1/8" thick. Equal to Armaflex insulation tape.

2.03 ADHESIVES

- A. An air drying contact adhesive specifically designed for joining seams and ends of Armaflex AP-2000 in specification section 2.02-A. Equal to Armstrong 520 adhesive.

2.04 FINISHES

- A. A white, elastomeric, UL classified outdoor grade, vinyl mastic for finished outdoor insulation. Water based latex enamel. Equal to WB Armaflex finish.

PART 3 - EXECUTION

3.01 WORKMANSHIP

- A. All materials shall be applied by Workmen skilled in this trade. Unsightly work shall be cause for rejection.
- B. Mechanical fasteners shall be used whenever possible to assure permanent construction.
- C. Materials shall be applied only after systems have been tested and all surfaces are clean and dry.
- D. All insulation of cold surfaces shall be vapor sealed. All joints, laps, breaks and faults in vapor barriers of insulation covering cold surfaces shall be thoroughly sealed.
- E. Piping systems requiring tests to be witnessed by the Engineer shall not be insulated until such systems have been tested and approved.

3.02 APPLICATION

- A. Insulation shall be butted together and adhered in place with joint adhesive (see Part 2, 2.03, A). All joints and seams shall be sealed with contact adhesive. Where possible insulation shall be slipped on without slitting. Insulation shall be butted firmly to equipment. Short radius elbows shall be mitered, adhesive applied and firmly held together until the adhesive hardens sufficiently to prevent separation.
- B. Paint all exposed insulation with Armaflex white paint (see Part 2, 2.04, A).
- C. Provide PVC tubular supports as detailed on the drawings for all insulated refrigerant piping at pipe supports.
- D. Refrigerant pipe circuits for Ductless Split Systems shall be insulated per 23 81 30 requirements.

3.03 INSULATION THICKNESS

- A. Provide 3/4" thick insulation materials for all refrigerant suction line piping.

3.04 MISCELLANEOUS

- A. This contractor will contact the engineer at the start of all phases of work, as follows:
 - 1. During installation of any concealed insulation.
 - 2. during installation of above ceiling insulation work.
- B. The engineer will ascertain the continuation of work subject to the requirements aforementioned.

END OF SECTION

SECTION 23 07 40

INSULATION FOR CONDENSATE DRAINS

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Work of this section shall include providing the thermal insulation for mechanical systems and shall include the following principal items:
 - 1. Condensate Drains
- B. This work shall be performed by a competent insulation contractor whose primary business is the installation of insulation systems and who has been in this business for a minimum of five years.

1.02 SUBMITTALS

- A. Submittals and product literature for each insulation type, finish type and equipment served, shall be required. Provide submittals on method of installation for each type of insulation used.
- B. Product samples and installation samples are required and shall be provided at the discretion of the engineer.

PART 2 - PRODUCTS

2.01 THERMAL INSULATION

- A. All insulating systems shall be tested on a composite basis in accordance with NFPA and UL 723 and shall have a maximum flame spread rating of 25 and a maximum smoke developed rating of 50 under ASTM E-84.

2.02 INSULATION TYPES

- A. Closed cell, flexible elastomeric thermal insulation, black in color, supplied in unslit tubing. Equal to Armaflex AP 2000.
- B. Closed cell, elastomeric thermal insulation tape. Commonly supplied in 2" X 1/8" thick. Equal to Armaflex insulation tape.

2.03 ADHESIVES

- A. An air drying contact adhesive specifically designed for joining seams and ends of Armaflex AP-2000 in specification section 2.02-A. Comply with Mil Spec. Mil-A-24179A and Amend-2 as type 11, class 1. Equal to Armstrong 520 adhesive.

2.04 FINISHES

- A. A white, elastomeric, UL classified outdoor grade, vinyl mastic for finished outdoor insulation. Water based latex enamel. Equal to WB Armaflex finish.

PART 3 - EXECUTION

3.01 WORKMANSHIP

- A. All materials shall be applied by Workmen skilled in this trade. Unsightly work shall be cause for rejection.
- B. Mechanical fasteners shall be used whenever possible to assure permanent construction.
- C. Materials shall be applied only after systems have been tested and all surfaces are clean and dry.
- D. Cellular glass block supports or other suitable non-compressible insulation material equal in thickness to the insulation and three times the pipe diameter in length shall be installed at hangers to eliminate through-metal conductance. Provide 16 GA, 180 degree, galvanized sheet metal saddles same length as block supports.
- E. All insulation of cold surfaces shall be vapor sealed. All joints, laps, breaks and faults in vapor barriers of insulations covering cold surfaces shall be thoroughly sealed.
- F. Insulation that becomes wet for any reason shall be removed, replaced and resealed at the expense of this Contractor.
- G. Piping systems requiring tests to be witnessed by the Engineer shall not be insulated until such systems have been tested and approved.

3.02 APPLICATION

- A. Condensate drain insulation
 - 1. Insulation shall be butted together and adhered in place with joint adhesive (see Part 2, 2.03, A). All joints and seams shall be sealed with contact adhesive. Where possible insulation shall be slipped on without slitting. Insulation shall be butted firmly to equipment. Short radius elbows shall be mitered, adhesive applied and firmly held together until the adhesive hardens sufficiently to prevent separation.
 - 2. Provide removable sections of insulation at all clean outs.
 - 3. Paint all exposed insulation with Armaflex white paint (see Part 2, 2.04, A).
 - 4. Provide sheet metal saddles for all insulated condensate piping at pipe supports.

3.02 INSULATION THICKNESS

- A. Provide 1/2" thick insulation materials for all condensate piping.

3.03 MISCELLANEOUS

- A. This contractor will contact the engineer at the start of all phases of work, as follows:
 - 1. During installation of any concealed insulation.
 - 2. During installation of above ceiling insulation work.
- B. The engineer will ascertain the continuation of work subject to the requirements aforementioned.

END OF SECTION

SECTION 23 08 05

ROOF TOP UNIT STARTUP

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Provide all labor, equipment and instrumentation necessary to perform the startup of the roof top units by factory authorized and trained personnel.

1.02 REFERENCES

- A. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
- B. Sheet Metal and Air Conditioning Contractor's Association (SMACNA)

1.05 SUBMITTALS

- A. Prior to commencing work submit a sample form to be used for each piece of equipment. The form shall include spaces for project name, project location, tag, model number, serial number, location of equipment, area served by equipment, date inspected and inspector's name.
- B. After completion of all start up procedures, submit six (6) final sets of completed start up reports for Engineer review and approval. The reports shall be submitted in a three ring binder, with the units arranged by "Tag".

PART 2 - EQUIPMENT (NOT APPLICABLE)

PART 3 - EXECUTION

3.01 GENERAL

- A. The Mechanical Contractor shall coordinate the scheduling of the startup of the roof top units with the manufacturer's representative. The startup shall not be started until:
 - 1. All pieces of equipment have been set in place.
 - 2. All utility connections are complete.
 - 3. All duct connections are complete.
 - 4. All equipment has been tagged.
 - 5. All debris has been cleaned from the equipment interior.
 - 6. New filters have been installed.
 - 7. The unit has been started unless factory startup has been specified.

3.02 START UP

- A. The following items, when applicable, shall be verified by the factory authorized representative:
 - 1. Unit is sitting on the curb properly.
 - 2. Visually inspect the unit for damage, installation of accessories, accessibility, etc. and note any discrepancies.

3. Unit is level on the curb within 1/4" per foot and that the condensate connection is not on the higher side.
 4. Roofing material does not rise above the nailer on the curb.
 5. Weep holes are clear and free of caulking or other blockage.
 6. Drain pan connection has not been cracked due to over tightening of drain pipe.
 7. Drain lines are properly sloped downward away from the unit.
 8. Drain trap is sized according to specifications.
 9. Outside air damper operates correctly.
 10. Outside air damper actuator wiring does not block filter access.
 11. Inside of unit is clean and free of debris.
 12. Filters are in place and are clean.
 13. Filter spacers have been installed in the filter racks to minimize air by-passing the filters.
 14. Coil is clean and free of debris.
 15. Flue box and awning is installed on exterior of unit.
 16. No combustible material has been left in the combustion chamber.
 17. Gas pipe entrance has been sealed between the pipe and the plastic sleeve/cabinet.
 18. Incoming voltage is correct.
 19. Control transformer has been property tapped (240V vs. 208V) for units shipped for 240V power supply.
 20. PSC indoor motors have correct wire tap when applied to 208V.
 21. Record amp draws.
 22. Field installed accessories have been wired to low voltage pigtail, unless required otherwise.
 23. Proper DIP switch positions for proper evaporator fan speed.
 24. Adequate clearance to adjacent structures, equipment, etc.
 25. Convenience outlet is properly installed, wired and operating.
 26. Economizer has been installed correctly and operates properly.
- B. Report any deficiencies that are the contractor's responsibility to the Mechanical Contractor to be fixed, corrected, cleaned, etc. prior to completion of the startup report.
- C. Any deficiencies that are the responsibility of the Manufacturer shall be corrected prior to completion of the start up report.
- D. Once the start up report has been satisfactorily completed, submit the required number of copies for approval and distribution.

END OF SECTION

SECTION 23 09 20

DDC BUILDING CONTROLS

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Furnish and install a complete and functioning building management and automatic temperature control system as specified hereafter and indicated on the drawings.
- B. Provide all direct digital control equipment, thermostats, humidistats, valves, dampers, operators, switches, sensors, controllers, conduit, and wiring required for the systems to operate as described in the Sequence of Operation.
- C. The controls system shall be fully compatible and capable to communicate with Decatur City Schools' existing Andover system without any gateways.

1.02 RELATED WORK

- A. All automatic valves and separable wells provided under this section shall be installed by the mechanical contractor in accordance with Division 23.
- B. Piping connections, taps, and wells required for flow, pressure, or temperature devices shall be installed by the mechanical contractor in accordance with Division 23.
- C. All automatic dampers and air flow measuring stations provided under this section shall be installed by the mechanical contractor in accordance with Division 23.
- D. A power source shall be provided in each mechanical room by Division 26. The controls contractor shall provide power wiring and conduit to all control devices and control panels as required.
- E. Interconnection of smoke detectors to the building fire alarm system shall be provided under Division 26. This contractor shall mount, supply, and wire for local unit shutdown the duct smoke detectors as shown on the drawings.

1.03 REFERENCES

Underwriter Laboratories (UL)
National Electrical Code (NEC)
National Electrical Manufacturers Association (NEMA)

1.04 SUBMITTALS

- A. Submit product data on the following items:
 - 1. Control devices including those factory mounted as an integrated part of the mechanical equipment.
 - 2. Valves
 - 3. Dampers
 - 4. Control System Diagrams

5. Points Lists by Systems
 6. Microprocessors
 7. Flowmeters
- B. Submit operation and maintenance instructions for the following items:
1. Control Devices
 2. Valves
 3. Dampers
 4. Control Panels
- C. Submit a logic diagram along with each separate sequence of control that will accomplish that sequence. The diagram will show each input to each function block, the basis of the decision or action in that block and the resultant output. The routing of the output shall be shown to the next function block or control device. Failure to submit a logic diagram, along with its sequence of control, will be grounds for rejection.

PART 2 - PRODUCTS

2.01 GENERAL

- A. The Building Automation System (BAS) shall be capable of integrating multiple building functions including equipment supervision and control, alarm management, energy management, and historical data collection and archiving.
- B. The facility management system shall consist of the following:
1. Network Control Modules
 2. Standalone DDC panels
 3. Standalone application specific controllers (ASCs)
- C. The system shall be modular in nature, and shall permit expansion of both capacity and functionality through the addition of sensors, actuators, standalone DDC panels, and operator devices.
- D. System architectural design shall eliminate dependence upon any single device for alarm reporting and control execution. Each DDC panel shall operate independently by performing its own specified control, alarm management, operator I/O and historical data collection. The failure of any single component or network connection shall not interrupt the execution of control strategies at other operational devices.
- E. Standalone DDC panels shall be able to access any data from, or send control commands and alarm reports directly to any other DDC panel or combination of panels on the network without dependence upon a central processing device. Standalone DDC panels shall also be able to send alarm reports to multiple operator workstations without dependence upon a central processing device.

2.02 CONTROL DEVICES

- A. Control Dampers

1. All dampers required in the temperature and smoke control functions of the automatic control system shall be as specified in the ductwork specification section(s). All dampers shall be sized as shown on drawings or as specified.
- B. Control Valves
1. Valves shall be sized by the control manufacturer to produce the required capacity at a pressure loss not exceeding the allowable pressure drop indicated on the drawing. Nominal body rating shall be not less than 125 PSI. However, the valve body and packing selected shall be sized to withstand the system static head plus the maximum pump head and the maximum temperature of the control medium, chilled water, steam, and/or hot water. Two-way modulating valves shall have close-off ratings exceeding the maximum pressure difference, at any load condition, between the outlet and inlet. Each valve shall be equipped with proper packing to assure there will be no leakage at the valve stem.
- C. Operators
1. Damper or valve operators shall be electric and be provided for each automatic damper or valve and shall be of sufficient capacity to operate the damper or valve under all conditions and to guarantee tight close-off of valves, as specified, against system pressure encountered. Each shall be provided with spring-return for normally closed or normally open position for fail safe operation.
- D. Sensors and Controllers
1. Differential Pressure Switch for water shall have a single-pole, single-throw (SPST) contact, adjustable setpoint, UL rated 6 amperes at 120 volts, 100 psig design, and shall have automatic reset. Each switch shall be provided with isolation and drain valves.
 2. Differential Pressure Switch_for air shall have a single-pole, single-throw (SPST) contact, adjustable setpoint, UL rated 9.8 amperes at 120 volts.
 3. Low Limit Thermostats shall be of manual reset type, with setpoint adjustment. The sensing element shall be 20 foot minimum and shall be installed completely across the coil. When any one foot of the element senses a temperature as low as the setpoint, the thermostat contacts shall open. These shall contain double pole switches for simultaneous remote alarms or as desired.
 4. Duct Type Temperature Transmitter shall be a general purpose RTD sensing element, moisture resistant transmitter for mounting into a duct. The operating range shall be as indicated with an accuracy of $\pm 1\%$ over the full range. The output shall be compatible with the panel it serves.
 5. Duct Averaging Type Temperature Transmitter shall be a general purpose RTD sensing element, moisture resistant transmitter for mounting into a duct. The operating range shall be as indicated with an accuracy of $\pm 1\%$ over the full range. The output shall be compatible with the panel it serves. Transmitter shall have 17 feet of sensor capillary.
 6. Space Temperature Transmitter shall contain an RTD sensing element to monitor room air temperatures in the range of 30 degrees F to 90 degrees F,

unless indicated otherwise. The transmitter shall be factory calibrated to an accuracy of $\pm 1\%$. The assembly shall be installed within a metal ventilated enclosure suitable for wall mounting. The output shall be compatible with the panel it serves. Transmitter shall be factory calibrated to an accuracy of $\pm 1\%$ over the full range.

7. Pipe Temperature Transmitter shall contain an RTD sensing element to monitor water temperature. The Contractor shall provide brass wells of sufficient size for the pipe to be installed. The output shall be compatible with the panel it serves. Transmitter shall be factory calibrated to an accuracy of $\pm 1\%$ over the full range.
8. Outdoor Air Temperature Transmitter shall contain an RTD sensing element mounting in an enclosure rated for outdoor use. The output shall be compatible with the panel it serves. Transmitter shall be factory calibrated to an accuracy of $\pm 1\%$ over the full range.
9. Humidity Transmitter Duct shall be capable of providing continuous measurement of percent relative humidity with an accuracy of $\pm 4\%$ over the range of 10 to 80% RH. The output shall be proportional VDC over a cable pair.
10. Humidity Transmitter Outside Air shall be capable of providing continuous measurement of percent relative humidity with an accuracy of $\pm 2\%$ over the range 20 to 90% RH. The output shall be a 4 to 20 Ma signal over a shielded cable pair. Transmitter shall have outside weather enclosure. Transmitter shall be General Eastern RH-1 or equal.
11. Humidity Transmitter Space shall be capable of providing continuous measurement of percent relative humidity with an accuracy of $\pm 3\%$ over the range of 20 to 60% RH. The output shall be proportional VDC over a cable pair.
12. Pressure Transducer shall be suitable for steam service and have a stainless steel sensor. The device shall output a 4-20 milliamp signal which is linear in relation to the sensed pressure. Accuracy shall be $\pm .05\%$ of the full scale. Power shall be from the controller and range from 22-26 volts DC. The unit shall have temperature compensation so that thermal effects are no more than $\pm .05\%$ of the full scale from 0-175 deg F. The unit shall be suitable for the media and pressure measured.
13. Differential Pressure Transducer shall be for air or water service. The device shall output a 4-20 milliamp signal which is linear in relation to the sensed pressure. Accuracy shall be $\pm .01\%$ of full scale. The power shall be from the controller and shall be in the range of 22-26 volts DC. The unit shall have temperature compensation so that thermal effects are no more than $\pm .05\%$ of the full scale from 32-100 degrees F. The transducer shall be suitable for the media and pressure measured.
14. Smoke Detectors (when not indicated to be provided by others) shall be ionization type for duct installation with supply and return sampling tubes. Detector shall be UL listed with housing, relays for air handling unit stop and remote alarm. Duct mounted smoke detector shall be BRK Model DH1851AC or equal with duct sampling tube to match duct work, 120 volt, 60 hertz, single-phase power source, reset switch, two SPST contacts rated for 125 V AC and 3 amp, and local indicator light.

15. Duct Type CO2 Sensors shall use a single beam absorption infrared diffusion sampling method to detect CO2 levels from 0 to 10,000 ppm with an accuracy of +/- 75ppm or +/- 7%, whichever is greater. The sensor shall have a 4-20 mA and a 0-10 VDC output as well as a relay output with an adjustable setpoint.
16. Air flow measurement stations shall consist of one or more sensor probe assemblies and a single microprocessor based transmitter. Each sensor probe will contain one or more independently wired sensor housings. Multiple sensor housings shall be weighted and averaged by the transmitter prior to output. Each sensor housing shall utilize two hermetically sealed, bead-in-glass thermistor probes to determine air flow and ambient temperature. Each sensor housing shall be calibrated at a minimum of 16 airflow rates and have an accuracy of +/-2% over the entire operating range. The sensor probe assembly shall be able to operate over a temperature range of -20 F to 160 F, a humidity level of 0 to 99% RH and an airflow range of 0 to 5,000 FPM.

The probe assembly shall communicate to a transmitter by means of a plenum rated cable and plug assembly. The transmitter shall have an LCD display for airflow and temperature. The transmitter shall operate on 24 VAC and shall be capable of communicating with the building controls system.

The air flow measurement stations shall be EBTRON GTx116-P or approved equals.
17. Liquid switch at secondary cooling coil condensate drain connection shall be Kele model SS2AP. Interlock the operation for unit shut down when activated by a high water level.
18. Liquid switch in the unit auxiliary drain pan shall be Kele model SS3. Interlock the operation for unit shut down when activated by water in the auxiliary pan.

2.03 Standalone DDC Panels

A. General

Supervisory control shall be accomplished through the use of control modules. Standalone DDC panels shall be microprocessor based, multi-tasking, multi-user, real-time digital control processors. Each standalone DDC panel shall consist of modular hardware with plug-in enclosed processors, communication controllers, power supplies, and input/output modules. A sufficient number of controllers shall be supplied to fully meet the requirements of this specification and the sequence of operation

B. Memory

Each DDC panel shall have sufficient memory to support its own operating system and databases including:

1. Control Processes
2. Energy Management Applications
3. Alarm Management
4. Historical/Trend Data for all points

5. Maintenance Support Applications
6. Custom Processes
7. Operator I/O
8. Dial-Up Communications
9. Manual Override Monitoring

C. Point Types

Each DDC panel shall support the following types of point inputs and outputs:

1. Digital inputs for status/alarm contacts
2. Digital outputs for on/off equipment control
3. Analog inputs for temperature, pressure, humidity, flow, and position measurements
4. Analog outputs for valve and damper position control, and capacity control of primary equipment
5. Pulse inputs for pulsed contact monitoring

D. Expandability

The system shall be modular in nature, and shall permit easy expansion through the addition of software applications, workstation hardware, field controllers, sensors, and actuators.

The system architecture shall support 10% expansion capacity of all types of DDC panels, and all point types included in the initial installation.

2.04 System Software Features

A. General

All software and programming necessary to form a complete operating system as described in this specification shall be provided.

B. Control Software Description

1. Pre-Tested Control Algorithms

The DDC panels shall have the ability to perform the following pre-tested control algorithms:

- a. Two Position Control
- b. Proportional Control
- c. Proportional plus Integral Control
- d. Proportional, Integral, plus Derivative Control
- e. Automatic Control Loop Tuning

2. Equipment Cycling Protection

Control software shall include a provision for limiting the number of times each piece of equipment may be cycled within any one-hour period.

3. Heavy Equipment Delays

The system shall provide protection against excessive demand situations during start-up periods by automatically introducing time delays between successive start commands to heavy electrical loads.

4. Power Fail Motor Restart

Upon the resumption of normal power, the DDC panel shall analyze the status of all controlled equipment, compare it with normal occupancy scheduling, and turn equipment on or off as necessary to resume normal operation.

C. Energy Management Applications

DDC panels shall have the ability to perform any or all of the following energy management routines:

1. Time of Day Scheduling
2. Calendar Based Scheduling
3. Holiday Scheduling
4. Temporary Schedule Overrides
5. Optimal Start
6. Optimal Stop
7. Night Setback Control
8. Enthalpy Switchover (Economizer)
9. Peak Demand Limiting
10. Temperature Compensated Load Rolling
11. Fan Speed/CFM Control
12. Heating/Cooling Interlock
13. Supply Air Reset
14. Supply Water Reset
15. Chilled Water Reset
16. Condenser Water Reset
17. Chiller Sequencing

- D. All programs shall be executed automatically without the need for operator intervention, and shall be flexible enough to allow user customization. Programs shall be applied to building equipment as described in the Execution portion of this specification.

2.05 APPLICATION SPECIFIC CONTROLLERS- HVAC APPLICATIONS

- A. Each Standalone DDC Controller shall be able to extend its performance and capacity through the use of remote Application Specific Controllers (ASCs).
- B. Each ASC shall operate as a standalone controller capable of performing its specified control responsibilities independently of other controllers in the network. Each ASC shall be a microprocessor-based, multi-tasking, real-time digital control processor.
- C. Each ASC shall have sufficient memory to support its own operating system and data bases including:
1. Control Processes
 2. Energy Management Applications
 3. Operator I/O (Portable Service Terminal)

- D. The operator interface to any ASC point data or programs shall be through any network-resident PC workstation, or any PC or portable operator's terminal connected to any DDC panel in the network or local I/O devices (LED's Switches etc.) where described and provided.
- E. Application Specific Controllers shall directly support the use of a portable operator's terminal, providing the following:
 - 1. Display temperatures
 - 2. Display status
 - 3. Display setpoints
 - 4. Display control parameters
 - 5. Override binary output control
 - 6. Override analog setpoints
 - 7. Modification of gain and offset constants
- F. All system setpoints, proportional bands, control algorithms, and any other programmable parameters shall be stored such that a power failure of any duration does not necessitate reprogramming the controller.

2.06 FULLY PROGRAMMABLE CONTROLLERS

- A. Fully programmable controllers shall be microprocessor based, consisting of analog and binary input and output points, and programmable logic, designed for monitoring and control alarm applications. The controllers shall be capable of operating as completely independent units and/or as part of a facility-wide building control system. The controller shall have sufficient memory to support its operating system, database, and programming requirements.
- B. The controllers shall be software configurable for the types of input/output points required per the points list, and for future expansion. The controllers shall receive signals from industry standard sensors and input devices and directly control analog and binary control devices. Each controller shall monitor all analog inputs and control analog outputs, utilizing 12-bit analog-to-digital and digital-to-analog conversion.
- C. Each controller shall be capable of executing proportional, integral, and derivative (PID) control loops and custom logic control routines. PID loops shall be programmable to operate at user-defined intervals, as frequently as one second.
- D. The custom application controllers shall include a communications data port for connection to a personal computer for upload, download, and editing of data and programs.
- E. Controllers that perform scheduling shall have a real time clock.
- F. The controller shall continually check the status of its processor and memory circuits. If an abnormal operation is detected, the controller shall assume a predetermined failure mode, and generate an alarm notification. The controller shall maintain all BIOS and programming information in the event of a power loss for at least 72 hours.
- G. Provide diagnostic LEDs for power, communications, and processor. All low voltage wiring connections shall be made such that the controller electronics can be removed and/or replaced without disconnection of field termination wiring.

- H. Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal voltage

2.07 OPERATOR INTERFACE

- A. The system shall have an operator interface consisting of either a touch pad or key pad for entering and selecting data on an LCD screen. All readouts and data entries shall be in English, codes will not be acceptable. Both the data entry pad and the screen shall be permanently mounted in a cabinet located as shown on the drawings. From this cabinet the operator shall be able to view equipment status, issue overrides, make parameter and schedule changes and view historical trends, temperatures, alarms and overrides for any equipment or systems connected to the network. The interface shall be protected by five levels of password protection.

PART 3 – EXECUTION

3.01 INSTALLATION REQUIREMENTS

- A. All electrical work performed in the installation of the BAS system as described in this specification shall be per the National Electrical Code (NEC) and per applicable state and local codes. Where exposed, conduit shall be run parallel to building lines properly supported and sized at a maximum of 40% fill. In no cases shall field installed conduit smaller than 1/2" trade size be allowed. Where conductors are concealed (tenant spaces), cable rated for use in return air plenums shall be used.

3.02 OWNER TRAINING

- A. The BAS contractor shall provide 3 copies of an operator's manual describing all operating and routine maintenance service procedures to be used with the temperature control and Building Automation System supplied. This contractor shall instruct the owner's designated representatives in these procedures during the startup and test period. The duration of the instruction period shall be no less than 12 hours, during normal working hours.
- B. The demonstration training shall be video recorded and submitted on DVD with closeout documents.
- C. Each of the three copies of the operations manuals shall include all methods of operation, sequences of operation and full diagnostic and trouble shooting

3.03 CALIBRATION AND ADJUSTMENTS

- A. After completion of the installation, perform final calibrations and adjustments of the equipment provided under this contract and supply services incidental to the proper performance of the BAS system under warranty below.

3.04 ACCEPTANCE PROCEDURE

- A. Upon completion of the calibration, contractor shall startup the system and perform all necessary testing and run diagnostic tests to ensure proper operation in the presence of the owner and engineer. Contractor shall be responsible for generating all software and entering all database necessary to perform the sequence of control and specified software routines. An acceptance test in the presence of the owner's representative and engineer shall be performed.

3.05 PROVING THE SEQUENCE OF OPERATION

- A. After completing the calibration and adjustments and the acceptance procedure, the Controls Contractor shall prove to the Mechanical Engineer that the sequences are complete and functioning as intended. This shall be performed in the Engineer's office and shall involve the following types of items:
 - 1. Changing set points of devices to verify that other devices and temperatures respond accordingly.
 - 2. Start or stop devices to verify proper interlocking with other devices.
 - 3. Operate all equipment to verify proper sequencing of events.
 - 4. Any other operations or tests that are required to verify the proper operation of the mechanical system by the control system.
- B. The Controls Contractor shall provide a copy of the software to the Engineer for loading on his computer to do the proving on. The contractor shall provide all devices at the job site necessary to access the controls from the Engineer's office. The Engineer shall contact the owner to obtain a password for the access.
- C. The Controls Contractor shall provide all required additional programming, debugging, etc. necessary to correct any deficiencies in the control sequences.

3.06 WARRANTY

- A. All BAS devices and installation shall be warranted to be free from defects in workmanship and material for a period of one year from the date of job substantial completion. Any equipment, software, or labor found to be defective during this period shall be repaired or replaced without expense to the owner. Factory authorized warranty service shall be available within 125 miles of job site.

END OF SECTION

SECTION 23 11 30

GAS PIPING SYSTEM

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. The following described work, materials and equipment shall be furnished and installed as shown on the Drawings and as herein specified.
 - 1. Gas service, specialties and piping to all equipment.

1.02 REFERENCES

- A. All installation and fabrication shall be in accordance with applicable Local Gas Codes.

1.03 SUBMITTALS

- A. Submit catalog data and shop drawings for all materials listed under this section and per basic mechanical requirements.
- B. Materials, valves, hangers or equipment installed without review or after rejection shall be replaced by this contractor with acceptable items at the Engineer's direction.
- C. All materials, equipment and appliances shall be new, without defect, first line quality unless specifically noted or specified otherwise.
- D. The supplier, by submitting, certifies the materials and equipment to be satisfactory for the application involved.
- E. Contractor further agrees that if deviations, discrepancies or conflicts between submittals and specifications are discovered either prior to or after submittals are processed by the Engineer, the design drawings and specifications shall control and be followed.

PART 2 - PRODUCTS

2.01 GAS PIPING SYSTEM

- A. Above Grade:
 - 1. Steel pipe: ASTM A53, Schedule 40 black. Fittings: ANSI/ASME B16.3, malleable iron, or ASTM A234, forged steel welding type. Joints: Screwed for pipe 2" and under; ANSI/AWS D1.1, welded, for pipe over 2".
- B. Below Grade:
 - 1. MDPE pipe conforming to ASTM D 2513. Pipe shall be marked "GAS" and "ASTM D 2513". PE Fittings: ASTM D 2683, socket-fusion type or ASTM D 3261, butt-fusion type with dimensions matching PE pipe. PE transition fittings aboveground portion: Factory-fabricated fittings with PE pipe complying with ASTM D 2513, SDR 11 and steel pipe complying with ASTM A 53/A 53M, black steel, Schedule 40, Type E or S,

Grade B. Anodeless Service-Line Risers: Factory fabricated and leak tested. Casing: Steel pipe complying with ASTM A 53/A 53M, Schedule 40, black steel, Type E or S, Grade B, with corrosion-protective coating covering. Outlet shall be threaded or flanged or suitable for welded connection. Pipe shall be manufactured with a UV stabilizer suitable for unprotected outdoor storage for at least four (4) years. All joints, connections and work shall be made with fusion procedures meeting the pipe manufacturer's and local governing authority's requirements. Verify pipe preference of local utility. Provide tracer wire connection. Provide yellow indicator tape with an insulated copper tracer wire the continuous pipe length. The wire shall terminate above ground at each end of nonmetallic piping. The tracer wire shall not be less than 18 AWG and the insulation type shall be suitable for direct burial.

2. Steel Pipe: Schedule 40, black, per ASTM A-53 TYPE F may be substituted for outside underground pending approval by the Engineer. Piping shall be factory coated with a fusion bonded epoxy coating equal to 3M Scotchkote 6233. Fittings: Malleable iron per ASTM A-105 or forged steel welding type per ASTM A 234. Joints: Welded per ANSI/AWS D1.1 for all pipe sizes. Fittings and joints shall be covered with multiple layers of black plastic tape to provide protection equal to factory applied coatings. Tape shall be Kendall Company "Polyken #900" or equal by Tapecoat, 3M or Steelcoat.
- C. High Pressure System (containing 1 psig or greater) pipe to meet specifications listed in 2.01 A and B (1) above. Fittings: Forged steel welding type per ASTM A234. Joints: ALL sizes shall be welded.
- D. Flexible Connectors: Flexible connectors for connecting gas utilizing equipment to building gas piping shall conform to ANSI Z21.45. Flexible connectors for movable food service equipment shall conform to ANSI Z21.69.
- E. All welded joints on above grade piping 2" and larger shall be butt welds. 1-1/2" piping and smaller may be socket welds. All below grade welds shall be butt welds.
- F. Pipe identification markers shall be as specified in 23 05 53.

2.02 GAS SPECIALTIES

A. Pressure Regulators

1. Pressure regulators for individual service shall be of iron or steel body, shall be suitable in all respects for the indicated conditions and shall be adjustable for changing the downstream pressure. The regulator shall be adjustable with automatic loading, and shall have automatic pressure relief. The regulator shall be adjusted for an outlet pressure as scheduled on plans. The outlet pressure shall not vary more than 1/2 inch of the water column from the setting point at the connected-load capacity for the regulator. The pressure relief shall be diaphragm-operated, spring-loaded type with vent for relief of excess pressure on the low-pressure side of each main service regulator. Regulators shall be Equimeter, American, and Fisher or approved equal.
Pressure regulators shall be configured where the vent is in the vertical down position.
2. Pressure regulators installed inside mechanical rooms, boiler rooms or in any general area inside the building exceeding 7" WG pressure shall have the vents routed to atmosphere. Piping used shall be sized for the vent connection and conform to the listing of above grade gas piping.

3. Increases installed on the low pressure side of the pressure regulator shall be installed immediately after the regulator, and as detailed on the drawings.
 4. Testing procedures shall not include testing thru or to a gas pressure regulator. The Mechanical Contractor shall install a short "spool piece" of piping with the same lay length in place of the regulator and removable with a union between the two isolating valves. The regulator shall be installed after the test is approved. The regulator shall be pressure tested with soap bubbles or approved electronic leak detector after installation.
- B. Stop Cock Valves:
1. Stop cock valves shall carry an ASME B16.33 rating. Valves shall meet or exceed the State and Local Code Authority's requirements. Valves shall be equal to Kitz model # 58 with a vented ball and blowout proof stem.

PART 3 - EXECUTION

3.01 GENERAL

- A. Work shall be roughed-in so that all exposed piping will be straight and true without bends or off-sets.

3.02 GAS PIPING SYSTEM

- A. Provide a complete system of gas piping including interior and exterior work as indicated on the drawings.
- B. Pressure testing procedure:
1. High pressure piping (1 psig and greater): Gas pipe shall be tested with 50 psig nitrogen pressure for 12 hours and measured with a pressure measuring device designed and calibrated to read, record and indicate a pressure loss due to pipe leakage during the pressure test period. Any reduction of test pressure as indicated by the device shall be deemed to indicate the presence of a leak. Any leaks shall be located by means of a spray liquid & soap solution, or an equivalent nonflammable solution. Since some leak solutions, including soap and water may cause corrosion or stress cracking, the piping shall be rinsed with water after testing unless it has been determined the leak solution is non-corrosive. Any leaks shall be repaired by this contractor and the system re-tested in the prescribed manner. The 12 hour chart readout shall be submitted to the Engineer with a verification of the time, date and witness of the testing procedures.
 2. Low pressure piping (less than 1 psig): Gas pipe shall be tested with 10 psig nitrogen pressure for 12 hours and measured with a pressure measuring device designed and calibrated to read, record and indicate a pressure loss due to pipe leakage during the pressure test period. Any reduction of test pressure as indicated by the device shall be deemed to indicate the presence of a leak. Any leaks shall be located by means of a spray liquid & soap solution, or an equivalent nonflammable solution. Since some leak solutions, including soap and water may cause corrosion or stress cracking, the piping shall be rinsed with water after testing unless it has been determined the leak solution is non-corrosive. Any leaks shall be repaired by this contractor and the system re-tested in the prescribed manner. The 12 hour chart readout shall be submitted to the Engineer with a verification of the time, date and witness of the testing procedures.

- C. This Contractor shall make final connections to each piece of equipment furnished by him or by others unless noted otherwise. Provide a shut-off cock, union and 8" dirt leg at each individual equipment connection. Any reduction in gas pipe size for equipment connection shall be made within 6" of the factory connection. Regulators shall be installed at each piece of equipment or at branch intervals where required and indicated on the drawings.
- D. Gas piping shall not be installed in any inaccessible concealed and unventilated space.
- E. Install piping with a minimum 48" clearance from other buried metallic piping or equipment.
- F. Unless other specified herein, final connections shall be made with rigid metallic pipe and fittings. Final connection to kitchen ranges, (and other equipment where moving for cleaning purposes is required) shall be made using flexible connectors not less than 40" long and not more than 72" long and shall comply with ANSI Z21.69. In addition to cautions listed in instruction required by ANSI Standards for flexible connectors, insure that flexible connectors do not pass through equipment cabinets. Provide accessible gas shutoff valve and coupling for each gas equipment connection.
- G. Exterior piping above grade and concealed from normal view shall be coated with a rust inhibiting primer and two coats of exterior grade black paint. Exposed gas piping shall be primed as previously listed and painted with a color similar to nearest structure or as directed by the Architect.
- H. Whenever gas pipe transitions from below grade to above grade, the transition shall be made with an isolating union to electrically isolate the gas distribution systems. A DC voltage reading shall be made to test the effectiveness of the isolating unions. A minimum reading of 0.2 volts (measured across the union) shall be required. Repair or replace unions until this voltage can be obtained.
- I. Provide 17 pound magnesium anodes for steel piping below grade. Locate as indicated in an augured hole five feet from the pipe. The electrode shall be brazed or thermite welded to the pipe and then coated with approved mastic and tape.
- J. The condition of the pipe coating, the effectiveness of the isolation and other tests shall be approved by the Engineer.
- K. All underground piping shall be buried a minimum of 24 inches, have a yellow pipe marker with copper tracer wire located 6 inches below final finish grade, and shall be laid in a minimum of 4 inches of sand with sand extending to 6 inches above pipe. Provide PVC sleeves below all concrete sidewalks, roadways or concrete pads. Sleeve shall be a minimum of 2 pipe sizes larger than gas line. Sleeves shall be sealed and vented. Vents shall be routed as detailed and shown on the drawings.

END OF SECTION

SECTION 23 21 14

CONDENSATE DRAIN PIPING SYSTEMS

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Provide condensate drain piping systems complete with all accessories as specified herein and/or as indicated on the Drawings.

1.02 RELATED WORK (WHERE APPLICABLE)

- A. Underground condensate piping..

1.03 REFERENCES

American National Standards Institute (ANSI)

American Society of Mechanical Engineers (ASME)

American Society of Testing and Materials (ASTM)

1.04 SUBMITTALS

- A. Submit manufacturer's catalog data for all materials and equipment listed under this section.

PART 2 - PRODUCT

2.01 PIPING

- A. Condensate drain piping shall be one of the following:
 - 1. Type L hard drawn copper per ASTM B-88. Fittings are to be wrought copper or cast brass. Joints are to be soldered with lead free, tin-silver solder.
 - 2. PVC Pipe and Fittings: Schedule 40 per ASTM D-1785 / ASTM D-2466. Joints: Solvent weld per ASTM D-2855 with solvent per ASTM D-2564. DWV and Foam Core will not be allowed

2.02 OVERFLOW DRAIN PANS

- A. Condensate overflow drain pans are to be fabricated from minimum 20 gauge galvanized steel and shall have joints welded water tight. The drain pan shall be minimum of 1 ½" deep and shall be two inches larger on all sides than the piece of equipment it is under. All drain pans with any dimension greater than 24" shall be cross broken. The top edge of the pan shall be hemmed to remove all exposed sharp edges.

2.03 EQUIPMENT

- A. All vertical units with an auxiliary condensate drain connections shall have a float switch installed in the upper connection.

PART 3 - EXECUTION

3.01 GENERAL

- A. Piping shall be accurately cut to measurements established at the project site, worked into place without springing or forcing, run as directly as possible, run parallel or perpendicular to building lines, located as indicated on the Drawings and supported as specified elsewhere. Parallel piping shall be grouped together as much as practical. Piping shall be supported as high as practical. Piping not located in mechanical rooms shall be concealed unless noted otherwise.
- B. Piping shall be run as directly as possible, avoiding all unnecessary fittings and joints. Changes in routing of piping due to field conditions shall be at the expense of this Contractor.
- C. Provide sleeves for all piping penetrations of floors and walls. Sleeves for insulated piping above grade shall be sized for the insulation diameter.
- D. Provide escutcheon plates at each exposed piping penetration of walls and ceilings. Escutcheon plates for insulated piping shall be sized for the insulation diameter.

3.02 CONDENSATE DRAIN PIPING

- A. Provide condensate drain trap with a depth at least two inches greater than the fan total static pressure as measured from the invert of unit connection to the discharge invert.
- B. Condensate drains on the roof shall be supported with Miro Industries model 3-RAH-7, polycarbonate base with threaded risers and adjustable roller support. Adjustments shall be from 3.5" to 7" to achieve slope of the drain. All metal components will be stainless steel. Condensate drains shall be supported at proper intervals and at all elbows to prevent sagging.
- C. Provide a vent on the trap if the discharge height is ten feet or greater.
- D. Slope piping at a uniform slope of at least 1/4" inch per foot to ensure proper drainage.
- E. Condensate drain lines shall be adequately supported to prevent low points which could cause double trapping. Copper and PVC piping shall be supported as indicated in Specification Section 23 05 32.
- F. Condensate drain lines indicated to be terminated at floor drains with an elbow. Provide piping support from floor as required.
- G. Pre-formed condensate drain traps will not be allowed.
- H. Minimum condensate drain pipe size on the roof shall be 1 1/4".

3.03 DRAIN PANS

- A. Drain pans shall be installed under the following equipment conditions:
 - 1. All horizontal equipment located in rooms without floor drains or above ceilings.
 - 2. All vertical equipment without auxiliary drain connections and located in rooms without floor drains.

- B. Horizontal units shall be held up off the bottom of the drain pans with rubber in shear isolators. The isolators shall be located above rigid supports beneath the pan.
- C. Drain pans for vertical units shall be place beneath the equipment stand with the stand held up off of the bottom of the pan with rubber in shear isolators. This condition shall only apply when the unit has a side return duct connection.
- D. All drain pans shall have a liquid switch attached to or inside the pan which shall break the control circuit if activated by the presence of water.
- E. All vertical units with an auxiliary drain connection shall have a float switch installed in the upper connection.

END OF SECTION

SECTION 23 23 10

REFRIGERANT PIPING SYSTEMS

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Provide refrigerant piping systems complete with all accessories as specified herein and/or as indicated on the Drawings.
- B. Pressure test all refrigerant piping systems as specified herein.

1.02 REFERENCES

American National Standards Institute (ANSI)
American Society of Mechanical Engineers (ASME)
American Society of Testing and Materials (ASTM)

1.03 SUBMITTALS

- A. Submit manufacturer's catalog data for all materials and equipment listed under this section.

PART 2 - PRODUCTS

2.01 PIPING

- A. Refrigerant Piping shall be copper ACR tubing Type L hard drawn or Type K per ASTM B280 and shall be cleaned, dehydrated, charged with gaseous nitrogen and sealed. Fittings shall be forged or wrought copper. Joints shall be brazed silver.

2.02 ACCESSORIES

- A. Filter/dryers in sizes 1/2" and larger shall be the full-flow, replaceable-core type. Sizes smaller than 1/2" shall be the sealed type. Cores shall be of a suitable desiccant that will not plug, cake, dust, channel, or break down but shall remove water, acid, and foreign material from the refrigerant. The dryer shall be constructed so that no desiccant will pass into the refrigerant lines. A filter/dryer shall be provided in the liquid line to each evaporator and shall be piped with two isolation valves. Pressure drop through the dryer shall not exceed 2 psi when operating at full connected evaporator capacity.
- B. Liquid Sight Glasses. Sight glasses shall be double glass, see-through type, with cover cap on each side. Sight glass shall be provided in liquid line immediately preceding each expansion valve. Glass shall be furnished with a color-change-type moisture indicator.
- C. Moisture Indicators. Color-change moisture indicators shall be provided downstream from each filter/dryer and bypass or shall be combined as a single unit in the liquid sight glasses.
- D. Shutoff Valves. Shutoff valves shall be packless diaphragm (in sizes commercially

available), with packed, ground-finish stem, key operated, back seating, sealed-cap type; otherwise, angle pattern valves shall be used whenever possible.

- E. Solenoid Valves. Valves shall be brass or steel body, packless type, with corrosion-resistant steel trim, rated for continuous-duty service, direct-or pilot-operated, provided with manual lift stems, and designed for use with type of refrigerant used. The valve capacities shall be sufficient for the requirements of the installation at a pressure drop not in excess of 2 psi. Valves in suction lines shall be sized in accordance with temperature rise and superheat normal to the system.
- F. Expansion Valves. Shall be thermal-expansion type to suit specific system refrigerant, designed to fit coil distributors, and capable of operating from 40 to 100 percent of full load at system head pressure without hunting or liquid hammer. Valves shall have external equalizer connections and external superheat adjustments with seal caps. Joint connections shall be mechanical threaded or flanged type. Valves shall require not over 4 degrees F. superheat change to move from fully open to fully closed position. Superheat setting shall be 10 degrees F. at full load. Expansion valves shall be balanced double seated or pilot operated, capable of stable operation at 15 percent design load. Each valve shall be provided with external strainer.

PART 3 - EXECUTION

3.01 GENERAL

- A. Piping shall be accurately cut to measurements established at the project site, worked into place without springing or forcing, run as directly as possible, run parallel or perpendicular to building lines, located as indicated on the Drawings and supported as specified elsewhere. Parallel piping shall be grouped together as much as practical. Piping shall be supported as high as practical. Piping not located in mechanical rooms shall be concealed unless noted otherwise.
- B. Piping shall be run as directly as possible, avoiding all unnecessary fittings and joints. Changes in routing of piping due to field conditions shall be at the expense of this Contractor.
- C. Provide sleeves for all piping penetrations of floors and walls. Sleeves for insulated piping above grade shall be sized for the insulation diameter.
- D. Provide escutcheon plates at each exposed piping penetration of walls and ceilings. Escutcheon plates for insulated piping shall be sized for the insulation diameter.

3.02 REFRIGERANT PIPING SYSTEMS

- A. Provide a complete refrigerant tubing system as indicated herein and on the Drawings.
- B. All refrigerant piping shall be ACR Type L hard drawn tubing except for exposed piping in public areas which shall be ACR Type K tubing.
- C. All refrigerant lines shall be sized in accordance with the equipment manufacturers' recommendations.
- D. All elbows in refrigerant piping systems shall be long radius elbows.
- E. Joints shall be silver brazed using a continuous flow of nitrogen inside the piping to prevent oxidation.

- F. All piping shall be rigidly supported.
- G. Provide filter driers, sight glasses, moisture indicators, shutoff valves, solenoid valves and expansion valves when not provided as standard or as an option on equipment. Components shall be specifically designed for refrigeration service.
- H. Pressure test each piping system at 150 psig using dry nitrogen. Test each joint for leaks by spraying with soapy water. Joints that leak shall be disassembled, cleaned to bare copper and silver brazed again. Pressure test shall be repeated until all joints pass.
- I. Vacuum test each piping system after pressure test is completed. Piping shall be drawn to 500 microns of HG and tested for 12 hours without additional pumping. If piping system fails vacuum test repeat pressure test.
- J. Charge each piping system after vacuum test is completed. Charge each system per manufacturer's instructions. Halide torch test each joint after charging.

END OF SECTION

SECTION 23 31 10

GALVANIZED SHEET METAL DUCTWORK

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Provide a galvanized sheet metal ductwork system as indicated on the drawings, complete with all accessories specified herein and as required for proper system operation and balance.

1.02 REFERENCES

Air Diffusion Council (ADC)

Air Movement and Control Association (AMCA)

American Society of Heating Refrigeration and Air Conditioning Engineers (ASHRAE)

National Fire Protection Association (NFPA)

Sheet Metal and Air Conditioning Contractors National Association (SMACNA)

Underwriters Laboratories, Inc. (UL)

1.03 SUBMITTALS

- A. Submit catalogue data and shop drawings for all materials and equipment listed under this section.

PART 2 – PRODUCTS

2.01 GENERAL

- A. All sheet metal ductwork shall be fabricated and installed in accordance SMACNA standards unless more stringent requirements are stated herein.

2.02 GALVANIZED SHEET METAL DUCTWORK

- A. Sheet Metal Ductwork
 1. Galvanized steel ductwork shall be carbon steel, of lock-forming quality, hot dip galvanized, with regular spangle-type zinc coating, conforming to ASTM A-527/A527M-G90.
 2. In addition to the above, all rectangular ductwork exposed in occupied areas shall also have a paint grip finish that will readily accept a field painted finish. This also applies to all fabricated sheet metal accessories including hangers, drives, etc.
 3. Sheet metal gauges and reinforcement shall conform to the latest edition SMACNA HVAC duct construction standards, with the exception that 26 gauge will be the lightest gauge allowed for rectangular ductwork.
 4. Round sheet metal ducts shall use the gauges recommended by SMACNA in Tables 3-2A and 3-2B, HVAC Duct Construction Standards, 1998 edition, with the exception that 26 gauge duct shall be the lightest gauge allowed. All round sheet metal duct

- exceeding 14" diameter shall be spiral. See Specification Section 23 31 11 for requirements.
5. Exterior ductwork and any duct specifically called for on the drawings shall be assembled with Ductmate Industries type 35, rectangular duct connection system with roll-formed flanges, corner pieces, gasket and metal cleat. The system shall be self-sealing. Assembly and installation shall conform to the manufacturers requirements.

2.03 DUCTWORK SEALANT

- A. Sealant shall be non-flammable when wet, fire resistive when dry, and suitable for use in high velocity ductwork. Shall meet NFPA 90A and 90B and be UL classified. Sealant shall have a maximum 25 flame spread and 50 smoke developed (dry state) compound specifically for sealing ductwork.
- B. Tape for use with duct sealant shall be specifically designated by the manufacturer for ductwork sealing. See Specification Section 23 07 10 for requirements

2.04 DUCTWORK ACCESSORIES

A. General

Provide duct accessories as indicated on the drawings and as required for proper system operation and balance.

B. Flexible Duct Connections

Flexible duct connections shall be UL listed fire retardant neoprene coated woven glass fiber fabric connections, shall conform to NFPA 90A and 90B and have a maximum flame spread rating of 25 and a maximum smoke development rating of 50.

1. For static pressures up to 3", flexible connection fabric shall be 22 oz./sq. yard and 3" wide with 3" metal on either side of fabric. Equal to Duro Dyne #10105.
2. For static pressures 3" or greater, flexible connection fabric shall be 30 oz./sq. yard and 3" wide with 3" wide metal on either side of fabric. Equal to Duro Dyne #10003.

C. Manual Balancing Dampers

1. Dampers in round ductwork (low pressure) shall be single blade type with a 20 gauge beaded frame. The blade is to be two layers of galvanized steel with the equivalent thickness of 14 gauge. A neoprene seal shall be sandwiched between the two blades. The damper axle shall be 1/2" diameter and extend 6" beyond the frame for the damper quadrant or motorized operator and shall be installed in stainless steel or oil impregnated bronze bearings.
The damper shall be Ruskin model CDRS25, American Warming and Ventilating model VC-25 or Air Balance Inc. Model AC-530.
2. Dampers in rectangular ductwork greater than 8" x 10" shall be the opposed blade type, complete with concealed linkage and extended shaft for the damper quadrant or motorized operator, 16 gauge frame and double skin airfoil blades with the equivalent thickness of 14 gauge. The axle is to be 1/2" plated hex steel with stainless steel or oil impregnated bearings. The blades shall have neoprene edge seals and compression jamb seals.
The damper shall be Ruskin model CD-60, American Warming model VC-27 with optional bronze bearings or Air Balance Inc. Model AC-516 with optional bronze

GALVANIZED SHEET METAL DUCTWORK

- bearings. Dampers listed as 8" x 10" or smaller shall be single blade.
3. All dampers shall have an operable blade area equal to the duct net area. No blank off plates will be allowed in place of non-standard blade widths.

D. Damper Quadrants

Damper Quadrants shall have indicators showing open and closed positions, and shall be Ventfabrics, "Ventlock", as follows:

1. Dampers with shaft length 12" or less - No. 620 for base ductwork and No. 637 for insulated ductwork.
2. Dampers with shaft length longer than 12" - No. 637.

E. Motorized Dampers

Motorized dampers shall be the same as the manual dampers with the addition of a motorized operator, specified as follows:

1. If Specification Section 23 09 20, DDC Building Controls, is included in this project, that section shall be used for specifying the actuator.
2. If Specification Section 23 09 20 is not included in this project, then the actuator shall be as follows:
 - a. Motorized dampers shall be controlled with Belimo model AF24-SR-us, direct coupled, 24 volt, 133 in-lb torque with 150 second run time, spring return and built in auxiliary switch. Actuators shall be factory mounted to the dampers.

F. Splitter Dampers and Adjustable Volume Extractors

Rectangular duct mounted splitter dampers and adjustable volume extractors shall be fabricated from 16-gauge steel with a hemmed leading edge. The trailing edge shall be pivoted on a rod or hinges. Install in accordance with the latest edition of SMACNA's Low Velocity Manual and as detailed on the drawings. Secure rod to leading edge of damper and extend rod through side of ductwork using Ventlock #603 ball joint bracket with set screw.

G. Turning Vanes

1. All turning vanes shall be double thickness with a 2" radius, installed on runners with 2-1/8" blade spacing. Blades shall be 26 gauge.

H. Access Doors

1. Duct Access Doors shall be UL labeled, galvanized steel, double panel construction, internally insulated with minimum 1-inch thick fiberglass insulation complete with gaskets.
2. Access doors held in place with sheet metal screws are not acceptable.
3. The location of the access doors shall be coordinated for easy access to the fire damper fusible links.
4. The following access doors are specified to establish the quality of the products. Other products by prior approved manufacturers will be considered.
 - a. Rectangular, low pressure duct.
United Air, Series ADH, 24 gauge with hinged frame connection and cam lock closures. Doors shall be 16" x 16" or large as possible.

- b. Rectangular, high pressure duct.
Kees Incorporated, Series ADC-HP, 24 gauge galvanized panel, 22 gauge frame with camlock closures on all sides. Provide safety chain.
- c. Round, low pressure duct.
United Air, Series ADC, 22 gauge, spiral compression with conical springs and hand knobs.
- d. Round, high pressure duct.
Ductmate Industries, Inc., sandwich access doors with conical springs and hand wheels.

2.05 45 DEGREE, SQUARE-TO-ROUND TAKEOFF FITTINGS

- A. All branch duct takeoffs to a single air distribution device, shall be made using a rectangular, 45 degree takeoff that transitions to the round duct size shown on the plans.
- B. The takeoff shall be fabricated from hot dipped galvanized steel sheets of lock forming quality per ASTM-A653. The longitudinal seam shall have a continuous weld for no air leakage at 2" W.G. static pressure.
- C. Takeoff shall have a 1" wide gasketed flange with pre-drilled screw holes.
- D. All sizes shall have a 3/8" solid or square shaft, U-bolt retainers from the dampers to the shafts and nylon bushings.
- E. All sizes shall be fabricated with a 2" damper handle insulation standoff and Duro Dyne KR-3 locking quadrant.
- F. Flexmaster Model STOD-B03 is specified to establish the product quality. For take offs shown at 45° angles, provide Flexmaster STO45D-B03. Equals by Crown or requested prior approval will be considered 10 working days prior to project bid date.

2.06 INSULATED FLEXIBLE DUCTWORK

- A. Insulated flexible duct shall be listed under UL standard 181 as class 1 air duct and shall comply with NFPA standards 90A and 90B. The duct shall be 25/50 rated for flame spread/smoke developed.
- B. The duct shall be constructed with an acoustically transparent PE film mechanically locked to a corrosion resistant galvanized steel wire helix.
- C. The duct shall be insulated with a factory applied fiberglass blanket.
 - 1. Insulation R value for duct inside the building insulation envelope shall be R-6.0.
 - 2. Insulation R value for duct outside the building insulation envelope shall be R-8.0.
- D. The vapor barrier shall be a fire retardant, reinforced, metalized outer jacket with a permeance of 0.05 perm.
- E. Flexible ductwork shall be rated for 6 inches W.G. positive pressure and 1 inches W.G. negative pressure through 16" diameter. Flexible duct on sizes greater than 16" shall not be used. The rated temperature range shall be -20 to +200 degrees F. The UL rated velocity shall be 5000 fpm.

- F. Insulated flexible duct shall be Thermaflex Type M-KE, Flexmaster Type 1M or ATCO #039.

2.07 DUCT SUPPORTS

- A. General
 - 1. Duct supports shall be placed within two feet on either side of each elbow.
 - 2. Duct supports shall be placed within four feet on every side of each branch intersection.
 - 3. If spacing of the building structure components is greater than the maximum allowed for duct supports, additional structural members (unistrut, steel angles, etc.) shall be placed to span the building components to provide support points for the ducts.
- B. Rectangular ductwork
 - 1. Rectangular ductwork shall be supported at a maximum of every five (5) feet using a pair of 1" straps fabricated from 20 gauge sheet metal or two-3/8" rods. The supports shall be attached to the duct and the building in accordance with SMACNA standards. This shall apply to all rectangular ducts up to a maximum half of duct perimeter of 120".
 - 2. For ducts with a half of duct perimeter greater than 120", the gauge of the support straps and size of the rods shall be in accordance with SMACNA standards.
- C. Round ductwork
 - 1. Round ductwork up to 36" diameter shall be supported at a maximum of every eight (8) feet using a single 1" strap fabricated from 20 gauge sheet metal or 3/8" rod. The supports shall be attached to the duct and the building in accordance with SMACNA standards.
 - 2. Round ducts greater than 36" diameter, shall be supported by straps or rods sized in accordance with SMACNA standards.
- D. Flexible ductwork
 - 1. Flexible duct shall be supported by materials in accordance with SMACNA or the Flex duct manufacturer's recommendations. Where 90 degree bends occur for duct or diffuser connections are made, the bend shall be reinforced with a Flex Right Elbow as manufactured by Titus or approved equal.

PART 3 - EXECUTION

3.01 GALVANIZED SHEET METAL DUCTWORK

- A. Sheet Metal Ductwork shall be fabricated and installed per the latest edition of the SMACNA HVAC duct construction standards and ASHRAE Handbook.
- B. All ductwork shall be supported in accordance with SMACNA standards. All threaded rod supports shall be double nutted.
- C. Duct transitions shall be gradual, the angle of the side of the transition piece shall not exceed 15 degrees from the straight run of duct extended.

- D. All rectangular duct elbows shall be fabricated in accordance with either of the following:
 - 1. Radius Elbow - All radius elbows shall have a centerline radius equal to 1.5 times the width of the duct. This results in an inside radius equal to the width of the duct. Under no circumstances will radius elbows with a centerline radius of 0.5 times the duct width and an inside radius of 0.0 (90 degrees angle throat and radius heel) be allowed.
 - 2. Mitered Elbow (Square Throat - Square Heel) - All mitered elbows with an angle over 45 degrees shall be provided with turning vanes.
- E. All duct sizes shown on plans are net free area.
- F. All duct sections and fittings shall be fabricated with the ASTM stamp side of the sheets used for the exterior surfaces.

3.02 DUCT SEALANT

- A. All duct systems shall be sealed to meet SMACNA Seal Class B. Seal per SMACNA recommended methods with sealant or sealant plus tape as appropriate. All transverse and longitudinal seams in all positive pressure and negative pressure ducts shall be sealed.

3.03 DUCTWORK ACCESSORIES

- A. Flexible duct connection shall be installed on all ductwork required to be attached to motor driven equipment.
 - 1. The ends of the flexible connection shall be overlapped and sealed, to prevent air leakage, per the manufacturer's recommendations. If manufacturer does not have recommended method of sealing, the following method shall be used. Both ends of the flexible connection shall be extended three inches and turned inward (into air stream). Silicone caulking shall be applied between the overlap and outward clinching staples shall be used to fasten the lap.
- B. Manual Balancing Dampers, Splitter Dampers, Quadrant Dampers
 - 1. All dampers shall be installed so that damper blades have a full range of movement without interference or binding. Damper quadrant shall be located to provide easy access.
- C. Turning Vanes
 - 1. Turning vanes shall be installed in all mitered (Square Toe-Square Heel) elbows with an angle greater than 45 degrees. This shall include all supply, return, exhaust, transfer, etc. ducts.
 - 2. The trailing edge of the turning vanes shall be installed tangent to the air stream.
 - 3. All individual vanes shall be installed on the vane rails, i.e., omitting every other blade will not be allowed.

3.04 RECTANGULAR TO ROUND TAKE-OFFS

- A. Rectangular to round take-offs shall be installed in accurately cut openings in the sheet metal duct work.
- B. Rectangular to round take-offs shall be suitably sealed for the pressure class required.

- C. The quadrant damper shall be checked for free movement and left in the full open position after the take-off and insulation is installed.

3.05 INSULATED FLEXIBLE DUCTWORK

- A. For run outs to air distribution devices, the length of flexible duct work shall not exceed 5 feet. For lengths of duct required over 5 feet, the remainder shall be galvanized steel round duct. Flexible ductwork shall only be used on supply ducts, return ducts and transfer duct. All other aspects of the installation of flexible ductwork shall follow SMACNA guidelines.
- B. Bends in flexible duct shall be made with not less than 1 duct diameter centerline radius. Extend flexible duct a few inches beyond end of sheet metal connection before bending.
- C. Flexible duct shall be secured to sheet metal duct with a draw band and be independent of flexible duct insulation. The insulation shall be secured with a separate draw band. A band of tape shall be applied to the end of the outer jacket and the sheet metal duct or air distribution device.

END OF SECTION

SECTION 23 31 11

SPIRAL DUCTWORK

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Provide air distribution systems as indicated on the Drawings complete with all accessories specified herein and as required for proper system balance.

1.02 REFERENCES

Air Diffusion Council (ADC)

Air Movement and Control Association (AMCA)

American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)

National Fire Protection Association (NFPA)

Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

Underwriters Laboratories, Inc. (UL)

1.03 SUBMITTALS

- A. Submit catalog data and shop drawings for all materials and equipment listed under this section.

PART 2 - PRODUCTS

2.01. SPIRAL DUCTWORK - GENERAL

- A. Unless otherwise specified all duct and fittings shall be galvanized sheet metal in accordance with ASTM A 527. Duct shall be spiral lockseam construction.
- B. Unless otherwise noted on the drawings, all exposed spiral ductwork shall be fabricated from sheet metal with a phosphatized "Paint-Grip" finish suitable for painting.
- C. All duct materials directly exposed to airflow shall be non-combustible. When insulation is required for thermal or acoustical purposes, it shall be sandwiched between a solid or perforated inner liner and a solid outer pressure shell.
- D. Duct sealants shall be UL classified with a flame-spread rating of 25 or less and smoke-developed rating of 50 or less. Sealants shall have a solid content of 70 percent or greater and shall not require any type of surface cleaning or preparation prior to application.
- E. Duct shall be provided in continuous, unjoined lengths wherever possible. Except when interrupted by fittings, round duct sections shall be at least 10 feet long.
- F. All duct diameter dimensions shown on the drawings are the inner free area dimensions.
- G. Joint Construction

1. All round sections in diameters of less than 16 inches shall be provided with slip couplings.
 - a. All fitting ends shall be sized to slip inside mating duct sections. They shall provide a tight fit and have a minimum 2-inch insertion length with a stop bead. No additional coupling shall be required for duct-to-fitting joints.
 - b. Duct-to-duct joints shall be by means of a slip coupling that fits inside both mating duct sections (fitting size). Couplings shall provide a tight fit and have minimum 2-inch insertion length with a stop bead.
 - c. Fitting-to-fitting joints shall be by means of a slip coupling that slips over both mating fitting ends (duct size). Couplings shall provide a tight fit and have a minimum 2-inch overlap length.
 2. All round sections with diameters greater than 14 inches shall be provided with flanged joints.
 - a. Welded flanges shall be solid welded or tack welded. The finished flange assembly must be able to withstand maximum design pressure with no leakage.
 - b. Vanstone flanges on spiral duct shall include a fully welded sleeve that fits inside the end of the duct and provides a flange that will retain the angle ring on the duct. On fittings, the retaining flange may be a turn-out of the fitting body.
 - c. Unless otherwise specified, duct shall be furnished with welded flanges, and fittings shall be furnished with Vanstone flanges.

Flanges shall be constructed of galvanized steel in 14 gauge through 24 inches in diameter, 12 gauge from 25 through 42 inches in diameter, and 10 gauge from 43 through 60 inches in diameter.
 - e. Flanges larger than 60 inches in diameter shall be of standard iron angle ring construction.
 3. Joints for double wall duct shall be the same as for the single wall duct with the coupling/flange being applied to the outer pressure shell. An inner coupling shall be provided for the inner liner.
- H. All takeoff or branch entrances shall be by means of factory-fabricated fittings or factory-fabricated duct/tap assemblies.

2.02 DOUBLE WALL INSULATED ROUND DUCT

- A. Insulated duct shall be constructed of a perforated inner liner, 1 inch thick layer of fiberglass insulation, and an outer pressure shell. The outer pressure shell shall be 2 inches larger than the nominal inner liner dimension. The outer pressure shell gauge shall be based on actual outer shell dimensions as follows:

Pressure Shell Diameter	Gauge 2-10 In Wg
3- 14	26
15-26	24
27-36	22
37-50	20
51-60	18

- B. Liners shall be constructed as follows:

Inner Liner Diameter (In.)	Gauge
3- 26	26
27-60	24

- C. Fittings

1. Fittings for double wall duct shall be constructed with an inner perforated liner, a 1" layer of fiberglass insulation and an outer pressure shell.
2. Rectangular to round fittings are to be concentric.
3. Register taps are to be double wall. All register taps shall be installed with adjustable volume extractors with gear operators that can be adjusted through the face of the register.
4. 90 degree elbows shall be 5 piece construction: Semco E905, ESM E90 or Hamlin DWE-90-5.
5. Tees shall be combination tee or reducing combination tee: ESM CB or CBR, SEMCO CMT or CMTR.

- D. Double wall insulated round ductwork shall be Eastern Sheet Metal (ESM), SEMCO or Hamlin.

2.03 SINGLE WALL ROUND DUCT

- A. Single wall duct shall be fabricated in the gauges and connections shown for the pressure shell of double wall ducts.

- B. Fittings

1. Rectangular to round fittings are to be concentric.
2. 90 degree elbows shall be 5 piece construction: Semco E905, ESM E90 or Hamlin DWE-90-5.
3. Tees shall be combination tee or reducing combination tee: ESM CB or CBR, SEMCO CMT or CMTR.

- C. Single wall round ductwork shall be Eastern Sheet Metal (ESM), SEMCO or Hamlin.

2.04 DUCTWORK ACCESSORIES

- A. General: Provide duct accessories as indicated on the Drawings and as required for proper system operation and balance.

- B. Manual Balancing Dampers shall be as specified in Section 233110.
- C. Duct access Doors shall be as specified in Section 233110.

2.05 DUCT SEALANTS

- A. All factory fabricated sheet metal ductwork shall be sealed in accordance with manufacturer's and SMACNA recommendations.

PART 3 - EXECUTION

3.01 FACTORY FABRICATED SHEET METAL DUCTWORK

- A. All factory fabricated sheet metal ductwork shall be installed in accordance with the manufacturer's guide lines.
- B. Duct supports shall be provided at a maximum spacing of 12 feet on center.
- C. Duct shall be constructed and installed to maintain minimum friction loss throughout.
 - 1. The fewest possible number of duct joints shall be used, and in no case shall joints be closer than at 12-foot intervals.
 - 2. Couplings shall be tight to the duct wall surface, and projections into the duct at connections shall be minimized.
 - 3. The inside surface of all duct shall always be constructed of sheet metal.
- D. Only fittings with verifiable loss coefficients and performance data developed from actual laboratory testing will be acceptable. Performance data on fittings must be furnished upon request.
- E. System Performance
 - 1. The system has been designed for optimum performance. Any subsequent alterations to the design must be accompanied by a computer analysis or hand calculations showing that the proposed alterations will still provide the original design volume without increasing the system total pressure.
 - 2. Any unavoidable field changes to the original design (offsets, etc.) must be reported to the Engineer so that accurate "as built" operating parameters may be established.

END OF SECTION

SECTION 23 31 12

KITCHEN HOOD DUCTWORK

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Provide ductwork system for the kitchen hood as indicated on the drawings, complete with all accessories specified herein and as required for proper system operation and balance.

1.02 REFERENCES

Air Diffusion Council (ADC)

Air Movement and Control Association (AMCA)

American Society of Heating Refrigeration and Air Conditioning Engineers (ASHRAE)

National Fire Protection Association (NFPA)

Sheet Metal and Air Conditioning Contractors National Association (SMACNA)

Underwriters Laboratories, Inc. (UL)

1.03 SUBMITTALS

- A. Submit sheet metal shop drawings for kitchen hood duct work.

PART 2 – PRODUCTS

2.01 GENERAL

- A. All sheet metal ductwork shall be fabricated and installed in accordance SMACNA standards unless more stringent requirements are stated herein.

2.02 DUCTS SERVING TYPE I HOODS

- A. Grease duct for Type I hoods (for collecting and removing grease vapors and smoke) shall be constructed of type 316 stainless steel, not less than 16 Gage.
- B. All joints seams and penetrations of grease ducts shall be made with a continuous liquid-tight weld made on the external surface of the duct system. Internal welding shall be allowed, providing that the joint is formed or ground smooth and is provided with access for inspection.
- C. Duct joints shall be butt joints or overlapping duct joints of either the telescoping or bell type. Overlapping joints shall be installed to prevent ledges and obstructions from collecting grease or interfering with gravity drainage to the intended collection point. The difference between the inside cross sectional dimensions of overlapping sections of duct shall not exceed 0.25 inch. The length of overlapping duct joints shall not exceed 2

inches.

- D. The duct connections to the hood shall be fully welded or flanged. Flange connection will have a 1-inch deep flange made by a 1-inch by 1-inch angle welded to the full perimeter of the duct not less than 1-inch above the bottom of the duct. A gasket rated for use at not less than 1,500°F shall be installed between the hood and the duct flange. The duct to hood joint shall be secured by stud bolts not less than 0.25 inch in diameter welded to the hood at no greater than 4 inches on center for the full perimeter of the opening. All bolts and nuts shall be secured with lock washers.
- E. The duct to fan connection shall be flanged and gasketed at the base of the fan.
- F. Supports and bracing of grease ducts shall not penetrate the duct wall.
- G. Duct Cleanouts
 - 1. Cleanouts shall be provided on all sections of duct that are not provide with access from the duct entry or discharge. On horizontal ducts, duct cleanouts shall be spaced not more than every 20 feet and shall be at every change in direction. The cleanouts shall be on the sides of the duct with the opening not less than 1.5" above the bottom of the duct and not less than 1" from the top of the duct. The minimum opening of cleanout shall be 12" x 8" or large as possible. Confirm with plans for duct sizes.
 - 2. The cleanout openings shall be equipped with tight fitting doors constructed of steel having a thickness not less than that required for the duct. The doors shall be equipped with a substantial method of latching, sufficient to hold the door tightly closed. The doors shall be designed so that they are operable without the use of any tools. Door assemblies, including any frames and gasketing, shall be designed for that purpose, and shall not have fasteners that penetrate the duct. Cleanout doors shall be 3M Fire Barrier Grease Duct Access Door.
 - 3. Access Doors / Cleanouts shall be Morgan ThermalCeramics FastDoor XL, stainless steel construction. Doors shall be:
 - a. UL 1978 tested
 - b. ASTM E2336 and ASTM E814 tested complete assembly
 - c. Liquid tight gasket.
 - d. 1500°F HIGH TEMPERATURE GASKET
 - e. Zero clearance and 2-hour enclosure rated.
 - f. UL Listed
 - g. Single layer 1-1/2" thick enclosure insulation.
 - h. Code compliant signage.

2.03 DUCTS SERVING TYPE II HOODS

- A. Ducts for Type II hoods (for collecting and removing steam, vapor, heat and odors) shall be constructed of stainless steel or aluminum, which shall be of the following thicknesses:

Duct Size, Largest Side, in.	Stainless	Aluminum
Up to 10"	26 ga.	0.032"
11" - 12"	24 ga.	0.040"
13" - 14"	22 ga.	0.050"
15" - 16"	20 ga.	0.063"
17" - 18"	18 ga.	0.071"
21" - 24"	16 ga.	0.090"

These thicknesses are based on galvanized sheet metal with no reinforcement. Thinner thicknesses may be used based on the *Rectangular Duct Reinforcement Tables* and *Rectangular Aluminum Duct Adapted From 3" W.G. or Lower Table*, as included in SMACNA, HVAC Duct Construction Standards, latest edition.

PART 3 - EXECUTION

3.01 KITCHEN HOOD GREASE DUCT

- A. Horizontal grease ducts shall be sloped not less than 2% (0.25 in 12) toward the hood or an approved grease reservoir. For horizontal ducts longer than 75 feet, the slope shall not be less than 8.3% (1 in 12).

3.02 TESTING

- A. Prior to the use or concealment of any portion of a grease duct system, a leakage test shall be performed in the presence of the code official and Engineer. Ducts shall be considered to be concealed where installed in shafts or covered by coatings or wraps that prevent the duct work from being visually inspected on all sides.
- B. The mechanical contractor shall be responsible for scheduling, providing equipment for, and performing the leakage test.
- C. The leakage test shall be performed where a non-toxic smoke test is utilized. All exhaust ducts at the range hood shall be completely sealed. The entire duct system will then be introducing to a pungent, thick smoke produced by one or more smoke machines or introducing a white/gray non-toxic smoke emitter. When the smoke appears at the exhaust fan curb opening on the roof, the duct shall be closed and a pressure equivalent to a 1-inch water column shall be held for a test period of not less than 15 minutes.
- D. The ductwork may be tested in sections as long as every joint is tested.

END OF SECTION

SECTION 23 34 12

CENTRIFUGAL EXHAUST FANS

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Provide fans as indicated on the drawings and as specified herein with all accessories required for proper system balance.

1.02 REFERENCES

Air Diffusion Council (ADC)

Air Movement and Control Association (AMCA)

American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)

National Fire Protection Association (NFPA)

Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

Underwriters' Laboratories, Inc. (UL)

1.03 SUBMITTALS

- A. Submit catalog data and shop drawings for all materials and equipment listed under this section.

PART 2 - PRODUCTS

2.01 CENTRIFUGAL EXHAUST FANS

- A. Centrifugal Exhaust Fans

Centrifugal Exhaust Fans shall be UL Listed and bear the AMCA Seal for air and sound performance. Housings shall be constructed of heavy gauge, spun aluminum with a rolled bead. Curb cap shall be one piece, aluminum with deep spun venturi inlet and pre-punched mounting holes. Motor and drive housings shall be constructed of aluminum, provide easy access to motors and drives, be isolated from fan discharge air and be positively ventilated with fresh air. Fan wheels shall be constructed of aluminum, be statically and dynamically balanced and backward curved, non-overloading type. Drives of belt drive fans shall have shafts mounted with heavy duty, permanently lubricated, sealed ball bearings and be equipped with variable pitch, cast iron pulleys. Drives shall be sized for a minimum of 150 percent of driven power. Motors shall have permanently lubricated, sealed ball bearings and be factory wired with disconnect switches in the motor compartment. Motor and drive assemblies shall be mounted on vibration isolators.

- B. Low Silhouette Centrifugal Exhaust Fans

Low Silhouette Centrifugal Exhaust Fans shall be UL Listed and bear the AMCA Seal for air

and sound performance. Fans shall have fabricated hoods constructed of heavy gauge aluminum with roll formed stiffening ribs or louvered penthouse hoods constructed of heavy gauge extruded aluminum. Hoods shall be hinged for easy access to motor, drive and fan. Curb cap shall be one piece, aluminum with deep spun venturi inlet and pre-punched mounting holes. Fan wheels shall be constructed of aluminum, be statically and dynamically balanced and backward curved, non-overloading type. Drives of belt drive fans shall have shafts mounted with heavy duty, permanently lubricated, sealed ball bearings and be equipped with variable pitch, cast iron pulleys. Drives shall be sized for a minimum of 150 percent of driven power. Motors shall have permanently lubricated, sealed ball bearings and be factory wired with disconnect switches in the motor compartment. Motor and drive assemblies shall be mounted on vibration isolators.

- C. The following accessories shall be provided when indicated in the fan schedule:
 - 1. Backdraft Dampers shall be heavy duty box type, blades of aluminum with felt edges, linked together with a counterbalanced adjustable spring.
 - 2. Roof curbs shall be of welded construction, G-90 galvanized steel with 3# density rigid, 1" insulation with FSK jacket. Minimum curb height to be 12". Roof curves to be canted with a wood nailer. Curbs shall be sloped for a true level surface for the equipment to rest on.
 - 3. Provide mounting frame for wall mounted exhaust fans
 - 4. Speed controls for direct drive fans.
 - 5. Protective coating.
 - 6. Service switch.
- D. Cook units are specified to establish quality of equipment. Equals by Greenheck, Penn and Twin City will be considered.

2.02 GENERAL

- A. Provide and install fans and accessories as scheduled on the Drawings and specified in this section.
- B. Fan air performance ratings shall be in accordance with AMCA Standard 210.
- C. Fan sound performance ratings shall be in accordance with AMC Standard 300. Sound levels shall not exceed specified level at specified air delivery conditions.
- D. Fan performance based on sea level conditions.
- E. Equivalent fan selections shall not decrease motor horsepower (wattage), increase noise level, increase tip speed by more than 10 percent, or increase inlet air velocity by more than 10 percent, from that specified.
- F. Provide fans capable of accommodating static pressure variations of plus or minus 10 percent.
- G. Provide balanced variable sheaves for all motors with the size selected at midpoint in the adjustment.
- H. Statically and dynamically balance fans to eliminate vibration or noise transmission to occupied areas of the building.
- I. Provide belt guards on belt driven fans and safety screens where inlet or outlet is exposed.

- J. Fan wheels and housings not of aluminum or stainless steel shall be factory primed inside and outside.

PART 3 - EXECUTION

3.01 CENTRIFUGAL EXHAUST FANS

- A. Set and install roof mounted fans on curbs and structural steel frame.
- B. Equipment installation shall be such that filters, motors, bearings, and belts can be easily serviced.
- C. Provide flexible connections at inlet ducts of roof mounted fans per 233110.
- D. All fans shall be checked for proper direction of rotation and be lubricated before start-up.
- E. Set wall mounted exhaust fan on angle iron frame (2 x 2 x 1/4) angle minimum. anchor frame to wall with a minimum of 3 anchors per side. Anchors shall be 3/8" diameter butterfly bolts.

END OF SECTION

SECTION 23 74 31

HOT GAS REHEAT GAS FIRED MAKEUP AIR UNIT

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Provide all labor, material, services and appurtenances necessary for the installation of the following equipment:
 - 1. Gas fired makeup AC unit

1.02 REFERENCES

American National Standards Institute (ANSI)
American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
National Fire Protection Association (NFPA)
Underwriters Laboratory (UL)

1.03 SUBMITTALS

- A. Submit catalog data, performance data, shop drawings and installation instructions prior to commencement of work for all materials and equipment incorporated into the drawings and specified herein.

1.04 WARRANTY

- A. Provide a full 5 year parts and labor warranty from substantial completion.

PART 2 – PRODUCTS

2.01 HOT GAS REHEAT GAS FIRED MAKEUP AC UNIT

- A. General
 - 1. Unit furnished and installed shall be cooling with hot gas reheat as scheduled on contract documents and these specifications. Unit(s) shall consist of insulated weather tight casing with compressor(s), hot gas reheat coil, modulating face and by-pass dampers for hot gas reheat control, air cooled condenser coil, condenser fans, evaporator coil, return air filters, supply motors and drives, and DDC microprocessor controls . The DDC controller must control and modulate Face and By-pass dampers for discharge air temperature, or space temperature, or space humidity control.
 - 2. Unit shall be factory run tested and fully charged with R-22.
 - 3. Unit shall have labels, decals, and/or tags to aid in the service of the unit and indicate caution areas.
 - 4. Wiring internal to the unit shall be colored and numbered for identification.
 - 5. The unit shall have a single point power wiring connection.

B. Unit Casing

1. The cabinet shall be fabricated from galvanized steel, phosphatized, and finished with an air-dry paint coating with removable access panels. Structural members shall be 18 gauge with access doors and removable panels of minimum 20 gauge. Unit construction shall be Double-wall with insulation sandwiched between inner and outer wall. No insulation shall be in the airstream. Double wall panels must be easily removable with separable panels to inspect the sandwiched fiberglass insulation.
2. Units cabinet surface shall have been tested 500 hours in salt spray test in compliance with ASTM B117.
3. Cabinet construction shall allow for all service/ maintenance from one side of the unit. Insulation on the doors must not be exposed to the airstream. Unit must be double-wall construction.
4. Cabinet top cover shall be one piece construction or where seams exist, it shall be double hemmed and gasket sealed.
5. Access panels shall be water and air tight panels with handles and shall provide access to filters, heating section, supply air fan section, evaporator coil section, and unit control section.
6. Down flow unit's base pans shall have a raised 1 1/8 inch high lip around the supply and return openings for water integrity.
7. Insulation: Provide 1/2 inch thick coated fiberglass insulation sandwiched between outer and inner double walls on all exterior panels in contact with the return and conditioned air stream.
8. The base of the unit shall have provisions for forklift and crane lifting.

C. Fans and Motors

1. Provide evaporator fan section with forward curved, double width, double inlet, centrifugal type fan.
2. Provide self-aligning, grease lubricated, ball or sleeve bearings with permanent lubrication fittings.
3. Outdoor and Indoor Fan motors shall be permanently lubricated and have internal thermal overload protection.
4. Outdoor fans shall be direct drive, statically and dynamically balanced, draw through in the vertical discharge position.
5. Provide shafts constructed of solid hot rolled steel, ground and polished, with key-way, and protectively coated with lubricating oil.

D. Evaporator and Hot Gas Reheat Section

1. Provide configured aluminum fin surface mechanically bonded to copper tubing coil.

HOT GAS REHEAT GAS FIRED MAKEUP AIR UNIT

2. Provide a thermal expansion valve for each refrigeration circuit. Factory pressure test at 450 psig and leak tested at 200 psig.
3. Provide drain pan for base of evaporator coil constructed of stainless steel with external connections.
4. Provide a hot gas reheat coil mounted after the fan discharge with a modulating face and by-pass damper to modulate air thru or around reheat coil as needed to meet programmed air temperature or humidity setpoint. Hot gas reheat coil must be piped in series to condenser coil. Parallel piping is unacceptable.
5. The Hot Gas Reheat Coil must be mounted at least 24" away from the DX coil to prevent radiated heat from evaporating moisture back into the air stream.
6. The DX coil must be intertwined; horizontal split coils are not acceptable. The vendor will be responsible for changing the coil out in the field if a horizontal coil is substituted with or without approved submittals.

E. Gas Heat

1. The gas heating section shall have a drum and tube heat exchanger of stainless steel construction.
2. A forced combustion blower shall supply pre-mixed fuel to a single burner ignited by a pilotless hot surface ignition system. A negative pressure gas valve shall be used that requires blower operation to initiate gas flow. The blower shall purge the heat exchanger for 45 seconds prior to ignition. After three unsuccessful ignition attempts, the entire heating system shall be locked out until manually reset.

G. Air Filters

1. Air filters shall be factory installed and shall mount integral within the unit and shall be accessible thru access panels. The filters shall be standard sizes that are readily available through local supply houses. Filters that are odd sizes or require special ordering will not be allowed. Two inch thick pleated media glass fiber disposable media filters shall be provided.
2. The filters that are provided shall completely cover the air passage to the unit coil. If this is not possible, filter spacers shall be provided to fill the opening.
3. The outside air intake shall be protected by either a hood or a louver.

H. Outdoor Air Section

1. Provide 100% outside air hood with bird screen.
2. Outside air dampers and return air dampers shall be the low leak, opposed-blade type. The blades shall be 14-gauge galvanized steel construction with a roll-formed airfoil blade shape. The dampers shall have factory installed actuators.

I. Condenser Section

1. Provide internally finned 3/8 " seamless copper tube mechanically bonded to aluminum fins. Factory pressure tested to 450 psig.

HOT GAS REHEAT GAS FIRED MAKEUP AIR UNIT

2. Provide vertical discharge, direct drive fans with aluminum blades. Fans shall be statically balanced. Motors shall be permanently lubricated, with integral thermal overload protection in a weather tight casing.

J. Refrigeration System

1. Compressor(s): Provide scroll compressors with direct drive operating at 3600 rpm. Integral centrifugal oil pump, inlet dirt separator, rolling element bearings, crankcase heater, completely enclosed compression chamber with no leakage paths. Provide suction gas cooled motor with over temperature and over current protection.
2. Units shall have cooling capabilities down to 60 degree F.
3. Provide with thermostatic temperature control in the compressor windings, to protect against excessive temperatures, high and low pressure conditions.

K. Unit Controls

1. Provide microprocessor unit mounted control (UCM) which when used with an electronic discharge air sensor mounted on the DX coil provides proportional, integral, and derivative supply air control. This UCM shall perform all unit functions by making all heating, cooling and ventilating decisions through resident software logic. The microprocessor shall include several temperature functions. A discharge air sensor mounted after the evaporator coil shall maintain the specified dehumidification temperature. The second temperature sensor shall modulate the hot gas reheat coil face and by pass damper to maintain the specified supply or space air temperature. The third temperature sensor shall monitor suction temperature and lockout compressors to keep the evaporator coil from freezing. The fourth temperature sensor shall monitor liquid line temperature to modulate condenser fans to maintain head pressure. The fifth sensor is a space adjustable temperature or humidity input. The last temperature sensor monitors outdoor air temperature and makes the decision on when to lock out the compressors. All functions of the microprocessor shall be fully programmable and have the capability to be monitored and adjusted thru a laptop computer and/or remote LCD keypad. The UCM shall be LONtalk compatible.

L. Refrigeration Controls

1. Refrigeration controls and features shall include crankcase heaters, high and low pressure switches, high temperature switch, five (5) minute timed-off cycle controller, service pressure ports, a filter drier and a liquid line sight glass.

M. The following options shall be provided when scheduled on the drawings and shall be as follows:

1. Roof Mounting Curb
Minimum 14" high perimeter type roof mounting curb. A 24" high curb shall be provided whenever the thickness of the steel deck, roof insulation and the crickets get to within three inches of the lowest part of the unit overhang.
2. Economizer
Return and outside air low-leak dampers with separate unit controlled actuators. Return air shall be up through the base of the unit from inside the unit curb. The Control of the economizer control shall be by a CO2 sensor.

HOT GAS REHEAT GAS FIRED MAKEUP AIR UNIT

3. Non-fused disconnect switch and convenience outlet.
 4. Space Humidity Sensor.
 5. Space CO2 Sensor.
 6. Through the Base Electrical
 7. Provide 2 spare sets of filters (turn over to owner).
- N. Startup
1. Provide checkout and startup of equipment by factory approved Technician.
- O. Trane Model OA is specified to establish quality of equipment. Equal equipment by Aaon or Desert Aire will be considered. Equal equipment by Aaon or Desert Aire will be considered pending prior approval as stated in specification 23 05 00

PART 3 - EXECUTION

3.01 GENERAL

- A. The roof mounted gas fired makeup AC unit shall be mounted on a factory furnished curb. The curb shall be designed for the type, style and slope of roof it is to be set on. For sloped or pitched roofs, the curb height shall be verified to be of sufficient height for the roofing surface to be properly terminated and to prevent any interference between the unit and any roofing crickets that are to be installed. Curb to be leveled, flashed and counter-flashed watertight. Set unit on curb and provide all final connections as specified herein and indicated on the drawings.
- B. Slab mounted packaged air conditioning units shall be set on a standard roof curb on top of the concrete slab.
- C. Observe manufacturers spacing requirements between units and adjacent walls, etc.
- D. The units shall be installed in accordance with the manufacturer's recommendations.
- E. The unit shall be checked prior to start up to insure proper installation and connections up by a factory. The factory representative shall then supervise the start up of the unit.

END OF SECTION

SECTION 23 81 31

VARIABLE REFRIGERANT FLOW ZONING SYSTEM

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Provide all labor, material, services and appurtenances necessary for the installation of variable refrigerant flow zoning systems including indoor units, outdoor units, branch circuit controllers, controls, refrigerant piping, etc.

1.02 REFERENCES

American National Standards Institute (ANSI)
Air Conditioning and Refrigeration Institute (ARI)
American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)
National Fire Protection Association (NFPA)
Underwriters Laboratories, Inc (UL)
National Electric Code (NEC)

1.03 SUMMARY

- A. The HVAC basis of design shall be Trane 4TVR/4TVH Air Source VRF as scheduled.
- B. Bidders shall provide the minimum system as indicated on drawing, including Heat Recovery or Heat Pump systems as defined by model and family numbers. All systems shall be capable of providing the scheduled capacity at the location of the indoor unit regardless of pipe length. Nominal or catalog capacities will not be accepted.
- C. Heat Recovery systems shall be capable of simultaneous cooling and heating. The Heat Recovery system shall consist of Trane Air Source unit(s), MCU(s) (Mode Change Unit), multiple Trane indoor units and Trane VRF System Controls.
- D. The Heat Recovery system shall be capable of transferring heat between individual indoor units, and between individual Mode Control Units.
- E. To ensure maximum occupant comfort, Heat Recovery systems may have a space temperature controller for each connected indoor unit. Each individual space temperature controller shall be capable of automatically satisfying heating or cooling regardless of time of day, occupancy, or season without inhibiting or affecting other space temperature controllers.
- F. If the application calls for simultaneous heating and cooling with multiple zones and multiple controllers, and the installing contractor submits a Heat Pump system, the submittal shall be summarily rejected. The contractor shall then be required to resubmit and install a simultaneous heating and cooling system. The contractor shall bear all additional costs required to provide a simultaneous heating and cooling system, with no additional cost to the owner.

- G. BAS System Controls, installation, and integration shall be provided by the manufacturer of the VRF system. This is to ensure sole source responsibility for the BAS control system including non-VRF systems.

1.04 SUBMITTALS

- A. Submit catalog data, shop drawings and installation instructions prior to commencement of work for all materials and equipment incorporated in the Drawings and/or specified herein.
- B. Submit manufacturer's installation instructions.
- C. Show on shop drawings all equipment, piping connections, valves, strainers, and thermostatic valves required for complete system.

1.05 WARRANTY

- A. The units shall be covered by the manufacturer's standard limited warranty for a period of 12 months from date of installation. If during this period, any part should fail to function properly due to defects in workmanship or material, it shall be replaced or repaired at the discretion of the manufacturer.
- B. The units shall carry an extended manufacturer's parts and compressor warranty for a period of 10 years from date of installation. The following steps shall be taken by the contractor to ensure systems are eligible for extended warranty.
 - 1. System is designed and submitted using the approved application tool (Trane VRF Select).
 - 2. System installed by a contractor who has successfully completed the Trane factory training class.
 - 3. Upon completion of installation and prior to final commissioning, contractor shall provide revised piping layout reflecting actual installation conditions to Trane VRF technician for submittal to Trane Factory Service Department.
 - 4. Provide a verified and submitted commissioning report to Trane Factory Service Department.
- C. The contractor shall provide labor warranty as specified in the general conditions for this project.

1.06 CONTRACTOR'S RESPONSIBILITY

- A. The contractor shall obtain training and certification in the installation and service of this type of system as required by the manufacturer.

1.07 MANUFACTURERS

- A. Basis of design shall be Trane
- B. The following manufacturers shall be allowed to bid as a deductive alternate provided they meet the scheduled performance indicated on the drawings:
 - 1. Mitsubishi
 - 2. Samsung

PART 2 - PRODUCTS

2.01 VARIABLE REFRIGERANT FLOW ZONING SYSTEM

A. General

1. Provide the systems and components with capacities and features as scheduled on the drawings and/or as specified below.
2. The system shall be capable of simultaneous heating and cooling separate zones at the same time.

2.02. HEAT RECOVERY AIR SOURCE UNITS

- A. The Trane 4TVR Heat Recovery Air Source unit shall be used specifically with Trane Heat Recovery systems (simultaneous heating and cooling). The unit electrical power shall be 208-230 volts or 460 volts, 3 phase, 60 hertz as specified. Units shall have weather tight construction for outdoor installation, (outdoor unit).
- B. To ensure maximum occupant comfort, Heat Recovery systems may have a space temperature controller for each connected indoor unit. The Heat Recovery system shall provide simultaneous heating and cooling without the use of reheat.
- C. In order to ensure maximum Simultaneous Cooling and Heating Efficiencies (SCHE), Heat Recovery outdoor units will feature a low temperature/low pressure gas line, high temperature/high pressure gas line, and a medium temperature/high pressure liquid line. All three lines will connect from the outdoor unit to each mode control units, (Hybrid Piping Layout.)
- D. The Trane Heat Recovery outdoor units shall be equipped with multiple circuit boards. These boards shall perform all functions necessary for operation of the outdoor units.
- E. The outdoor unit shall be completely factory assembled, internally piped and wired. Each unit shall be run tested at the factory.
 - 1 The combination ratio of the nominal indoor cooling capacity versus the nominal outdoor rated cooling capacity shall range from 50% to 130%.
 - 2 Outdoor unit shall have a sound rating no higher than 62/83(Pressure/Power) dB(A).
 - 3 Unit shall have a night quiet setting to reduce nighttime sound levels.
 - 4 All refrigerant lines from the outdoor unit to the MCU (Mode Change Unit), and or from MCUs to IDUs (Indoor Units,) shall be field insulated with a minimum insulation as referenced in the Trane VRF IOM (VRF-SVN034A-EN) Table 27, "Pipe insulation selector."
 - 5 The outdoor unit shall have an accumulator with crank case heater and controls.
 - 6 The outdoor unit shall have a high pressure safety switch, fuse, over-current protection and crank case heater.
 - 7 If the outdoor unit is above the indoor unit, the outdoor unit shall have the ability to operate with a maximum height difference of 361ft. If the indoor unit requirement is greater than 164 ft, contact your local Trane Sales Office.
 - 8 If the outdoor unit is below the indoor unit, the outdoor unit shall have the ability to operate with a maximum height difference of 131 ft.

- 9 The system shall have a maximum total refrigerant tubing length of 3281ft.
 - 10 The maximum length between outdoor unit and the furthest indoor units is not to exceed 656 ft (722 equivalent feet).
 - 11 The maximum height difference between MCU boxes shall be 49 ft.
 - 12 The maximum height difference between indoor units shall be 49 ft.
 - 13 The outdoor unit shall be capable of operating in cooling mode from 23°F to 120°F.
 - 14 The outdoor unit shall be capable of operating from 23°F to 5°F if the system is installed and configured per manufacturers guidelines.
 - 15 The outdoor unit shall be capable of operating in heating mode from 75°F to -13°F ambient temperatures without additional low ambient controls, additional modules, or low ambient accessories.
 - 16 The outdoor unit shall have a high efficiency oil separator plus additional logic controls to ensure adequate oil volume in the compressor is maintained.
 - 17 The outdoor units shall provide continuous heating during oil return and the defrost cycle through the use of rotational defrost. (multiple module systems)
 - 18 Units shall have a snow blower feature to ensure the dispersion of accumulated snow.
- F. The unit casing(s) shall be fabricated of galvanized steel, bonderized and finished with a powder coated baked enamel.
- G. The outdoor condenser fan shall be furnished with direct drive motors(s). All fan motors shall have inherent motor protection, and permanently lubricated bearings. All fan motors shall be mounted for quiet operation. All fans shall be provided with a raised guard to prevent contact with moving parts. The fans shall have vertical discharge airflow.
- H. R410A refrigerant shall be required for Trane VRF outdoor unit systems. Manufacturer shall only provide the refrigerant as required for unit charge. Contractor shall be required to provide additional refrigerant as specified in Trane VRF Select reports.
- I. System shall use Polyvinylether (PVE) oil. Due to the increased risk of hydrolysis and formation of acids, Polyolester (POE) oil shall not be acceptable.
- J. The outdoor condenser coil shall be of nonferrous construction with lanced or corrugated plate fins on copper tubing. The condenser coil shall have Blue Fin anti-corrosion protection as a standard feature. The coil shall be protected with an integral metal guard. The coil fins shall be coated with hydrophilic paints. Coil shall be capable of withstanding 1000 hour salt spray test.
- K. The outdoor units shall be equipped with inverter driven vapor injection asymmetric scroll compressor(s). The asymmetric design will allow for only one point of contact for the scroll compressor blades resulting in reduced friction, and increased efficiency. Conventional scroll compressors with 2-points of contact will not be allowed due to their inherent inefficiency.
1. The outdoor unit compressor shall utilize inverter driven technology to modulate capacity. The compressors shall also utilize advanced technology adaptive sine wave control for reduced harmonics and faster frequency acceleration.
 2. The compressor shall be capable of 1/60th second advanced micro-control.

3. The outdoor unit compressor shall utilize vapor injection technology which shall increase the mass flow rate of refrigerant, resulting in improved performance for low temperature conditions.
 4. The compressor will be equipped with an internal thermal overload protection.
 5. The compressor shall be mounted to avoid the transmission of vibrations.
- L. Use 18 AWG, 25pF/ft nom., 60.7 Ω impedance, braid or foil shielded, twisted pair wire for communications wiring. Splicing of communication wiring shall not be permitted.

2.03 MCU (MODE CHANGE UNIT)

- A. The Trane MCU (Mode Change Unit) shall be used for applications requiring simultaneous heating and cooling. The unit electrical power shall be 208/230 volts, 1 phase, 60 hertz.
- B. MCUs require they be used in conjunction with Trane VRF Heat Recovery water source or air source units. These units shall be equipped with a circuit board that shall perform all functions necessary for operation.
- C. The MCU (Mode Change Unit) shall be completely factory assembled, internally piped and wired. Unit shall be run tested. This unit shall be mounted indoors.
- D. Each MCU shall be capable of transferring heat to connected associated indoor units, and to the connected water source or air source unit. This shall allow simultaneous heating and cooling without the need for reheat.
- E. Isolation valves with access ports shall be installed by the contractor on the entering and leaving refrigerant circuits as shown on the drawings.
- F. Additional subcooling shall be provided at the MCU. The additional subcooling is required to mitigate losses due to pipe length and heat gain. This will ensure scheduled capacity at the indoor unit.
- G. MCU (Mode Change Units) shall be available in one of two styles, Standard MCUs or Series MCUs. Only one style of MCU may be used per Outdoor System.

2.04 4-WAY MINI/ 4-WAY CEILING CASSETTE INDOOR UNITS

- A. The Trane 4TVB/4TVC are four-way cassette style indoor units that recess into the ceiling grid with an exposed ceiling grille and an integral 2000 step modulating expansion device. The unit electrical power shall be 208-230 volts, 1-phase, 60 hertz.
- B. The indoor unit shall be a factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, the electronic modulating linear expansion device, control circuit board, and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, and an auto restart function.
- C. The unit cabinet shall be a space-saving ceiling-recessed cassette.
- D. The indoor fan shall consist of a turbo fan with a single direct drive motor. The indoor fan shall be statically and dynamically balanced to run on a motor with permanently lubricated bearings. The indoor fan shall have high, medium, and low fan speeds. The

fan speed shall be adjustable by an optional remote controller. The auto air swing vanes shall be capable of automatically swinging up and down for uniform air distribution. If require the cassette shall be capable of closing off one or more vanes to prevent "stray airflow".

- E. Return air shall be filtered by means of a long-life washable permanent filter.
- F. The indoor coil shall be constructed as follows:
 - 1. The indoor coil shall be of nonferrous construction with slit fins on copper tubing.
 - 2. The tubing shall have inner grooves for high efficiency heat exchange.
 - 3. All tube joints shall be brazed with phos-copper or silver alloy.
 - 4. The coils shall be pressure tested at the factory.
 - 5. A condensate pan and drain shall be provided under the coil.
 - 6. The coil fins shall be coated with hydrophilic paints.
 - 7. The factory installed condensate lift mechanism shall be able to raise drain water 29.5 inches water column above the condensate pan. The lift pump shall include a check valve, and a factory wired condensate float switch. The lift pump shall include a check valve, and a factory wired condensate float switch. The float switch will disable and alarm the indoor unit in the event of condensate overflow.
 - 8. Both refrigerant lines to the indoor units shall be insulated.
- G. Use 18 AWG, 25pF/ft nom., 60.7 Ω impedance, braid or foil shielded, twisted pair wire for communications wiring. Splicing of communication wiring shall not be permitted.
- H. This unit shall use controls provided by Trane to perform functions necessary to operate the system. Please refer to Part 3 of this guide specification for details on controllers and other control options.

2.05 WALL MOUNTED INDOOR UNITS

- A. The Trane 4TVW-C is a wall-mounted indoor unit section with a slim silhouette. The wall mounted indoor unit electrical power shall be 208-230 volts, 1-phase, 60 hertz. The 4TVW-C shall have a 2000 step modulating expansion device.
- B. The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, internal piping, the electronic modulating linear expansion device, control circuit board, and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, and an auto restart function.
- C. The unit casing shall have a white finish, with multi directional drain and refrigerant piping offering four (4) directions for refrigerant piping and four (4) directions for condensate drainage. The unit shall be secured firmly to the wall with factory mounting plate.
- D. The indoor fan shall consist of a cross-flow fan with a single direct drive motor. The indoor fan shall be statically and dynamically balanced to run on a motor with permanently lubricated bearings. A manual adjustable guide vane shall be provided to change the airflow from side to side (left to right) as desired. A motorized air sweep louver shall provide an automatic change in airflow by directing the air up and down to provide uniform air distribution. The indoor fan shall have multiple speeds.
- E. Return air shall be filtered by means of an easily removable, washable filter.

- F. The indoor coil shall be constructed as follows:
 - 1. The indoor coil shall be of nonferrous construction with Slit fins on copper tubing.
 - 2. The tubing shall have inner grooves for high efficiency heat exchange.
 - 3. All tube joints shall be brazed with phos-copper or silver alloy.
 - 4. The coils shall be pressure tested at the factory.
 - 5. A condensate pan and drain shall be provided under the coil.
 - 6. The coil fins shall be coated with hydrophilic paints.
 - 7. The optional field installed condensate lift mechanism shall be able to raise drain water 29.5 inches water column above the condensate pan. The lift pump shall include a check valve, and a condensate float switch. The float switch will disable the indoor unit in the event of condensate overflow.
 - 8. Both refrigerant lines to the indoor units shall be insulated.
- G. Use 18 AWG, 25pF/ft nom., 60.7 Ω impedance, braid or foil shielded, twisted pair wire for communications wiring. Splicing of communication wiring shall not be permitted.
- H. This unit shall use controls provided by Trane to perform functions necessary to operate the system. Please refer to Part 3 of this guide specification for details on controllers and other control options.

2.06 ACCESSORIES

- A. Y-Joint Kits- are a required component for Trane VRF-Systems with multiple evaporators or MCU's on the same system. Y-joints shall be provided for liquid, suction, and hot gas fittings as required. Y-joints shall be provided with polystyrene insulation. Y-branches shall facilitate different pipe sizes without having to braze additional fittings. Field fabrication or substitution of non-Trane Y-Joints shall void warranty. Kits shall be installed per manufacturer guidelines. Requires field installation.
- B. T-Joint Kits – are a required component for Trane VRF systems capable of operating multiple outdoor modules on a single system, (check catalog(s) for factory approved combinations). The T-Joint shall be provided for liquid, suction, and hot gas fittings as required. T-Joints shall be provided with polystyrene insulation. T-Branched shall facilitate different pipe sizes without having to braze additional fittings. Field fabrication or substitution of non-Trane T-joints shall void warranty. Kits shall be installed per manufacturer guidelines. Requires field installation.
- C. EEV KITS- the EEV (Electronic Expansion Valve) provides refrigerant management of indoor units. The EEV shall be required for field installation on ceiling suspended (floor) indoor units. Heat Recovery systems shall use the one unit EEV kit. Heat Pump systems may utilize the one, two, or three unit EEV kits. Kits shall be installed per manufacturer guidelines. Requires field installation.
- D. Condensate Drain Pumps shall be provided for field installation as required for efficient condensate management. Condensate pumps shall be capable of 29.5" of lift to allow condensate to reach the closest gravity drain line. Condensate pumps shall include a check valve to prevent water from flowing back into the indoor unit. Pump shall be mounted in the chassis of the indoor unit. Pump shall draw on required power from the associated indoor unit. Requires field installation (Standard factory installed for all ceiling cassettes and MSP Ducted).
- E. Refrigerant Isolation Ball Valves - shall be provided for field installation as specified by the contract documents. Valves shall utilize a uni-body full port design to minimize leaks

and internal pressure drops. Valves shall be rated for 700PSIG, and are offered with an optional factory insulation package. Valves shall be factory tested under pressure. Valves shall require polytetrafluoroethylene (PTFE) seals and gaskets. No synthetic O-rings are allowed. Design shall permit valve operation without removal of seal cap. Valves shall have a temperature operation range of -40°F to 300°F. Valves shall have a UL listing for the application they are intended. Requires field installation.

- F. Wireless remote temperature controller can be used with all Trane VRF Indoor Units. (Ducted units require the use of the VRF Duct Signal Receiver Kit.) Remote shall utilize a multi-function LCD display and shall possess the following functionality:

1. Power on/off setting
2. Infrared control of IDU
3. Battery operated
4. Utilizes indoor unit mounted temperature sensor for temperature control.
5. ON/OFF Control
6. Mode Selection
7. Temperature Set-point
8. Fan Speed Setting
9. Adjustment of individual airflow blade control (cassette units).
10. Dirty Filter Alert
11. 4 transmission channel options can separate control to specific IDU.
12. Requires VRF Duct Signal receiver for ducted units.

- G. Simple wired remote controller can be used with all Trane VRF Indoor Units. Remote shall utilize a multi-function LCD display and shall possess the following functionality:

1. Power on/off setting
2. Mode selection
3. Temperature set point control
4. Fan speed setting
5. On/off timer
6. Controls up to 16 idus
7. Up to 2 simple remotes may be configured as Master Slave for 1 IDU
8. Child lock
9. Filter timer

- H. Simple Touch Remote Controller can be used with all Trane VRF Indoor Units. Remote shall utilize an intuitive touchscreen multi-function LCD display and shall possess the following functionality:

1. Power on/off setting
2. Intuitive touch pad
3. Integral space temperature thermistor
4. Temperature set point control
5. Fahrenheit or Centigrade
6. Mode control settings (auto/cool/dry/fan/heat)
7. Fan control settings (auto/high/medium/low)
8. Sleep function
9. Filter timer
10. Access restriction settings
11. Occupied/unoccupied (manual function)
12. IDU vane position control (cassette units)

13. Integrated IR receiver
 14. Controls up to 16 idus
 15. Up to 2 simple remotes may be configured as Master Slave for 1 IDU
- I. Wired Remote Temperature Controller can be used with all Trane VRF Indoor Units. Remote shall utilize a multi-function LCD display and shall possess the following functionality:
1. Power on/off setting
 2. Temperature set point control
 3. Built-in room temperature sensor
 4. Operation mode: Auto-Cool-Dry-Fan-Heat
 5. Fan speed: Auto-Low-Med-High
 6. Filter alarm reset (timer)
 7. Individual airflow blade control on cassette units
 8. Controls up to 16 IDUs
 9. Real-time clock includes current time, day display
 10. Daylight savings time adjustment (program in the date)
 11. Weekly operating scheduling
 12. Motion Detection/Away function (applies to enabled IDUs)
 13. Upper/Lower temperature limit settings
 14. Up to 2 remotes may be averaged as single controller for 1 IDU
 15. Error display
 16. Service Mode provides configuration settings
 17. Security lock code
- J. External Room Temperature Sensor is wall-mounted to provide accurate room temperature sensing for an associated VRF cooling and heating unit. It is used in place of the unit-mounted return air sensor provided with VRF indoor units. It may also be used when there is a desire to prohibit direct occupant control. Requires field installation.
- K. The VRF Duct Signal Receiver is a wall or ceiling-mounted device that receives signals from the Wireless (Infrared) Remote Control. It re-transmits those signals to an associated concealed VRF Indoor Unit. This allows for use of remote control of concealed indoor units. Requires field installation.
- L. Motion Detector is an optional component for the Mini 4-Way cassette that offers a smart solution to saving energy and costs. It works by turning off the air conditioning system once it detects the absence of any users in the vicinity. Energy efficiency is further maximized through its ability to automatically identify and set operation patterns. The Motion Detector Sensor prevents air flow from blowing directly onto a person by adjusting the blade direction when motion is detected. This creates a more constant and comfortable environment. The motion sensor must be used with the wired remote controller, (TVCTRLTWRWD01T). Requires field installation.
- M. External Contact Interface shall permit the on/off control of indoor units through an external input. The device will also allow the indoor unit to interlock control of external devices. This will allow the external devices to operate in sequence with the interlocked indoor unit.
- N. Auxiliary heat contact shall enable the operation of external auxiliary supplemental heat. Standard Cassette Panels shall be required with as indicated for all 1-way, Mini 4-way, and 4-way ceiling cassettes.

- O. Filter Box is an optional return filter box (rear placement) that enables the use of high efficient filters with ducted concealed indoor units. If using the optional return filter box, verify the filter/filter box performance is within the bounds of the unit's external pressure performance. Filter box shall ship with one set of 2" MERV 13 filters. Requires field installation.
- P. Electric Heater Kit allows a Convertible Air Handling Unit (only) to provide supplemental heat with an optional electric resistance heater. The electric heater shall be available in 4KW, 5KW, 8KW, 10KW, 15KW, and 20 KW sizes. Heater kits are available with circuit breaker, pull disconnect, or lug connections (choose one). Review product IOM (VRF-SVX038*-EN or VRF-SVX040*-EN) for specific kit details. Requires field installation.
- Q. Single point power entry kit allows a Convertible Air Handling Unit (only) to use single point power if the desired Electric Heater kit is greater than 10 KW. Heaters 10KW and less are single point connection as standard. Requires field installation.
- R. Hail guards shall protect the air source condenser coil(s) from damaging hail. Requires field installation.
- S. Wind/Snow Prevention Duct. The kits are used in windy or snowy regions to prevent cold gusts of air from interfering with stable operation of the units. They are also for use in snowy regions to prevent snow from accumulating on the units. The kit is recommended when low ambient heating is required. The Wind/Snow prevention kit may require the additional use of the Duct Discharge Kit. Requires field installation.
- T. Snow Hood/Duct Discharge Kit protects the Air Source VRF Outdoor unit from heavy snowfall. The kit also allows the Air Source VRF unit to be located inside a structure, and duct the condenser discharge air to the exterior of the structure. Requires field installation.

PART 3 - EXECUTION

3.01 GENERAL

- A. Install units as indicated on the drawings, in accordance with manufacturer's recommendations and according to applicable codes.
- B. The contractor shall locate the BC Controller as required to minimize the line lengths to the indoor and outdoor units. The maximum length recommended by the manufacturer shall not be exceeded. The locations of the controllers shown on the plans are diagrammatic only. The actual locations are dependent upon several variables including routing of the refrigerant lines, heights of the refrigerant lines and controllers and the exact location of the indoor units.
- C. Contractor shall verify that locations of units shall permit service or removal of unit without interference with piping, conduit, light fixtures or structure.
- D. Piping to the units shall be routed to allow filter replacement and full accessibility to access the unit for service.
- E. Both refrigerant lines from the outdoor unit to the BC (Branch Circuit) Controller and from

the controller to each indoor unit shall be insulated.

END OF SECTION

SECTION 26 01 01 BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL REQUIREMENTS

1.1 RELATED DOCUMENTS

- A. The following codes and standards are referenced in this document.
 - 1. NFPA 70, National Electrical Code, 2011
 - 2. ASHRAE 90.1, Energy Standard for Buildings, 2007
 - 3. International Fire Code (IFC) 2009
 - 4. International Building Code (IBC) 2009
 - 5. Americans with Disabilities Act Accessibility Guidelines (ADAAG) 2010
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SCOPE OF WORK

- A. Arrange with the local utility companies for providing such electrical services as shown on drawings or herein specified. Coordinate all requirements for the electrical services shown on the plans with the utility engineering and construction supervisors prior to bidding and/or roughing.
- B. Remove or relocate all electrical services located on or crossing through the Project property, either above or below grade, which would obstruct the construction of the Project or conflict in any manner with the completed Project or any Code pertaining thereto.
- C. Furnish and install complete temporary electrical light and power system during construction period. The required temporary lighting required during finish work shall be sufficient so as to facilitate other trades (finishes). Coordinate lighting requirements where interior finishes are being applied with the general contractor and/or painting subcontractor.
- D. Furnish and install complete electrical light and power systems.
- E. Connect all meters, switchboards, panelboards, dry type transformers, circuit breakers, power outlets, convenience outlets, switches and/or other equipment forming part of the system.
- F. Furnish and install complete system of outlet boxes, blank faceplates, conduit raceways and terminal cabinets for IT and security systems system.
- G. Connect all electrical equipment noted in this Section or noted on Drawings, whether furnished by Electrical Contractor or by others.
- H. The electrical contractor shall review all sections of the contract documents (Plans and Specifications) and shall endeavor to determine all equipment requiring electrical power whether shown on the electrical plans or not. Notify the Electrical Engineer in writing prior to the bid with any discrepancies with mechanical and/or plumbing plans. Include in bid price all required materials and labor required for a full functioning system/building.
- I. Connect all mechanical and plumbing equipment as required to provide a full functioning system as specified by the Mechanical Engineer. Verify locations for all dampers, circulating pumps, and other loads with the mechanical and plumbing plans prior to bidding.
- J. Install all starters as shown on plans or as called for in these Specifications. All starters shall be NEMA rated.
- K. Furnish and install all disconnect switches.

- L. Furnish and install power wiring and connection for starters and motors. Furnish and install all control wiring specifically shown on drawings or as required to make the system operational as designed.
- M. Furnish and install Auxiliary Systems as shown on the Drawings and as required.
- N. Procure and pay for permits and certificates as required by local and state ordinances and Fire Underwriters Certificate of Inspection.
- O. Submit to Architect, a certificate of Final Inspection from local inspection department.
- P. Work noted "NIC" (Not in Contract) shall be excluded from the work to be done by this trade, as follows:
 - 1. A complete System of Control Wiring for the Mechanical System (unless specifically shown on Drawings).
 - 2. Motors in place by others, connection for correct rotation by this trade.

1.3 DRAWINGS AND SPECIFICATIONS

- A. Electrical work is shown on drawings inclusive. Follow any supplementary drawings as though listed above.
- B. Drawings and Specifications are complementary. Work called for by one is binding as if called for by both.
- C. Drawings show general run of circuits and approximate location of equipment. Right is reserved to change location of equipment and devices and routing of conduits to a reasonable extent, without extra cost to Owner.
- D. Refer conflicts between drawings and specifications describing electrical work and work under other Sections to Architect for remedial action.
- E. Use dimensions in figures in preference to scaled dimensions. Do not scale drawings for exact sizes or locations.
- F. Execution of Contract is evidence that Contractor has examined all drawings and specifications related to work, and is informed to extent and character of work. Later claims for labor and materials required due to difficulties encountered, which should have been foreseen had examination been made, will not be recognized.

1.4 PROJECT COORDINATION MEETINGS

- A. Promptly after award of the Contract, and prior to commencing any project related activities. The Successful Electrical Contractor shall contact the Electrical Engineer to schedule an acceptable date and time for the initial project coordination meeting. This meeting will be held at the Electrical Engineer's office at the scheduled time to discuss any/all issues related to the electrical aspects of the Project. The Contractor, as well as the contractor's job foreman for the project is required to attend this meeting. The contractor shall furnish a complete set of Plans and Specifications at this meeting.

1.5 EXISTING CONDITIONS

- A. The Contractor shall visit the site and determine all conditions which affect this Contract. Contractor shall include in bid price cost of relocating any electrical or auxiliary lines and/or equipment as required whether shown or not. Failure to do so will in no way relieve Contractor of his/her responsibility under this contract.

1.6 TEMPORARY SYSTEMS

- A. The Contractor shall be responsible for the furnishing and installation of all equipment and materials necessary for providing electrical power and lighting to the new buildings during construction. All temporary wiring shall be made in a safe and approved manner.
- B. It shall be the responsibility of the electrical contractor to visit the site prior to submitting bid and thoroughly review all existing conditions affecting the temporary systems requirements.
- C. The contractor shall provide temporary lighting levels (average value 50 foot-candles) where interior finishes are being applied. Coordinate with general contractor for required lighting.

1.7 CONTRACTOR QUALIFICATIONS

- A. The Electrical Contractor shall use State of Alabama licensed masters and journeymen electricians as job superintendents. The Electrical Contractors superintendent (Journeyman or Master Electrician) shall be on site when electrical work is being performed. The Electrical Contractor shall have on Journeyman or Master Electrical on site for every eight (8) apprentices.
- B. The Electrical Contractor and his/her sub-contractors shall have been in business (under the same name and principal control) for five (5) years prior to date of opening bids and shall have past experience in the types of work involved in this project, and be regularly engaged in all the applicable types of work. Documentation shall be provided on past projects with references and contact information for at least three projects or similar type, size and scope.

1.8 INSURANCE

- A. This contractor shall carry Workmen's Compensation Insurance, Public Liability Insurance and shall save Owner free from all damage from suits arising out of the performance of this Contract.

1.9 QUALITY ASSURANCE

- A. All work shall be in accordance with the NFPA 70 National Electrical Code NEC 2011 and the rules and regulations of the local bodies having jurisdiction.
- B. The published standards and requirements of the National Electrical Manufacturers Association, the American National Standard Institute, the Institute of Electrical and Electronic Engineers, and the American Society of Testing Materials, are made a part of these specifications and shall apply wherever applicable.
- C. Work under this Section shall be first class with emphasis on neatness and workmanship.
- D. Install work using competent mechanics under supervision of foreman, all duly certified by local authorities. Installation subject to Architect's constant observation, final approval, and acceptance. Architect may reject unsuitable work.
- E. Furnish Architect written guarantee, stating that if workmanship and/or material executed under this Section is proven defective within one (1) year after final acceptance, such defects and other work damaged will be repaired and/or replaced.
- F. In event that project is occupied or systems placed in operation in several phases at Owner's request, guarantee will begin on date each system or item of equipment is accepted by the Owner.
- G. Listing and Labeling: Provide products specified in this Section that are listed and labeled. The Terms "Listed and Labeled": As defined in the National Electrical Code, Article 100.

1.10 ON-SITE OBSERVATIONS AND DEMONSTRATION OF FUNCTIONALITY

- A. Contractor shall notify Engineer at least three (3) days prior to covering any underground feeders, pouring slab, installing ceiling systems in order to allow time for on-site observations.

- B. At all observations of work, open panel covers, junction box covers, pull box covers, device covers, and other equipment with removable plates for check. Provide sufficient personnel to expedite cover removal and replacement.
- C. Contractor to assist Architect in demonstration of operation of new systems to satisfaction of Owner. Contractor to have manufacturer available for demonstration of systems where requested by Owner or as called for in other sections of this specification. Contractor shall notify Engineer and Architect two (2) weeks prior to demonstration of systems where manufacturer assistance is required.
- D. Perform test required by Architect to indicate compliance with specifications, drawings and applicable codes. Provide instruments, labor and materials for tests.

1.11 PROTECTION OF PERSONS AND PROPERTY DURING CONSTRUCTION

- A. Take all precautions to provide safety and protection to persons and protection of materials and property as necessary, including protection from injury from rotating or moving equipment, tools, hot surfaces, holes, shafts, falling objects, electrical energy and all other potential hazards. Erect sign, barricades, warning lights, instruct workmen and others who may be subject to construction hazards.
- B. Protect items of equipment from stain, corrosion, scratches and any other damage or dirt, whether in storage at job site or installed. No damaged or dirty equipment, lenses or reflectors will be accepted.

1.12 CLEARANCE WITH UTILITIES

- A. Before submitting a proposal, check with all authorities or utilities concerned as to points of connection with power and telephone lines, installation of transformers, location of service cut-in and metering, requirements as to any additional service equipment, and other details of the installation. If their requirements are at variance with these specifications or drawings and involve extra expense, these requirements shall be included in bid and the contract price shall include all costs necessary to meet those requirements without extra cost to the Owner after a contract is entered into.

1.13 CHANGES ORDERS AND ADDITIONAL WORK

- A. No change shall be made from the work as called for by these specifications and drawings except on written order of the Architect. Deviations from drawings and specifications shall be made in submittal form and shall include all information for approval including drawings where required. No change for extra work will be allowed unless such extra work has been duly authorized by a written order of the Architect stating the change to be made.

1.14 SEQUENCING AND SCHEDULING

- A. Coordinate electrical equipment installation with other building components.
- B. Arrange for chases, slots, and openings in building structure during progress of construction to allow for electrical installations.
- C. Coordinate installing required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- D. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning prior to closing in the building.
- E. Coordinate connecting electrical service to components furnished under other Sections.
- F. Coordinate connecting electrical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.

- G. Coordinate installing electrical identification after completion of finishing where identification is applied to field-finished surfaces.
- H. Coordinate installing electrical identifying devices and markings prior to installing acoustical ceilings and similar finishes that conceal such items.

1.15 AS-BUILT DRAWINGS

- A. Contractor to provide to owner at project completion the following:
 - 1. Two (2) compact disc/DVD volumes with color pdf files showing any/all deviations to the contract documents.
 - 2. One each set of electrical plans on reproducible media indicating any/all deviations to contract documents.
 - 3. Two each sets of electrical plans (blue prints) indicating any/all deviations to contract documents.
 - 4. There will be a \$100 service charge for electronic drawings. Submit your request in writing and include a check payable to Jack R. Morgan Engineering, Inc.

1.16 COORDINATION WITH OTHER TRADES

- A. Review all specification sections and drawings including HVAC, plumbing and other equipment drawings and other divisions of the specifications for equipment requiring electrical service. Provide service to and make connections to all such equipment requiring electrical service.
- B. Contractor to coordinate all aspects of mechanical equipment furnished and installed by others with approved equipment submittals prior to any roughing. It is the responsibility of this contractor to coordinate phase, voltage, minimum circuit amps and maximum over-current protective devices with approved submittals prior to roughing. Coordinate exact connection locations with the mechanical contractor prior to any roughing. Notify engineer in writing of discrepancies between the plans and the approved equipment data.
- C. Contractor to coordinate all aspects of plumbing equipment furnished and installed by others with approved equipment submittals prior to any roughing. It is the responsibility of this contractor to coordinate phase, voltage, minimum circuit amps and maximum over-current protective devices with approved equipment submittals prior to roughing. Coordinate exact connection locations with plumbing contractor prior to any roughing. Notify engineer in writing of discrepancies between the plans and the approved equipment data.

PART 2 - ELECTRICAL PRODUCT REQUIREMENTS

2.1 SUBMITTALS AND MATERIALS DATA

- A. **For this project - all submittals under this division shall be provided in searchable PDF file format. All warranty materials and O&M manuals shall be provided in searchable PDF file format - NO EXCEPTIONS.**
- B. The approval of shop drawing shall not be interpreted as a complete check by the Engineer, but will indicate only that the general specifications for the equipment to be provided is satisfactory. Approval of such drawings does not relieve the contractor of responsibility of coordination of components, auxiliary equipment, accessories or special conditions required for satisfactory operation of the completed system.
- C. All shop drawings for a specific item shall be made in one submittal. No submittals will be checked until all required submittals are received by the Engineer. All submittals must be approved prior to commencing any work on this project.
- D. The electrical contractor shall check all suppliers' submittals regarding measurements, capacity, performance and details to satisfy him/herself that they conform to the intent of the contract drawings and specifications. Shop drawings and submittals shall bear the stamp of approval of

the Contractor as evidence that the drawings have been checked by him. Drawings submitted without this stamp of approval will not be considered and will be returned for contractor approval and stamp. A minimum of ten (10) working days shall be allowed for checking for submittals.

- E. Any materials and equipment listed which are not in accordance with specification requirements may be rejected.
- F. All submittals shall clearly identify the item submitted. Standard catalog sheets shall be marked, in ink, so as to identify which item is to be considered. All drawings submitted must be by factory as field drawings will not be accepted.

2.2 ELECTRICAL PRODUCT SUBSTITUTIONS

- A. Any proposed substitution of equipment or materials from that specified must be submitted in writing to the Engineer within ten (10) days prior to the bid date. The Engineer will respond in writing as to the acceptance/rejection of the proposed product. Faxed transmittals, e-mails and verbal requests will not be considered.
- B. All proposed substitutions shall clearly identify the item submitted as well as the technical information which is called for in other portions of the Electrical Divisions of this Specification. Standard catalog sheets shall be marked, in ink, so as to identify which item is to be considered. All drawings submitted must be by factory as field drawings will not be accepted.
- C. Responses to proposed substitutions will be in writing and delivered U.S. mail. Include return mailing address in substitution request package.

PART 3 - EXECUTION

NOT APPLICABLE

END OF SECTION

SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

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:
 - 1. Building wires and cables rated 600 V and less.
 - 2. Connectors, splices, and terminations rated 600 V and less.

1.3 DEFINITIONS

- A. VFC: Variable frequency controller.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.5 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Alcan Products Corporation; Alcan Cable Division.
 - 2. Encore Wire Corporation.
 - 3. General Cable Technologies Corporation.
 - 4. Southwire Incorporated.
- B. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.
- C. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN-2-THWN-2, Type XHHW-2, and Type SO.
- D. VFC Cable:
 - 1. Comply with UL 1277, UL 1685, and NFPA 70 for Type TC-ER cable.
 - 2. Type TC-ER with oversized cross-linked polyethylene insulation, dual spirally wrapped copper tape shields and three bare symmetrically applied ground wires, and sunlight- and oil-resistant outer PVC jacket.
 - 3. Comply with UL requirements for cables in Classes I and II, Division 2 hazardous location applications as required.

2.2 CONNECTORS AND SPLICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AFC Cable Systems, Inc.
 - 2. Hubbell Power Systems, Inc.
 - 3. Ideal Industries, Inc.
 - 4. O-Z/Gedney; a brand of the EGS Electrical Group.
 - 5. 3M; Electrical Markets Division.
 - 6. Tyco Electronics.
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SYSTEM DESCRIPTION

- A. 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.
- B. Comply with NFPA 70.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper - Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger, except VFC cable, which shall be extra flexible stranded.

3.2 CONDUCTOR INSULATION AND WIRING METHODS

- A. Service Entrance: Type XHHW-2, single conductors in raceway (Southwire SIMPull or approved equal). Cross-linked polyethylene (XLP) insulation.
- B. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway (Southwire SIMPull or approved equal).
- C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN/THWN-2, single conductors in raceway (Southwire SIMPull or approved equal).
- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW-2, single conductors in raceway (Southwire SIMPull or approved equal). Cross-linked polyethylene (XLP) insulation.
- E. Exposed Branch Circuits, Including in Crawlspace: Type THHN-2-THWN-2, single conductors in raceway.
- F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-2-THWN-2, single conductors in raceway.
- G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-2-THWN-2, single conductors in raceway.
- H. Branch Circuits Installed below Raised Flooring: Type THHN-2-THWN-2, single conductors in raceway.
- I. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

- J. VFC Output Circuits: Type TC-ER cable with dual tape shield.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- B. Complete raceway installation between conductor and cable termination points according to Section 26 05 33 "Raceways and Boxes" prior to pulling conductors and cables.
- C. 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.
- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- F. Support cables according to Section 26 05 29 "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-486B.
- B. Make splices, terminations, 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, termination, and tap for aluminum conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches of slack.

3.5 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 26 05 53 "Electrical Identification."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 26 05 44 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.7 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to IBC 711 and 712, latest revision."

3.8 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance conductors, all panelboard feeder conductors and conductors feeding the following critical equipment and services for compliance with requirements.
 - a. Generator Set.

- b. Uninterruptible Power Supplies.
 - c. Chillers.
 - d. Cooling Towers.
 - e. Motor Control Centers.
- 2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
- B. Test and Inspection Reports: Prepare a written report to record the following:
 - 1. Procedures used.
 - 2. Results that comply with requirements.
 - 3. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- C. Cables will be considered defective if they do not pass tests and inspections.

END OF SECTION

SECTION 26 05 26 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes: Grounding systems and equipment.
- B. Section includes grounding systems and equipment.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

1.4 INFORMATIONAL SUBMITTALS

- A. Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article, including the following:
 - 1. Test wells.
 - 2. Ground rods.
 - 3. Ground rings.
 - 4. Grounding arrangements and connections for separately derived systems.
 - 5. Grounding for sensitive electronic equipment.
 - 6. Grounding equipment enclosures.
- B. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals to include the following:
 - 1. Instructions for periodic testing and inspection of grounding features at test wells ground rings grounding connections for separately derived systems based on NETA MTS.
 - a. Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
 - b. Include recommended testing intervals.

1.6 QUALITY ASSURANCE

- A. 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.
- B. Comply with UL 467 for grounding and bonding materials and equipment.
- C. Comply with NFPA 70, Section 250 (National Electrical Code) for grounding and bonding.

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: Predrilled rectangular bars of annealed copper, 1/4 by 12 inches in cross section, with 9/32-inch holes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.

2.2 CONNECTORS

- A. Listed and labeled by an NRTL 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, pressure type with at least two bolts.
 - 1. Pipe Connectors: Clamp type, sized for pipe.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- D. Bus-bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

2.3 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel; 3/4 inch diameter by 10 feet in length.
- B. Chemical-Enhanced Grounding Electrodes (where required to achieve specified grounding system resistance values): Copper tube, straight or L-shaped, charged with nonhazardous electrolytic chemical salts.
 - 1. Termination: Factory-attached No. 4/0 AWG bare conductor at least 48 inches long.
 - 2. Backfill Material: Electrode manufacturer's recommended material.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

- B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 2/0 AWG minimum.
 - 1. Bury at least 24 inches below grade.
- C. Grounding Bus: Install in electrical and telephone/IT equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
 - 1. Install bus on insulated spacers 2 inches minimum from wall, 6 inches above finished floor unless otherwise indicated.
 - 2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down to specified height above floor; connect to horizontal bus.
- D. Conductor Terminations and Connections:
 - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 - 2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
 - 3. Connections to Ground Rods at Test Wells: Bolted connectors.
 - 4. Connections to Structural Steel: Welded connectors.

3.2 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
 - 1. Feeders and branch circuits.
 - 2. Lighting circuits.
 - 3. Receptacle circuits.
 - 4. Single-phase motor and appliance branch circuits.
 - 5. Three-phase motor and appliance branch circuits.
 - 6. Flexible raceway runs.
 - 7. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
 - 8. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.
- C. 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.
- D. 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.
- E. Signal and Communication Equipment: In addition to grounding and bonding required by NFPA 70, provide a separate grounding system complying with requirements in TIA/ATIS J-STD-607-A.

1. For telephone, alarm, voice and data, 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.
 2. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-4-by-12-inch grounding bus.
 3. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.
- F. Metal Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.3 INSTALLATION

- A. 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.
- B. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.
- C. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.
1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
 2. For grounding electrode system, install at least three rods spaced at least two-rod lengths from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
- D. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
 3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.
- E. Grounding and Bonding for Piping:
1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
 2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.

3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
- F. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.
- G. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.
- H. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to NFPA 70; use a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG.
 1. If concrete foundation is less than 20 feet long, coil excess conductor within base of foundation.
 2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.

3.4 LABELING

- A. Comply with requirements in Section 260553 "Electrical Identification" for instruction signs. The label or its text shall be green.
- B. Install labels at the telecommunications bonding conductor and grounding equalizer and at the grounding electrode conductor where exposed.
 1. Label Text: "If this connector or cable is loose or if it must be removed for any reason, notify the facility manager."

3.5 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
 2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
 3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells, and at individual ground rods. Make tests at ground rods before any conductors are connected.
 - a. Measure ground resistance no fewer than two full days after 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.
 - b. Perform tests by fall-of-potential method according to IEEE 81.
 4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

- C. Grounding system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.
- E. Report measured ground resistances that exceed the following values:
 - 1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
 - 2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
 - 3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
 - 4. Power Distribution Units or panels serving Electronic Equipment: 3 ohm(s).
- F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION

SECTION 26 05 29 HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Hangers and supports for electrical equipment and systems.
 - 2. Construction requirements for concrete bases.

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. IMC: Intermediate metal conduit.
- C. RMC: Rigid metal conduit.

1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.5 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Steel slotted support systems.
 - 2. Nonmetallic slotted support systems.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:
 - 1. Trapeze hangers. Include Product Data for components.
 - 2. Steel slotted channel systems. Include Product Data for components.
 - 3. Nonmetallic slotted channel systems. Include Product Data for components.
 - 4. Equipment supports.

1.6 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.7 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Comply with NFPA 70.

1.8 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified together with concrete Specifications.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Section 07720 "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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit.
 - b. Cooper B-Line, Inc.; a division of Cooper Industries.
 - c. ERICO International Corporation.
 - d. GS Metals Corp.
 - e. Thomas & Betts Corporation.
 - f. Unistrut; Tyco International, Ltd.
 - g. Wesanco, Inc.
 - 2. Metallic Coatings: Hot-dip galvanized after fabrication and 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 and malleable-iron 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. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- 1) Cooper B-Line, Inc.; a division of Cooper Industries.
 - 2) Empire Tool and Manufacturing Co., Inc.
 - 3) Hilti Inc.
 - 4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - 5) MKT Fastening, LLC.
2. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
 3. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
 4. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
 5. Toggle Bolts: All-steel springhead type.
 6. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements specified elsewhere "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 scheduled in NECA 1, where its Table 1 lists maximum spacings less than stated in 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 or other 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 two-bolt conduit clamps.
- D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. 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.
- C. 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.
- D. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements specified elsewhere "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified elsewhere.
- C. Anchor equipment to concrete base.
 1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
 3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Touchup: Comply with requirements specified elsewhere in these specifications for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 26 05 33 RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Metal conduits, tubing, and fittings.
 - 2. Non-metal conduits, tubing, and fittings.
 - 3. Metal wireways and auxiliary gutters.
 - 4. Non-metal wireways and auxiliary gutters.
 - 5. Surface raceways.
 - 6. Boxes, enclosures, and cabinets.
 - 7. Hand holes and boxes for exterior underground cabling.

1.3 DEFINITIONS

- A. ARC: Aluminum rigid conduit.
- B. GRC: Galvanized rigid steel conduit.
- C. IMC: Intermediate metal conduit.

1.4 ACTION SUBMITTALS

- A. Product Data: For all products specified in this section.
- B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.
- C. Samples: For wireways and/or nonmetallic wireways and surface raceways and for each color and texture specified, 12 inches long.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
 - 1. Structural members in paths of conduit groups with common supports.
 - 2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.
- B. Qualification Data: For professional engineer.
- C. Seismic Qualification Certificates: For enclosures, cabinets, and conduit racks and their mounting provisions, including those for internal components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
 4. Detailed description of conduit support devices and interconnections on which the certification is based and their installation requirements.
- D. Source quality-control reports.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. AFC Cable Systems, Inc.
 2. Allied Tube & Conduit; a Tyco International Ltd. Co.
 3. Anamet Electrical, Inc.
 4. Electri-Flex Company.
 5. O-Z/Gedney; a brand of EGS Electrical Group.
 6. Picoma Industries, a subsidiary of Mueller Water Products, Inc.
 7. Republic Conduit.
 8. Robroy Industries.
 9. Southwire Company.
 10. Thomas & Betts Corporation.
 11. Western Tube and Conduit Corporation.
 12. Wheatland Tube Company; a division of John Maneely Company.
- B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. GRC: Comply with ANSI C80.1 and UL 6.
- D. ARC: Comply with ANSI C80.5 and UL 6A.
- E. IMC: Comply with ANSI C80.6 and UL 1242.
- F. EMT: Comply with ANSI C80.3 and UL 797.
- G. FMC: Comply with UL 1; zinc-coated steel.
- H. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
- I. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
 2. Fittings for EMT:
 - a. Material: Steel.
 - b. Type: Setscrew or compression.
 3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.

- J. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. AFC Cable Systems, Inc.
 2. Anamet Electrical, Inc.
 3. Arnco Corporation.
 4. CANTEX Inc.
 5. CertainTeed Corp.
 6. Condux International, Inc.
 7. Electri-Flex Company.
 8. Kraloy.
 9. Lamson & Sessions; Carlon Electrical Products.
 10. Niedax-Kleinhuis USA, Inc.
 11. RACO; a Hubbell company.
 12. Thomas & Betts Corporation.
- B. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
- D. LFNC: Comply with UL 1660.
- E. RTRC: Comply with UL 1684A and NEMA TC 14.
- F. Fittings for RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
- G. Fittings for LFNC: Comply with UL 514B.
- H. Solvent cements and adhesive 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."

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Cooper B-Line, Inc.
 2. Hoffman; a Pentair company.
 3. Mono-Systems, Inc.
 4. Square D; a brand of Schneider Electric.
- B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.
1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

- C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- D. Wireway Covers: Screw-cover type unless otherwise indicated.
- E. Finish: Manufacturer's standard enamel finish.

2.4 SURFACE RACEWAYS

- A. Listing and Labeling: Surface raceways and tele-power poles shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5. Manufacturer's standard enamel finish in color selected by Architect.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Wiremold / Legrand.
 - b. Panduit Corp.
 - c. Hubbell

2.5 BOXES, ENCLOSURES, AND CABINETS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Adalet.
 - 2. Cooper Technologies Company; Cooper Crouse-Hinds.
 - 3. EGS/Appleton Electric.
 - 4. Erickson Electrical Equipment Company.
 - 5. FSR Inc.
 - 6. Hoffman; a Pentair company.
 - 7. Hubbell Incorporated; Killark Division.
 - 8. Kraloy.
 - 9. Milbank Manufacturing Co.
 - 10. Mono-Systems, Inc.
 - 11. O-Z/Gedney; a brand of EGS Electrical Group.
 - 12. RACO; a Hubbell Company.
 - 13. Robroy Industries.
 - 14. Spring City Electrical Manufacturing Company.
 - 15. Stahlin Non-Metallic Enclosures; a division of Robroy Industries.
 - 16. Thomas & Betts Corporation.
 - 17. Wiremold / Legrand.
- B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

- D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.
- E. Non-metallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.
- F. Metal Floor Boxes:
 - 1. Material: As shown on the plans.
 - 2. Type: As shown on the plans.
 - 3. Shape: Rectangular.
 - 4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- G. Non-metallic Floor Boxes:
 - 1. Material: As shown on the plans.
 - 2. Type: As shown on the plans.
 - 3. Shape: Rectangular.
 - 4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- H. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.
- I. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- J. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- K. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.
- L. Gangable boxes [are allowed] [are prohibited].
- M. Hinged-Cover Enclosures: Comply with UL 50 and 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. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.
- N. 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.
 - 6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.6 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

- A. General Requirements for Handholes and Boxes:

1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
 2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Composite Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hubbell - Quazite
 - b. Carson Industries LLC.
 - c. CDR Systems Corporation; Hubbell Power Systems.
 - d. Oldcastle Precast, Inc.; Christy Concrete Products.
 - e. Synertech Moulded Products; a division of Oldcastle Precast, Inc.
 2. Standard: Comply with SCTE 77.
 3. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
 4. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
 5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
 6. Cover Legend: Molded lettering, "ELECTRIC." or as shown on the plans.
- C. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with frame and covers as called for on plans.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armorcast Products Company.
 - b. Carson Industries LLC.
 - c. CDR Systems Corporation; Hubbell Power Systems.
 - d. NewBasis.
 - e. Nordic Fiberglass, Inc.
 - f. Oldcastle Precast, Inc.; Christy Concrete Products.
 - g. Synertech Moulded Products; a division of Oldcastle Precast, Inc.
 2. Standard: Comply with SCTE 77.
 3. Color of Frame and Cover: Green.
 4. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
 5. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
 6. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
 7. Cover Legend: Molded lettering, "ELECTRIC." or as shown on the plans.

2.7 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

- A. Hand hole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
 - 1. Tests of materials shall be performed by an independent testing agency.
 - 2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
 - 3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012 and traceable to NIST standards.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
 - 1. Exposed Conduit: GRC IMC.
 - 2. Concealed Conduit, Aboveground: GRC IMC.
 - 3. Underground Conduit: RNC, Type EPC-40-PVC or Type EPC-80-PVC (as shown on the Plans), direct buried or concrete encased as shown on the Plans.
 - 4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
 - 5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
- B. Indoors: Apply raceway products as specified below unless otherwise indicated:
 - 1. Exposed, Not Subject to Physical Damage: EMT.
 - 2. Exposed, Not Subject to Severe Physical Damage: EMT.
 - 3. Exposed and Subject to Severe Physical Damage: GRC or IMC. Raceway locations include the following:
 - a. Loading dock.
 - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
 - c. Mechanical rooms.
 - 4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
 - 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
 - 6. Damp or Wet Locations: GRC or IMC.
 - 7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.
- C. Minimum Raceway Size: 3/4-inch trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
 - 1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
 - 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after

installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.

3. EMT: Use setscrew or compression, steel fittings. Comply with NEMA FB 2.10.
 4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.
- F. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
- G. Install surface raceways only where indicated on Drawings.

3.2 INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- 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. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
- E. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- F. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.
- G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- H. Support conduit within 12 inches of enclosures to which attached.
- I. Raceways Embedded in Slabs:
1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot intervals.
 2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
 3. Arrange raceways to keep a minimum of 2 inches of concrete cover in all directions.
 4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
 5. Change from RNC, Type EPC-40-PVC, to GRC or IMC before rising above floor.
- J. Stub-ups to Above Recessed Ceilings:
1. Use EMT, IMC, or RMC for raceways.
 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- K. 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.

- L. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.
- M. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
- N. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- O. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- P. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- Q. 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. Cap underground raceways designated as spare above grade alongside raceways in use.
- R. Surface Raceways:
 - 1. Install surface raceway with a minimum 2-inch radius control at bend points.
 - 2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.
- S. Install raceway sealing fittings at accessible locations according to NFPA 70 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 according to NFPA 70.
- T. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
 - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2. Where an underground service raceway enters a building or structure.
 - 3. Where otherwise required by NFPA 70.
- U. Comply with manufacturer's written instructions for solvent welding RNC and fittings.
- V. Expansion-Joint Fittings:
 - 1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet.
 - 2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
 - 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.
 - c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.

- d. Attics: 135 deg F temperature change.
- 3. 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 for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
- 4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
- 5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
- W. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed and semi-recessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
 - 1. Use LFMC in damp or wet locations subject to severe physical damage.
 - 2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.
- X. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to bottom of box unless otherwise indicated.
- Y. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.
- Z. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- AA. Locate boxes so that cover or plate will not span different building finishes.
- BB. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
- CC. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
- DD. Set metal floor boxes level and flush with finished floor surface.
- EE. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

- A. Direct-Buried Conduit:
 - 1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 02300 "Earthwork" for pipe less than 6 inches in nominal diameter.
 - 2. Install backfill as specified in Section 02300 "Earthwork."
 - 3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 02300 "Earthwork."
 - 4. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.

- a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete for a minimum of 12 inches on each side of the coupling.
 - b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.
5. Underground Warning Tape: Comply with requirements in Section 26 05 53 "Electrical Identification."

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.
- D. Install handholes with bottom below frost line.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 26 05 44 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.6 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 07841 "Through-Penetration Firestop Systems."

3.7 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

SECTION 26 05 44

SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

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:
 - 1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
 - 2. Sleeve-seal systems.
 - 3. Sleeve-seal fittings.
 - 4. Grout.
 - 5. Silicone sealants.
- B. Related Requirements:
 - 1. Section 07841 "Through-Penetration Firestop Systems" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Wall Sleeves:
 - 1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
- B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.
- C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.
- D. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.
- E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.
- F. Sleeves for Rectangular Openings:
 - 1. Material: Galvanized sheet steel.
 - 2. Minimum Metal Thickness:
 - a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches, thickness shall be 0.052 inch.
 - b. For sleeve cross-section rectangle perimeter 50 inches or more and one or more sides larger than 16 inches, thickness shall be 0.138 inch.

2.2 SLEEVE-SEAL SYSTEMS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Advance Products & Systems, Inc.
 - b. CALPICO, Inc.
 - c. Metraflex Company (The).
 - d. Pipeline Seal and Insulator, Inc.
 - e. Proco Products, Inc.
 - 2. Sealing Elements: EPDM rubber 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.
 - 4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.3 GROUT

- A. Description: Non-shrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.
- B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

- A. Comply with NECA 1.
- B. Comply with NEMA VE 2 for cable tray and cable penetrations.
- C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
 - 1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
 - a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 07920 "Joint Sealants."
 - b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.
 - 2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
 - 3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed or unless seismic criteria require different clearance.
 - 4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.

SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS & CABLING

5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.
- D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
 1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
 2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.
- E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.
- B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

END OF SECTION

SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Identification for raceways.
 - 2. Identification of power and control cables.
 - 3. Identification for conductors.
 - 4. Underground-line warning tape.
 - 5. Warning labels and signs.
 - 6. Instruction signs.
 - 7. Equipment identification labels.
 - 8. Miscellaneous identification products.

1.3 ACTION SUBMITTALS

- A. Product Data: For each electrical identification product indicated.
- B. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.
- C. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

1.4 QUALITY ASSURANCE

- A. Comply with ANSI A13.1 and IEEE C2.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.5 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, 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 POWER AND CONTROL 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 size.
- B. Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.

2.2 CONDUCTOR IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

2.3 FLOOR MARKING TAPE

- A. 2-inch- wide, 5-mil pressure-sensitive vinyl tape, with yellow and black stripes and clear vinyl overlay.

2.4 UNDERGROUND-LINE WARNING TAPE

- A. Tape:
 - 1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
 - 2. Printing on tape shall be permanent and shall not be damaged by burial operations.
 - 3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.
- B. Color and Printing:
 - 1. Comply with ANSI Z535.1 through ANSI Z535.5.
 - 2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE,.

2.5 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

2.6 INSTRUCTION SIGNS

- A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. inches 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.

2.7 EQUIPMENT IDENTIFICATION LABELS

- A. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch.
- B. Nameplate color and information required on nameplate as shown on the Plans.

2.8 CABLE TIES

- A. General-Purpose Cable Ties: Fungus inert, self extinguishing, one piece, self locking, Type 6/6 nylon.
 - 1. Minimum Width: 3/16 inch.
 - 2. Tensile Strength at 73 deg F, According to ASTM D 638: 12,000 psi.
 - 3. Temperature Range: Minus 40 to plus 185 deg F.
 - 4. Color: Black except where used for color-coding.
- B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self extinguishing, one piece, self locking, Type 6/6 nylon.
 - 1. Minimum Width: 3/16 inch.
 - 2. Tensile Strength at 73 deg F, According to ASTM D 638: 12,000 psi.
 - 3. Temperature Range: Minus 40 to plus 185 deg F.
 - 4. Color: Black.
- C. Plenum-Rated Cable Ties: Self extinguishing, UV stabilized, one piece, self locking.
 - 1. Minimum Width: 3/16 inch.
 - 2. Tensile Strength at 73 deg F, According to ASTM D 638: 7000 psi.
 - 3. UL 94 Flame Rating: 94V-0.
 - 4. Temperature Range: Minus 50 to plus 284 deg F.
 - 5. Color: Black.

2.9 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).
- B. 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 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 mechanical fasteners appropriate to the location and substrate.
- E. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
- F. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:
 - 1. Outdoors: UV-stabilized nylon.

IDENTIFICATION FOR ELECTRICAL SYSTEMS

2. In Spaces Handling Environmental Air: Plenum rated.
- G. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.
- H. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

- A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A, and 120 V to ground: Identify with self-adhesive vinyl tape applied in bands. Install labels at 10-foot maximum intervals.
- B. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:
 1. Emergency Power.
 2. Fire Alarm System.
 3. Power feeders
 4. Intercom System
 5. ETV System
 6. IT Systems
- C. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
 1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service feeder, and branch-circuit conductors.
 - a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
 - b. Colors for 208/120-V Circuits:
 - 1) Phase A: Black.
 - 2) Phase B: Red.
 - 3) Phase C: Blue.
 - 4) Phase A Neutral: White, Black stripe.
 - 5) Phase B Neutral: White, Red stripe.
 - 6) Phase C Neutral: White, Blue stripe.
 - c. Colors for 480/277-V Circuits:
 - 1) Phase A: Brown.
 - 2) Phase B: Orange.
 - 3) Phase C: Yellow.
 - 4) Phase A Neutral: White/Gray, Brown stripe.
 - 5) Phase B Neutral: White, Gray, Orange stripe.
 - 6) Phase C Neutral: White/Gray, Yellow stripe.

IDENTIFICATION FOR ELECTRICAL SYSTEMS

- d. 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.
- D. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.
- E. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive vinyl labels with the conductor or cable designation, origin, and destination.
- F. Control-Circuit Conductor Termination Identification: For identification at terminations provide self-adhesive vinyl labels with the conductor designation.
- G. 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 the Operation and Maintenance Manual.
- H. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.
 - 1. Install underground-line warning tape for both direct-buried cables and cables in raceway.
- I. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.
- J. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Baked-enamel warning signs.
 - 1. Comply with 29 CFR 1910.145.
 - 2. Identify system voltage with black letters on an orange background.
 - 3. Apply to exterior of door, cover, or other access.
 - 4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:
 - a. Power transfer switches.
 - b. Controls with external control power connections.
- K. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
- L. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- high letters for emergency instructions at equipment used for power transfer.
- M. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the 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, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

IDENTIFICATION FOR ELECTRICAL SYSTEMS

1. Labeling Instructions:
 - a. Indoor Equipment (in equipment rooms): Engraved, laminated acrylic or melamine label, screw fastened. Unless otherwise indicated, provide and install nameplates with equipment name, voltage, and phase – nameplate colors unique to system voltage.
 - b. Indoor Equipment (in finished spaces): Engraved, laminated acrylic or melamine label, secured to inside of door. Unless otherwise indicated, provide and install nameplates with equipment name, voltage, and phase – nameplate colors unique to system voltage.
 - c. Outdoor Equipment: Engraved, laminated acrylic or melamine label, screw fastened. Unless otherwise indicated, provide and install nameplates with equipment name, voltage, and phase – nameplate colors unique to system voltage.
 - d. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
 - e. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.
2. Equipment to Be Labeled:
 - a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be engraved, laminated acrylic or melamine label.
 - b. Enclosures and electrical cabinets.
 - c. Access doors and panels for concealed electrical items.
 - d. Switchgear.
 - e. Switchboards.
 - f. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
 - g. Emergency system boxes and enclosures.
 - h. Motor-control centers.
 - i. Enclosed switches.
 - j. Enclosed circuit breakers.
 - k. Enclosed controllers.
 - l. Variable-speed controllers.
 - m. Push-button stations.
 - n. Power transfer equipment.
 - o. Contactors.
 - p. Remote-controlled switches, dimmer modules, and control devices.
 - q. Battery-inverter units.
 - r. Battery racks.
 - s. Power-generating units.
 - t. Monitoring and control equipment.
 - u. UPS equipment.

END OF SECTION

SECTION 26 05 73 ELECTRICAL COORDINATION STUDY

1.1 SCOPE

- A. The contractor shall furnish short-circuit and protective device coordination studies. Studies shall be prepared by a licensed professional engineer in the state of Alabama.
- B. The contractor shall furnish an Arc Flash Hazard Analysis Study per the requirements set forth in the current version of NFPA 70E -*Standard for Electrical Safety in the Workplace*. The arc flash hazard analysis shall be performed according to the IEEE Standard 1584 – 2012, the IEEE *Guide for Performing Arc-Flash Calculations*.
- C. The scope of the studies shall include existing and new distribution equipment.

1.2 RELATED SECTIONS

- A. Drawings and general provisions of the Contract.

1.3 REFERENCES

- A. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
 - 1. IEEE 141 – Recommended Practice for Electric Power Distribution and Coordination of Industrial and Commercial Power Systems
 - 2. IEEE 242 – Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems
 - 3. IEEE 399 – Recommended Practice for Industrial and Commercial Power System Analysis
 - 4. IEEE 241 – Recommended Practice for Electric Power Systems in Commercial Buildings
 - 5. IEEE 1015 – Recommended Practice for Applying Low-Voltage Circuit Breakers Used in Industrial and Commercial Power Systems.
 - 6. IEEE 1584 -Guide for Performing Arc-Flash Hazard Calculations
- B. American National Standards Institute (ANSI):
 - 1. ANSI C57.12.00 – Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers
 - 2. ANSI C37.13 – Standard for Low Voltage AC Power Circuit Breakers Used in Enclosures
 - 3. ANSI C37.010 – Standard Application Guide for AC High Voltage Circuit Breakers Rated on a Symmetrical Current Basis
 - 4. ANSI C 37.41 – Standard Design Tests for High Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches and Accessories.
- C. The National Fire Protection Association (NFPA)
 - 1. NFPA 70 -National Electrical Code, latest edition
 - 2. NFPA 70E – Standard for Electrical Safety in the Workplace

1.4 SUBMITTALS FOR REVIEW/APPROVAL

- A. The studies shall be submitted to the design engineer prior to receiving final approval of

the distribution equipment shop drawings and/or prior to release of equipment drawings for manufacturing. If formal completion of the study may cause delays in equipment shipments, approval from the Engineer may be obtained for a preliminary submittal of data to ensure that the selection of device ratings and characteristics will be satisfactory to properly select the distribution equipment. The formal study will be provided to verify preliminary findings.

1.5 SUBMITTALS FOR CONSTRUCTION

- A. The results of the short-circuit, protective device coordination and arc flash hazard analysis studies shall be summarized in a final report. A minimum of five (5) bound copies of the complete final report shall be submitted. For large system studies, submittals requiring more than five (5) copies of the report will be provided without the section containing the computer printout of the short-circuit input and output data. Electronic PDF copies of the report shall be provided upon request.
- B. The report shall include the following sections:
 - 1. Executive Summary including Introduction, Scope of Work and Results/Recommendations.
 - 2. Short-Circuit Methodology Analysis Results and Recommendations
 - 3. Short-Circuit Device Evaluation Table
 - 4. Protective Device Coordination Methodology Analysis Results and Recommendations
 - 5. Protective Device Settings Table
 - 6. Time-Current Coordination Graphs and Recommendations
 - 7. Arc Flash Hazard Methodology Analysis Results and Recommendations including the details of the incident energy and flash protection boundary calculations, along with Arc Flash boundary distances, working distances, Incident Energy levels and Personal Protection Equipment levels.
 - 8. Arc Flash Labeling section showing types of labels to be provided. Section will contain descriptive information as well as typical label images.
 - 9. One-line system diagram that shall be computer generated and will clearly identify individual equipment buses, bus numbers used in the short-circuit analysis, cable and bus connections between the equipment, calculated maximum short-circuit current at each bus location, device numbers used in the time-current coordination analysis, and other information pertinent to the computer analysis.

1.6 QUALIFICATIONS

- A. The short-circuit, protective device coordination and arc flash hazard analysis studies shall be conducted under the responsible charge and approval of a Registered Professional Electrical Engineer skilled in performing and interpreting the power system studies.
- B. The Registered Professional Electrical Engineer shall be an employee of the equipment manufacturer or an approved engineering firm.
- C. The Registered Professional Electrical Engineer shall have a minimum of five (5) years of experience in performing power system studies.

1.7 COMPUTER ANALYSIS SOFTWARE

- A. The studies shall be performed using SKM Systems Analysis Power*Tools for Windows

(PTW) software program or approved equal.

PART 2 PRODUCT

2.1 STUDIES

- A. The contractor shall furnish an Arc Flash Hazard Analysis Study per NFPA 70E -Standard for Electrical Safety in the Workplace, reference Article 130.3 and Annex D. This study shall also include short-circuit and protective device coordination studies. All studies to be prepared by a Alabama-licensed engineer.

2.2 DATA

- A. Contractor shall furnish all data as required for the power system studies. The Engineer performing the short-circuit, protective device coordination and arc flash hazard analysis studies shall furnish the Contractor with a listing of required data immediately after award of the contract. The Contractor shall expedite collection of the data to assure completion of the studies as required for final approval of the distribution equipment shop drawings and/or prior to the release of the equipment for manufacturing.
- B. Source combination may include present and future motors and generators.
- C. Load data utilized may include existing and proposed loads obtained from Contract Documents provided by Owner, or Contractor.
- D. If applicable, include fault contribution of existing motors in the study. The Contractor shall obtain required existing equipment data, if necessary, to satisfy the study requirements.

2.3 SHORT-CIRCUIT ANALYSIS

- A. Transformer design impedances shall be used when test impedances are not available.
- B. Provide the following:
 - 1. Calculation methods and assumptions
 - 2. Selected base per unit quantities
 - 3. One-line diagram of the system being evaluated that clearly identifies individual equipment buses, bus numbers used in the short-circuit analysis, cable and bus connections between the equipment, calculated maximum short-circuit current at each bus location and other information pertinent to the computer analysis
 - 4. The study shall include input circuit data including electric utility system characteristics, source impedance data, conductor lengths, number of conductors per phase, conductor impedance values, insulation types, transformer impedances and X/R ratios, motor contributions, and other circuit information as related to the short-circuit calculations.
 - 5. Tabulations of calculated quantities including short-circuit currents, X/R ratios, equipment short-circuit interrupting or withstand current ratings and notes regarding adequacy or inadequacy of the equipment rating.
 - 6. Results, conclusions, and recommendations. A comprehensive discussion section evaluating the adequacy or inadequacy of the equipment must be provided and include recommendations as appropriate for improvements to the system.

- C. For solidly-grounded systems, provide a bolted line-to-ground fault current study for applicable buses as determined by the engineer performing the study.
- D. Protective Device Evaluation:
 - 1. Evaluate equipment and protective devices and compare to short circuit ratings
 - 2. Adequacy of switchgear, motor control centers, and panelboard bus bars to withstand short-circuit stresses
 - 3. The study engineer shall notify Owner in writing, of any circuit protective devices improperly rated for the calculated available fault current.

2.4 PROTECTIVE DEVICE TIME-CURRENT COORDINATION ANALYSIS

- A. Protective device coordination time-current curves (TCC) shall be displayed on log-log scale graphs.
- B. Include on each TCC graph, a complete title with descriptive device names.
- C. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which the device is exposed.
- D. Identify the device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.
- E. Plot the following characteristics on the TCC graphs, where applicable:
 - 1. Low voltage equipment circuit breaker trip devices, including manufacturer's tolerance bands
 - 2. Transformer full-load current, magnetizing inrush current, and ANSI through-fault protection curves
 - 3. Medium voltage conductor damage curves
 - 4. Ground fault protective devices, as applicable
 - 5. Pertinent motor starting characteristics and motor damage points, where applicable
 - 6. Pertinent generator short-circuit decrement curve and generator damage point
 - 7. The largest feeder circuit breaker in each motor control center and applicable panelboard.
- F. Provide adequate time margins between device characteristics such that selective operation is provided, while providing proper protection.
- G. Provide the following:
 - 1. A One-line diagram shall be provided which clearly identifies individual equipment buses, bus numbers, device identification numbers and the maximum available short-circuit current at each bus when known.
 - 2. A sufficient number of log-log plots shall be provided to indicate the degree of system protection and coordination by displaying the time-current characteristics of series connected overcurrent devices and other pertinent system parameters.
 - 3. Computer printouts shall accompany the log-log plots and will contain descriptions for each of the devices shown, settings of the adjustable devices, and device identification numbers to aid in locating the devices on the log-log plots and the system one-line diagram.

4. The study shall include a separate, tabular printout containing the recommended settings of all adjustable overcurrent protective devices, the equipment designation where the device is located, and the device number corresponding to the device on the system one-line diagram
5. A discussion section which evaluates the degree of system protection and service continuity with overcurrent devices, along with recommendations as required for addressing system protection or device coordination deficiencies.
6. The study engineer shall notify Owner in writing of any significant deficiencies in protection and/or coordination. Provide recommendations for improvements.

2.5 ARC FLASH HAZARD ANALYSIS

- A. The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA70E-2012, Annex D. The arc flash hazard analysis shall be performed in conjunction with the short-circuit analysis (Section 2.03) and the protective device time-current coordination analysis (Section 2.04)
- B. The flash protection boundary and the incident energy shall be calculated at significant locations in the electrical distribution system (switchboards, switchgear, motor-control centers, panelboards, busway and splitters) where work could be performed on energized parts.
- C. Circuits 240V or less fed by single transformer rated less than 125 kVA may be omitted from the computer model and will be assumed to have a hazard risk category 0 per NFPA 70E.
- D. Working distances shall be based on IEEE 1584. The calculated arc flash protection boundary shall be determined using those working distances.
- E. When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short-circuit and coordination study model. Ground overcurrent relays should not be taken into consideration when determining the clearing time when performing incident energy calculations
- F. The short-circuit calculations and the corresponding incident energy calculations for multiple system scenarios must be compared and the greatest incident energy must be uniquely reported for each equipment location in a single table. Calculations must be performed to represent the maximum and minimum contributions of fault current magnitude for normal and emergency operating conditions. The minimum calculation will assume that the utility contribution is at a minimum. Conversely, the maximum calculation will assume a maximum contribution from the utility. Calculations shall take into consideration the parallel operation of synchronous generators with the electric utility, where applicable as well as any stand-by generator applications.

The Arc-Flash Hazard Analysis shall be performed utilizing mutually agreed upon facility operational conditions, and the final report shall describe, when applicable, how these conditions differ from worst-case bolted fault conditions.

- G. The incident energy calculations must consider the accumulation of energy over time when performing arc flash calculations on buses with multiple sources. Iterative calculations must take into account the changing current contributions, as the sources are

interrupted or decremented with time. Fault contribution from motors should be decremented as follows:

1. Fault contribution from induction motors should not be considered beyond 5 cycles.
- H. For each piece of ANSI rated equipment with an enclosed main device, two calculations shall be made. A calculation shall be made for the main cubicle, sides, or rear; and shall be based on a device located upstream of the equipment to clear the arcing fault. A second calculation shall be made for the front cubicles and shall be based on the equipment's main device to clear the arcing fault. For all other non-ANSI rated equipment, only one calculation shall be required and it shall be based on a device located upstream of the equipment to clear the arcing fault.
- I. When performing incident energy calculations on the line side of a main breaker (as required per above), the line side and load side contributions must be included in the fault calculation.
- J. Miss-coordination should be checked amongst all devices within the branch containing the immediate protective device upstream of the calculation location and the calculation should utilize the fastest device to compute the incident energy for the corresponding location.
- K. Arc Flash calculations shall be based on actual overcurrent protective device clearing time. A maximum clearing time of 2 seconds will be used based on IEEE 1584-2002 section B.1.2. Where it is not physically possible to move outside of the flash protection boundary in less than 2 seconds during an arc flash event, a maximum clearing time based on the specific location shall be utilized.
- L. Provide the following:
1. Results of the Arc-Flash Hazard Analysis shall be submitted in tabular form, and shall include device or bus name, bolted fault and arcing fault current levels, flash protection boundary distances, working distances, personal-protective equipment classes and AFIE (Arc Flash Incident Energy) levels.
 2. The Arc-Flash Hazard Analysis shall report incident energy values based on recommended device settings for equipment within the scope of the study.
 3. The Arc-Flash Hazard Analysis may include recommendations to reduce AFIE levels and enhance worker safety.

PART 3 EXECUTION

3.1 FIELD ADJUSTMENT

- A. Contractor shall adjust relay and protective device settings according to the recommended settings table provided by the coordination study.
- Field adjustments to be completed by study engineer under the separate Startup and Acceptance Testing contract portion of project specifications.
- B. Contractor shall make minor modifications to equipment as required to accomplish conformance with short circuit and protective device coordination studies.

3.2 ARC FLASH LABELS

- A. The study engineer shall provide a 4.0 in. x 4.0 in. Brady thermal transfer type label of high adhesion polyester for each work location analyzed.
- B. The labels shall be designed according to the following standards:
 - 1. UL969 – Standard for Marking and Labeling Systems
 - 2. ANSI Z535.4 – Product Safety Signs and Labels
 - 3. NFPA 70 (National Electric Code) – Article 110.16
- C. The label shall include the following information:
 - 1. System Voltage
 - 2. Flash protection boundary
 - 3. Arc Flash Incident energy value (cal/cm²)
 - 4. Limited, restricted, and prohibited Approach Boundaries
 - 5. Study report number and issue date
- D. Labels shall be printed by a thermal transfer type printer, with no field markings.
- E. Arc flash labels shall be provided for equipment as identified in the study and the respective equipment access areas per the following:
 - 1. Floor Standing Equipment - Labels shall be provided on the front of each individual section. Equipment requiring rear and/or side access shall have labels provided on each individual section access area. Equipment line-ups containing sections with multiple incident energy and flash protection boundaries shall be labeled as identified in the Arc Flash Analysis table.
 - 2. Wall Mounted Equipment – Labels shall be provided on the front cover or a nearby adjacent surface, depending upon equipment configuration.
 - 3. General Use Safety labels shall be installed on equipment in coordination with the Arc Flash labels. The General Use Safety labels shall warn of general electrical hazards associated with shock, arc flash, and explosions, and instruct workers to turn off power prior to work.

3.3 LABEL INSTALLATION

- A. Labels shall be field installed by study engineer and/or staff.

END OF SECTION

SECTION 26 09 23 LIGHTING CONTROL DEVICES

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:
 - 1. Time switches.
 - 2. Photoelectric switches.
 - 3. Indoor occupancy sensors.
- B. Related Requirements:
 - 1. Section 26 27 26 "Wiring Devices" for wall-switch occupancy sensors, digital time switches and manual light switches.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show installation details for occupancy and light-level sensors.
 - 1. Interconnection diagrams showing field-installed wiring.
 - 2. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each type of lighting control device to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 TIME SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Intermatic, Inc.
 - 2. SensorSwitch
 - 3. Leviton Mfg. Company Inc.
- B. Electronic Time Switches: Solid state, programmable, with alphanumeric display; complying with UL 917.
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 2. Contact Configuration: SPST.
 - 3. Contact Rating: 20-A ballast load, 120-277-V AC.

4. Programs: Two on-off set points on a 24-hour schedule, allowing different set points for each day of the week.
5. Battery Backup: Not less than seven days reserve, to maintain schedules and time clock.

2.2 INDOOR OCCUPANCY SENSORS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 1. Cooper Industries, Inc.
 2. Hubbell Building Automation, Inc.
 3. Leviton Mfg. Company Inc.
 4. Sensor Switch, Inc.
 5. Lutron, Inc.
- B. General Requirements for Sensors: Wall- or ceiling-mounted, solid-state indoor occupancy sensors with a separate power pack.
 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
 3. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor is powered from the power pack.
 4. Power Pack: 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. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
 5. 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.
 6. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
 7. Bypass Switch: Override the "on" function in case of sensor failure.
 8. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc; turn lights off when selected lighting level is present.
- C. PIR Type: Ceiling mounted; detect occupants in coverage area by their heat and movement.
 1. 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..
 2. Detection Coverage (Room): Detect occupancy anywhere in a circular area of 1000 sq. ft. when mounted on a 96-inch- high ceiling.
- D. Ultrasonic Type: Ceiling mounted; detect occupants in coverage area through pattern changes of reflected ultrasonic energy.
 1. Detector Sensitivity: 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.

2. Detection Coverage (Small Room): Detect occupancy anywhere within a circular area of 600 sq. ft. when mounted on a 96-inch- high ceiling.
 3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch- high ceiling.
 4. Detection Coverage (Large Room): Detect occupancy anywhere within a circular area of 2000 sq. ft. when mounted on a 96-inch- high ceiling.
- E. Dual-Technology Type: Ceiling mounted; detect occupants in coverage area using PIR and ultrasonic detection methods. The particular technology or combination of technologies that control on-off functions is 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. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch- high ceiling.

2.3 SWITCHBOX-MOUNTED OCCUPANCY SENSORS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. Cooper Industries, Inc.
 2. Hubbell Building Automation, Inc.
 3. Leviton Mfg. Company Inc.
 4. Lutron Electronics Co., Inc.
 5. Sensor Switch, Inc.
- B. General Requirements for Sensors: Automatic-wall-switch occupancy sensor, suitable for mounting in a single gang switchbox.
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F.
 3. Switch Rating: Not less than 800-VA fluorescent at 120 V, 1200-VA fluorescent at 277 V, and 800-W incandescent.
- C. Wall-Switch Sensor Tag WS1:
1. Standard Range: 180-degree field of view, field adjustable from 180 to 40 degrees; with a minimum coverage area of 2100 sq. ft.
 2. Sensing Technology: Dual technology - PIR and ultrasonic.
 3. Switch Type: SP. SP, field selectable automatic "on," or manual "on" automatic "off."
 4. Voltage: Dual voltage, 120 and 277 V; dual-technology type.
 5. Concealed "off" time-delay selector at 30 seconds, and 5, 10, and 20 minutes.
 6. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and helps eliminate false "off" switching.

2.4 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 26 05 19 "Low Voltage Electrical Power Conductors and Cables."
- B. Classes 2 and 3 Control Cable: Multi-conductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Section 26 05 19 "Low Voltage Electrical Power Conductors and Cables."
- C. Class 1 Control Cable: Multi-conductor cable with stranded-copper conductors not smaller than No. 14 AWG. Comply with requirements in Section 26 05 19 "Low Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

- 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 systems, and partition assemblies.
- 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.

3.2 WIRING INSTALLATION

- A. Wiring Method: Comply with Section 26 05 19 "Low Voltage Electrical Power Conductors and Cables." Minimum conduit size is 3/4 inch.
- 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: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.3 IDENTIFICATION

- A. Identify components and power and control wiring according to Section 26 05 53 "Electrical Identification."
 - 1. Identify controlled circuits in lighting contactors.
 - 2. Identify circuits or luminaires 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 tests and inspections with the assistance of a factory-authorized service representative:
 - 1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Lighting control devices will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.5 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.
 - 1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.
 - 2. For daylighting controls, adjust set points and dead-band controls to suit Owner's operations.

3.6 DEMONSTRATION

- A. Coordinate demonstration of products specified in this Section with demonstration requirements for networked lighting control systems specified in Section 26 09 53 "Networked Lighting Controls".
- B. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices.

END OF SECTION

SECTION 26 09 25 LIGHTING CONTROL SYSTEM

PART 1 - GENERAL

1.1 SYSTEM REQUIREMENTS

- A. System shall support automatic lighting control (based on occupancy/vacancy), scheduled lighting control (based on the BMS status for the particular space) and manual lighting control, (based on input from a low voltage switch/dimming/scene-control device). Spaces may include one or more of the three lighting control options. Dimming and scene control shall be provided where indicated in the lighting controls narrative (See Plans). The system shall provide the control sequences identified in the lighting controls narratives (See Plans).
- B. Depending on the lighting control system/equipment selected, some components listed in the specifications may not be required. This specification includes typical equipment performance and functional information and installation methods that may be required to accomplish the sequence of control on the Plans. It is the responsibility of the electrical contractor and the lighting control equipment manufacturer (and factory-authorized technician) to provide and install all equipment, boxes, conduit, wiring and connections necessary to accomplish the sequence of operation.
- C. The electrical contractor and the lighting control equipment manufacturer shall coordinate at all stages of construction, the required automatic and manual control device locations and electrical requirements (boxes, conduit, wiring and connections) for each of these devices. The lighting control system manufacturer shall identify all lighting control components on the installation drawings that are to be provided for the electrical contractor. The contractor shall provide and install required components in a neat and professional manner as directed by the lighting control manufacturer's factory-authorized technician.
- D. The system shall be capable of turning lighting loads on/off as well as dimming lights (if lighting load is capable of being dimmed).
- E. The system architecture shall be capable of enabling stand-alone groups (rooms) of devices to function in some default capacity even if network connectivity to the greater system is lost.
- F. Where schedule-based control is required to accomplish the sequence of operation, the system architecture shall facilitate remote operation via a computer connection. All system devices shall be networked together enabling digital communication and shall be individually addressable.
- G. Intelligent lighting control devices shall consist of one or more basic lighting control components; occupancy sensors, photocell sensors, relays, dimming outputs, manual switch stations, and manual dimming stations. Combining one or more of these components into a single device enclosure should be permissible so as to minimize overall device count of system.
- H. Where multi-zone lighting control is required, the zones for each fixture are designated on the plans. Independent control of each zone (on/off/raise/lower) shall be provided as well as at least 2 preset scenes shall be selectable from the wall mounted control device.
- I. Devices within a lighting control zone shall be connected with low voltage cabling installed above the ceiling as specified elsewhere in these Specifications.
- J. Individual lighting zones must continue to provide a user defined default level of lighting control in the event of a system communication failure with the backbone network or the management software becoming unavailable.
- K. System shall have a web-based software management program that enables remote system control, status monitoring, and creation of lighting control profiles.

- L. System shall have one or more primary wall mounted network control "gateway" devices that are capable of accessing and controlling connected system devices and linking into an Ethernet LAN.

1.2 DEFINITIONS

- A. DDC: Direct digital control
- B. IP: Internet protocol
- C. TCP/IP: Transmission control protocol/Internet protocol
- D. Monitoring: Acquisition, processing, communication, and display of equipment status data, metered electrical parameter values, power quality evaluation data, event and alarm signals, tabulated reports, and event logs
- E. PC: Personal computer; sometimes plural as "PCs."
- F. Device: A collective term for low-voltage communication bus connected devices, including LED drivers, fluorescent ballast/drivers/drivers, incandescent fixtures, manual switches, occupancy/vacancy sensors, switching relays, and similar. Sometimes also known as "slave unit."
- G. IR: Infrared
- H. Scene: Digital light level associated with a preset; stored in the lighting fixture ballast/driver
- I. LAN: Local area network

1.3 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. Related specification sections:
 - 1. 26 01 01: Basic Electrical Requirements
 - 2. 26 05 19: Low-voltage Electrical Power Conductors and Cables
 - 3. 26 05 26: Grounding and Bonding for Electrical Systems
 - 4. 26 05 29: Hangers and Supports for Electrical Systems
 - 5. 26 05 33: Raceways and Boxes for Electrical Systems
 - 6. 26 05 53: Identification for Electrical Systems
 - 7. 26 09 23: Lighting Control Devices
 - 8. 26 27 26: Wiring Devices
 - 9. 26 51 00: Interior Lighting
 - 10. 26 56 00: Exterior Lighting
 - 11. 26 90 00: Structured Cabling System

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for control modules, power distribution components, relays, manual switches and plates, and conductors and cables.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

3. Product Datasheets (general device descriptions, dimensions, wiring details, nomenclature). Include enclosure types and details for all enclosure types. Detail wiring partition configuration, current, and voltage ratings.
4. Block Diagram: Show interconnections between components specified in this Section and devices furnished with power distribution system components. Indicate data communication paths and identify networks, data buses, data gateways, concentrators, and other devices to be used. Describe characteristics of network and other data communication lines. . Include diagrams for power, signal, and control wiring.

B. Shop Drawings:

1. Floor Plans: Location, orientation, and coverage area of each sensor; group designations; and other specific design symbols and designations as required to define the installation, location, and configuration of all control devices.
2. Address Drawing: Reflected ceiling plan and floor plans, showing data-bus-connected devices, address for each device, and device groups. The plans shall be based on construction plans, using the same legend, symbols, and schedules.
3. Point List and Data Bus Load: Summary list of all control devices, sensors, ballast/drivers/drivers, and other loads connected to each data bus and total connected load for each data bus. Include percentage of rated connected load and device addresses.
4. Wire Termination Diagrams and Schedules: Coordinate nomenclature and presentation with Drawings and block diagram. Differentiate between manufacturer-installed and field-installed wiring.
5. Riser Diagrams – typical per room type (detailed drawings showing device interconnectivity of devices). Show interconnecting signal and control wiring, and interface devices that prove compatibility of inputs and outputs. Coordination Drawings: Submit evidence that lighting controls are compatible with connected monitoring and control devices and systems specified in other Sections. For networked controls, list network protocols and provide statements from manufacturers that input and output devices comply with interoperability requirements of the network protocol
6. Block Diagram: Show interconnections between components specified in this Section and devices furnished with power distribution system components. Indicate data communication paths and identify networks, data buses, data gateways, concentrators, and other devices used. Describe characteristics of network and other data communication lines.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Submit evidence that lighting controls are compatible with connected monitoring and control devices and systems specified in other Sections.
 1. Show interconnecting signal and control wiring, and interface devices that prove compatibility of inputs and outputs.
 2. For control interfaces and adapters, list network protocols and provide statements from manufacturers that input and output devices comply with interoperability requirements of the LAN or DALI protocol.
- B. Field quality-control reports.
- C. Sample Warranty: For manufacturer's special warranty.
- D. Software licenses and upgrades required by and installed for operation and programming of digital and analog devices.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For lighting controls to include in emergency, operation, and maintenance manuals.
- B. Software and Firmware Operational Documentation:
 - 1. Software operating and upgrade manuals.
 - 2. Program Software Backup: On magnetic media or flash drive, complete with data files.
 - 3. Device address list.
 - 4. Printout of software application and graphic screens.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Bus Power Supplies: Equal to two percent of amount installed, but no fewer than two.
 - 2. Controller/Gateways: Equal to two percent of amount installed, but no fewer than two.
 - 3. Lighting Control Relays: Equal to two percent of amount installed, but no fewer than two.

1.8 QUALITY ASSURANCE

- A. To the greatest extent possible, all lighting control system components (local or networked) shall be provided by a single manufacturer.
- B. A factory authorized technician shall provide 4-hours on-site, pre-construction conference with the electrical contractor to review lighting control riser and block diagrams, control device locations and interconnect wiring, conduit and cabling requirements, and device power locations. The electrical contractor shall provide four (4) technicians for this training that will be responsible for the successful implementation of the lighting control system. Notify the electrical engineer and architect 10 days prior to scheduled meeting date.
- C. All applicable products must be UL / CUL Listed or other acceptable national testing organization

1.9 COORDINATION

- A. Coordinate lighting control components to form an integrated interconnection of compatible components.
- B. Coordinate lighting controls with BAS/BMS either through IP based intercommunication of system or hardwired auxiliary relay outputs.
- C. The installing contractor shall be responsible for a complete and functional system in accordance with all applicable local and national codes.

1.10 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of lighting controls that fail in materials or workmanship within the specified warranty period below at no cost to the owner.
 - 1. Failures include, but are not limited to, the following:
 - a. Software: Failure of input and output to execute switching or dimming commands.
 - b. Failure of modular relays to operate under manual or software commands.
 - c. Damage of electronic components due to transient voltage surges.
 - 2. Warranty Periods:

- a. For control components: three (3) years from date of Substantial Completion.
3. Warranty includes:
 - a. Materials
 - b. Labor
 - c. Travel expenses

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS

1. Subject to compliance with plans and specifications, provide lighting control components and system as manufactured by one of the following -
 - a. Acuity – Sensor Switch
 - b. Eaton-Cooper
 - c. Hubbell Controls
 - d. Leviton, Inc.
 - e. Intelligent Lighting Controls

2.2 SYSTEM DESCRIPTION

- A. Operation: Input signal from digital signal sources switches or network-based devices associated with fixture ballast/drivers/drivers/drivers or lighting fixtures, or switches field-deployed, control relays.
 1. If required in the sequence of control, the primary lighting control indicates whether or not the schedule information from the BAS (occupied or un-occupied) is required for lighting control in the space. This status will be provided over network by the existing BMS system. Corridors, stairwells, gymnasium, auxiliary gymnasium, cafeteria (both dining and serving), lobbies at the gymnasium and auditorium and at the Internet Café are examples of spaces requiring schedule information from the BMS. All spaces with scheduled operation will have occupant sensing within the space. Some spaces will only require schedule input and occupant sensing however some spaces will also require manual controls located in the space. If required, the controls within the space are further identified as switching or dimming. Some of the spaces will have manual controls (either switched or dimmed) but some areas such as corridors. Where dimming is required, scene control (2 scenes) shall also be provided.
- 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 47 CFR, Subparts A and B, for Class A digital devices.
- D. Comply with protocol described in IEC 60929, Annexes E and G, for network-based lighting control devices, wiring, and computer hardware and software.
- E. Comply with UL 916.

2.3 PERFORMANCE REQUIREMENTS

- A. Surge Suppression: Factory installed as an integral part of control components or field-mounted surge suppressors complying with UL 1449, SPD Type 2.
- B. Network-based system requirements:

1. Components: Individually addressable devices (such as ballast/drivers/drivers, relays, dimmers, and switches) that are operated from digital signals received through a low-voltage communications bus, from data-entry and -retrieval devices (such as PCs, personal digital assistants, hand-held infrared programming devices, wired Ethernet hubs, wireless IEEE 802.11 hubs and other digital communications devices. Devices also report status to data-entry and -retrieval devices through the bus.
 2. Digital Control: Use peer-to-peer communication and distributed logic, where the failure of any single component shall be automatically isolated and not affect global system functions.
- C. Ethernet LAN:
1. Provide an Ethernet LAN to connect controller/gateways to a PC running a Microsoft Windows operating system. Comply with requirements in Section 26 90 00: Structured Cabling System.
 2. Ethernet Protocols: Comply with and be compatible with 10/100 BaseT TCP/IP routers and networks.
 3. TCP/IP Modem: Capable of maintaining a secure Internet connection using VPN or equivalent protocol.
- D. Interface with DDC System for HVAC: Hardware and software shall interface with DDC system for HVAC to monitor, control, display, and record data for use in processing reports.
1. Hardwired Points:
 - a. Monitoring: On-off status, area occupied status.
 - b. Control: On-off operation.

2.4 BUS POWER SUPPLY

- A. Description: Supply power to data bus for 64 addressable devices, suitable for use with NFPA 70, Class 2 control circuit.
1. Primary Power: Field selectable, 120 and 277 V.
 2. Power Supply: Regulated to maintain the operating voltage above 15-V dc under full load, and rated for full charging load of 250 mA and a minimum maintained connected load of 190 mA.
 3. Pilot Lights: Indicate data bus ground fault and data bus traffic.

2.5 CONTROLLER/GATEWAYS

- A. Description: The network-based controller/gateways link the distributed data buses with an Ethernet network to provide computer configuration, control, analysis, and maintenance. The controller/gateways operate independently and continue to process local inputs and schedules when disconnected from the LAN. The controller/gateways shall provide local intelligence and features including the following:
1. Integrated real-time clock with automatic daylight savings adjustment and leap-year correction.
 2. Integrated sunrise/sunset support based on the site location (latitude and longitude).
 3. Automatic time schedules, to control groups for scheduled occupancy with support for holiday exceptions.
 4. Two digital outputs for additional control and interlocking with external equipment such as fans, valves, and security panels.
 5. Support one data bus.

6. Computer Monitoring and Configuration: The controller/gateway shall allow configuration, monitoring, and analysis from PCs on the Ethernet LAN.
- B. Allow connection of the following network-based system-compliant addressable devices:
 1. Fluorescent fixture switching and dimming, for linear and compact lamps.
 2. LED fixture switching and dimming.
 3. Occupancy and photoelectric sensors.
 4. Emergency lighting interface complying with UL 924.
 5. Manual switching/ dimming.
- C. Stores system programming in nonvolatile memory.
 1. Switch to enable or disable software programming.

2.6 USER INTERFACE

- A. Workstation:
 1. A laptop PC, with Microsoft Windows operating system and lighting control system management software installed. With two hard drives and automatic backup software to periodically copy the primary disk image to the second disk.
 2. Include licenses, documentation, and storage media and licensing for a minimum of five concurrent users.
- B. Personal Digital Assistant: Handheld, with custom graphical user-interface software, supplied by the controller/gateway supplier. The software shall provide for all programming commands to be applied to the controller/gateway via a tethered connection.

2.7 LIGHTING CONTROL SYSTEM MANAGEMENT SOFTWARE

- A. The software shall provide for programming, configuring, and monitoring all devices connected to all data buses of the lighting control system, using application-specific software with Microsoft Windows-based, user-friendly software with graphical user-interface designed screens.
 1. The software shall be object oriented with pop-up menus and built-in help screens. All specified features of the data-bus-connected devices and those associated with controller/gateways shall be included in the software.

2.8 LED FIXTURE SWITCHING AND DIMMING

- A. Each driver or zone/group shall include on-off, fade, dimming, scene settings, and other standard control functions and as required to meet the sequence of operation.

2.9 SENSORS

- A. Comply with requirements in section 26 09 23: Lighting Control Devices. All sensors shall be compliant with lighting control system protocol.
- B. Indoor Occupancy Sensors: Sensors may be powered directly from the lighting control network or with a standalone power supply. Units powered with a standalone power supply shall interface with the lighting control system through an electrically isolated digital input.

2.10 RELAYS AND RELAY PANELS

- A. Relays: Electrically operated, mechanically held single-pole switch, rated at 20 A at 277 V. Short-circuit current rating shall be not less than 5 kA. With pilot light indicating when relay is closed and latched. Control shall be by digital data bus. Relay status shall be displayed when queried by lighting management software.

- B. Relay Panel (where required to meet the sequence of operation) : A single enclosure with incoming lighting branch circuits, relays, and connection to the lighting control network.
1. Panel shall incorporate normally closed latching relays capable of switching 120/277 VAC loads.
 2. Panel shall power itself from an integrated 120/277 VAC supply
 3. Enclosure: NEMA 250, Type 1, unless otherwise indicated or required for the installation location.
 4. Barriers to separate low-voltage and line-voltage components.
 5. Directory: Cover mounted, identifying each relay with its device address and naming the load controlled.
- C. Individually Mounted Relays:
1. Power Pack shall incorporate one or more Class 1 relays and contribute low voltage power to the rest of the system. Secondary Packs shall incorporate the relay(s), shall have an optional 2nd relay, 0-10 VDC dimming output, or line voltage dimming output, but shall not be required to contribute system power. Power Supplies shall provide system power only, but are not required to switch line voltage circuit. Auxiliary Relay Packs shall switch low voltage circuits only.
 2. Power Packs shall accept 120 or 277 VAC, be plenum rated, and provide Class 2 power to the system.
 3. Power Pack shall securely mount to junction location through a threaded ½ inch chase nipple or be capable of being secured within a luminaire driver channel. All Class 1 wiring shall pass through chase nipple into adjacent junction box without any exposure of wire leads. Note: UL Listing under Energy Management or Industrial Control Equipment automatically meets this requirement, whereas Appliance Control Listing does not meet this safety requirement.
 4. When required by local code, Power Pack must install inside standard electrical enclosure and provide UL recognized support to junction box. All Class 1 wiring is to pass through chase nipple into adjacent junction box without any exposure of wire leads.
 5. Power (Secondary) Packs shall be available that provide up to 16 Amp switching of all lighting load types.
 6. Enclosure: Standard outlet box or NEMA 250, Type 1, unless otherwise indicated or required for the installation location.
 7. Directory: Cover mounted, identifying each relay with its device address.
- D. Sequencing relay controls with manual Override:
1. Automatic sequenced on and off switching of selected relays at times set at the timing unit, allowing timed overrides from external switches.
 2. Sequencing control shall operate relays one at a time, completing the operation of all connected relays in not more than 10 seconds.
 3. Override control shall allow any relay connected to it to be switched on or off by a field-deployed manual switch or by an automatic switch, such as an occupancy sensor..
 4. Override control "blink warning" shall warn occupants approximately five minutes before actuating the off sequence.
 5. Non-volatile memory shall retain all setup configurations. After a power failure, the controller shall automatically reboot and return to normal system operation, including accurate time of day and date.

2.11 NETWORKED LIGHTING CONTROL PANELS

- A. Description: Lighting control panels using mechanically latched relays to control lighting and appliances. The panels shall be capable of being interconnected with digital communications to appear to the operator as a single lighting control system.
- B. Unit shall be provided with a vertical barrier separating branch circuits from control wiring.
- C. Relays: Electrically operated, mechanically held single-pole switch, rated at 20 A at 277 V. Short-circuit current rating shall be not less than 5 kA.
- D. Power Supply: NFPA 70, Class 2, UL listed, sized for connected equipment, plus not less than 20 percent spare capacity. Powered from a dedicated branch circuit of the panelboard that supplies power to the line side of the relays, sized to provide control power for the local panel-mounted relays, bus system, low-voltage inputs, field-installed occupancy sensors, and low-voltage photo sensors.
- E. Operator Interface: At the main control unit, provide interface for a tethered connection of a portable PC running MS Windows for configuring all networked lighting control panels using setup software designed for the specified operating system. **Contractor to include one portable device for initial programming of the system and training of Owner's personnel. That device shall remain the property of Owner.**
- F. Software
 - 1. Menu-driven data entry
 - 2. Online and offline programming and editing
 - 3. Provide for entry of the room or space designation for the load side of each relay
 - 4. Monitor and control all relays, showing actual relay state and the name of the automatic actuating control, if any
 - 5. Size the software appropriate to the system

2.12 NETWORK BRIDGES/GATEWAYS

- A. Control module shall be a device that facilitates communication and time-based control of downstream network devices and linking into an Ethernet. Device shall be capable of aggregating communication from multiple lighting control zones for purposes of minimizing backbone wiring requirements back to Control Gateway
- B. Device shall surface mount to a standard 4" x 4" square junction box.
- C. Devices shall have a user interface that is capable of wall mounting, powered by low voltage, and have a touch screen.
- D. Control device shall have RJ-45 ports for connection to other backbone devices (bridges) or directly to lighting control devices.
- E. Device shall automatically detect all devices downstream of it.
- F. Device shall have a standard and astronomical internal time clock.
- G. Device shall have one RJ-45 10/100 BaseT Ethernet connection. Device shall be powered with Class 2 low voltage supplied locally via a directly wired power supply or delivered via other POE type connection

2.13 MANUAL LIGHTING CONTROL DEVICES AND PLATES

- A. Devices shall recess into single-gang switch box and fit a standard GFI opening.
- B. Device shall have two to six buttons for selecting programmable lighting control profiles or acting as on/off switches.

- C. Communication and low voltage power shall be delivered to each device via low voltage wiring.
- D. Devices with mechanical push-buttons shall provide tactile and LED user feedback.
- E. Devices with capacitive touch buttons shall provide audible user feedback with different sounds for on/off, raise/lower, start-up, and communication offline.
- F. Devices with mechanical push-buttons shall be made available with custom button labeling.
- G. Connection Type: Power shall be from the control unit.
- H. Push-Button Switches: Modular, operating over the digital data bus.
 - 1. Each manual lighting control location shall control the following functions, in coordination with programmed sequence of operation and related sensors:
 - a. On.
 - b. Off.
 - c. Dimming, increase light level.
 - d. Dimming, decrease light level.
 - e. Return to preset light level.
 - 2. LED Pilot Lights: On to indicate that the control is active, or when the manual control is operated.
 - 3. Match color and style specified in section 26 27 26: Wiring Devices.
- I. Wall Plates: Single and multi-gang plates as specified in section 26 27 26: Wiring Devices. All colors and finishes to be selected by the architect from the manufacturer's full range of standard colors.
- J. Legend: Engraved or permanently silk-screened on wall plate where indicated. Use designations indicated on Drawings.

2.14 GRAPHIC CONTROL STATIONS/SCENE CONTROLLERS

- A. Device shall have a 3.5" full color touch screen for selecting up to 8 programmable lighting control presets or acting as up to 16 on/off/dim control switches.
- B. Device shall enable configuration of lighting presets, switched, and dimmers via password protected setup screens.
- C. Device shall surface mount to single-gang switch box.

2.15 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Class 2 Power Source: Not smaller than No. 12 AWG, complying with section 26 05 19: Low-Voltage Electrical Power Conductors and Cables.
- B. Class 2 Control Cables: Multi-conductor cable with copper conductors not smaller than No. 18 AWG, complying with section 26 05 19: Low-Voltage Electrical Power Conductors and Cables.
- C. Class 1 Control Cables: Multi-conductor cable with copper conductors not smaller than No. 18 AWG, complying with section 26 05 19: Low-Voltage Electrical Power Conductors and Cables.
- D. Digital and Multiplexed Signal Cables: Unshielded, twisted-pair cable with copper conductors, complying with TIA/EIA-568-B.2, Category 6 for horizontal copper cable and complying with section 26 90 00: Structured Cabling System.

2.16 BMS COMPATIBILITY

- A. System shall provide a BACnet IP gateway as a downloadable software plug-in to its management software. No additional hardware shall be required. Johnson Controls Metasys is the HCS selected BMS.
- B. BACnet IP gateway software shall communicate information gathered by networked system to other building management systems.
- C. BACnet IP gateway software shall translate and forward lighting relay and other select control commands from BMS system to networked control devices.
- D. The BMS will provide "occupied" and "un-occupied" times for each day to accomplish the sequence of controls (see Plans). The lighting control contractor and the mechanical controls contractor shall coordinate the required systems interface as to equipment locations, required terminations, etc.

PART 3 - EXECUTION

3.1 INSPECTION OF MATERIALS

- A. Receive, inspect, handle, and store panels according to NECA 407.
- B. Examine elements and surfaces to receive panels for compliance with installation tolerances and other conditions affecting performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 WIRING INSTALLATION

- A. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters. Conceal raceway and cables except in unfinished spaces.
 - 1. Install plenum cable in environmental air spaces, including plenum ceilings.
 - 2. Comply with requirements for cable trays specified in section 26 90 00: Structured Cabling System.
 - 3. Comply with requirements for raceways and boxes specified in section 26 05 53: Raceways and Boxes for Electrical Systems"
- B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

3.3 CONTROL PANEL INSTALLATION

- A. Comply with NECA 1.
- B. Mount top of trim 90 inches above finished floor unless otherwise indicated.
- C. Mount panel cabinet plumb and rigid without distortion of box.
- D. Install filler plates in unused spaces.

3.4 IDENTIFICATION

- A. Identify system components, wiring, cabling, boxes, cabinets, and terminals. Comply with identification requirements specified in section 26 05 53: Identification for Electrical Systems.

- B. Provide and install vinyl labels on ceiling grids indicating "LTG. CONTROLS" at each location where lighting control equipment is concealed above accessible ceilings. Update as built drawings to indicate locations of all lighting control panels and other major lighting control equipment.
- C. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with section 26 05 53 Identification for Electrical Systems.
- D. Identify all ceiling-mounted controls with data bus number and device address.
- E. Label each device cable within 6 inches of connection to bus power supply or termination block.

3.5 FIELD QUALITY CONTROL

- A. Acceptance Testing Preparation:
 - 1. Test continuity of each circuit.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. Test each bus controller using a portable PC.
 - 2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- D. Field Test Reports:
 - 1. Printed list of all points created from actual queries of all addressed control points to include ballast/drivers/drivers, manual controls, and sensors.
 - 2. Event log verifying the performance of all devices generating event messages to include occupancy sensors, control buttons, alarm messages, and any other change of value messages.
 - 3. Trend data for all daylight zones covering a period of not less than one week and demonstrating performance consistent with the submitted computer models for those spaces.
- E. Lighting controls will be considered defective if they do not pass tests and inspections.
- F. Prepare test and inspection reports, including a certified report that identifies bus controllers included and describes query results. Include notation of deficiencies detected, remedial action taken, and observations made after remedial action.

3.6 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. Activate light fixtures and verify that all lamps are operating at 100 percent.
 - 3. Confirm correct communications wiring, initiate communications between devices and controller/gateways, and program the lighting control system according to approved configuration schedules, time-of-day schedules, and input override assignments.
- B. Include in bid price 4 each visits (8 hours per visit) to coordinate the installation of the lighting control system and its components. Manufacturer shall notify Engineer at least 10 days prior to

the meeting, Manufacturer shall notify Engineer of items that require the attention of the design team and/or electrical contractor after each meeting.

- C. Factory-authorized service representative shall make a record of all contractor's personnel present at each training session and shall copy engineer.

3.7 ADJUSTING

- A. Occupancy Adjustments: Within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to three visits to Project during other-than-normal occupancy hours for this purpose.

3.8 SOFTWARE SERVICE AGREEMENT

- A. Technical Support: Beginning at Substantial Completion, service agreement shall include software support and updates for two years.
- B. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.
 - 1. Upgrade Notice: At least 30 days to allow Owner to schedule and access the system and to upgrade computer equipment if necessary.

3.9 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain the control unit and operator interface.
- B. Include in bid price one full day, on-site with the owner's maintenance personnel. Provide written agenda for training session.

3.10 TRAINING

- A. On-site training shall be performed by a factory-authorized service representative and shall be scheduled after the complete system has been installed and tested but before the project's substantial completion. Include in bid price, factory-authorized training for eight (8) hours, one full day. Training shall consist of, at a minimum, two training sessions on non-consecutive days. Each session shall be 4 hours in duration.
- B. Training schedule shall be coordinated with owner. Owner shall have a minimum of 30 days advance notice prior to the scheduled date of training. Notify the owner, architect and engineer (in writing) a minimum of 14 days prior to the training.
- C. Training shall be recorded (video and audio) in digital format (both .avi and .mov) and shall be provided to the owner on multiple flash drives (minimum of 3 drives) and shall be available for download from the manufacturer for a minimum of 1 year after substantial completion.
- D. Manufacturer shall provide manuals for operation, maintenance and expansion of the system in clear, concise language for owners use during training. Manuals shall remain with owner. A minimum of 3 manuals shall be provided for each training session.
- E. Factory-authorized service representative shall make a record of all owner's personnel present at each training session.

END OF SECTION

SECTION 26 22 00 LOW-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following types of dry-type transformers rated 600 V and less, with capacities up to 1000 kVA:
 - 1. Distribution transformers.

1.3 ACTION SUBMITTALS

- A. Product Data: Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer indicated.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 1. Wiring Diagrams: Power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

- A. Source quality-control test reports.
- B. Field quality-control test reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For transformers to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain each transformer type through one source from a single manufacturer.
- 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.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

1.8 COORDINATION

- A. Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

- B. Coordinate installation of wall-mounting and structure-hanging supports with actual transformer provided.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

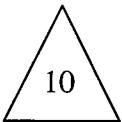
- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Products.
 - 2. General Electric Company.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Sola/Hevi-Duty.
 - 5. Square D; Schneider Electric.

2.2 GENERAL TRANSFORMER REQUIREMENTS

- A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.
- B. Cores: Grain-oriented, non-aging silicon steel.
- C. Coils: Continuous windings without splices except for taps.
 - 1. Internal Coil Connections: Brazed or pressure type.
 - 2. Coil Material: Aluminum.

2.3 DISTRIBUTION TRANSFORMERS

- A. Comply with NEMA ST 20 and list and label as complying with UL 1561.
- B. Cores: One leg per phase.
- C. Enclosure: Consistent with the environment in which the transformer is installed.
 - 1. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.
- D. Transformer Enclosure Finish: Comply with NEMA 250.
 - 1. Finish Color: Gray.
- E. Taps for Transformers Smaller Than 3 kVA: One 5 percent tap above normal full capacity.
- F. Taps for Transformers 7.5 to 24 kVA: One 5 percent tap above and one 5 percent tap below normal full capacity.
- G. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and two 2.5 percent taps below normal full capacity.
- H. Insulation Class: 220 deg C, UL-component-recognized insulation system with a maximum of ~~80 deg C~~ 115 deg C rise above 40 deg C ambient temperature.
- I. Energy Efficiency for Transformers Rated 15 kVA and Larger:
 - 1. Complying with NEMA TP 1, Class 1 efficiency levels.
 - 2. Tested according to NEMA TP 2.
- J. Wall Brackets: Manufacturer's standard brackets.
- K. Low-Sound-Level Requirements: Minimum of 3 dBA less than NEMA ST 20 standard sound levels when factory tested according to IEEE C57.12.91.



2.4 IDENTIFICATION DEVICES

- A. Nameplates: Engraved, laminated-plastic or metal nameplate for each distribution and buck-boost transformer, mounted with corrosion-resistant screws. Nameplates and label products are specified in Section 16075 "Electrical Identification."

2.5 SOURCE QUALITY CONTROL

- A. Test and inspect transformers according to IEEE C57.12.91.
- B. Factory Sound-Level Tests: Conduct sound-level tests on equipment for this Project.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.
- B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.
- C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.
- D. Verify that ground connections are in place and requirements in Section 26 05 26 "Grounding and Bonding" have been met. Maximum ground resistance shall be 5 ohms at location of transformer.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install wall-mounting transformers level and plumb with wall brackets fabricated by transformer manufacturer.
 - 1. Brace wall-mounting transformers as required by the manufacturer and/or the project structural engineer.
- B. Construct concrete bases and anchor floor-mounting transformers according to manufacturer's written instructions, seismic codes applicable to Project, and requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems."

3.3 CONNECTIONS

- A. Ground equipment according to Section 26 05 26 "Grounding and Bonding."
- B. Connect wiring according to Section 26 05 19 "Low Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.
- B. Perform tests and inspections and prepare test reports.
- C. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
- D. Remove and replace units that do not pass tests or inspections and retest as specified above.

- E. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.

3.5 ADJUSTING

- A. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.
- B. Connect buck-boost transformers to provide nameplate voltage of equipment being served, plus or minus 5 percent, at secondary terminals.
- C. Output Settings Report: Prepare a written report recording output voltages and tap settings.

3.6 CLEANING

- A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

END OF SECTION

SECTION 26 24 16 PANELBOARDS

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:
 - 1. Distribution panelboards.
 - 2. Lighting and appliance branch-circuit panelboards.

1.3 DEFINITIONS

- A. SVR: Suppressed voltage rating.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
 - 1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
 - 2. Detail enclosure types and details for types other than NEMA 250, Type 1.
 - 3. Detail bus configuration, current, and voltage ratings.
 - 4. Short-circuit current rating of panelboards and over-current protective devices.
 - 5. Detail features, characteristics, ratings, and factory settings of individual over-current protective devices and auxiliary components.
 - 6. Include wiring diagrams for power, signal, and control wiring.
 - 7. Include time-current coordination curves for each type and rating of over-current protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Field Quality-Control Reports:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- C. Panelboard Schedules: For installation in panelboards.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01782 "Operation and Maintenance Data," include the following:
 - 1. Manufacturer's written instructions for testing and adjusting over-current protective devices.
 - 2. Time-current curves, including selectable ranges for each type of over-current protective device that allows adjustments.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Keys: Two spares for each type of panelboard cabinet lock.
 - 2. Circuit Breakers as called for in the panel schedule.
 - 3. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
 - 4. Fuses for Fused Power-Circuit Devices: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

1.8 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of NETA or an NRTL.
 - 1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.
- B. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.
- C. Product Dimensions: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- 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.
- E. Comply with NEMA PB 1.
- F. Comply with NFPA 70.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.
- B. Handle and prepare panelboards for installation according to NECA 407 and NEMA PB 1.

1.10 PROJECT CONDITIONS

- A. Environmental Limitations:
 - 1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
 - 2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

- a. Ambient Temperature: Not exceeding 23 deg F to plus 104 deg F.
 - b. Altitude: Not exceeding 2000 feet.
- B. Service Conditions: NEMA PB 1, usual service conditions, as follows:
 - 1. Ambient temperatures within limits specified.
 - 2. Altitude not exceeding 6600 feet.
- C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
 - 1. Notify Architect and Owner no fewer than ten (10) days in advance of proposed interruption of electric service.
 - 2. Do not proceed with interruption of electric service without Architect's and Owner's written permission.
 - 3. Comply with NFPA 70E.

1.11 COORDINATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

1.12 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

- A. Enclosures: Flush- and/or surface-mounted cabinets as shown on the plans.
 - 1. Rated for environmental conditions at installed location.
 - a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
 - b. Outdoor Locations: NEMA 250, Type 3R.
 - c. Kitchen and Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
 - d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
 - e. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.
 - 2. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
 - 3. Finishes:

- a. Panels and Trim: Steel, factory finished immediately after cleaning and pre-treating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
 - b. Back Boxes: Galvanized steel.
- 4. Directory Card: Inside panelboard door, mounted in **primed and painted metal** frame with transparent protective cover.
- B. Incoming Mains Location: As required – coordinate prior to providing panelboard approval submittals.
- C. Phase, Neutral, and Ground Buses:
 - 1. Material: Hard-drawn copper, 98 percent conductivity.
 - 2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
- D. Conductor Connectors: Suitable for use with conductor material and sizes.
 - 1. Material: Hard-drawn copper, 98 percent conductivity.
 - 2. Main and Neutral Lugs: Mechanical type.
 - 3. Ground Lugs and Bus-Configured Terminators: Mechanical type.
 - 4. Feed-Through Lugs: Compression type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
 - 5. Subfeed (Double) Lugs: Compression type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
- E. Service Equipment Label: NRTL labeled for use as service equipment for panelboards or load centers with one or more main service disconnecting and overcurrent protective devices.
- F. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
- G. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.2 DISTRIBUTION PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D; a brand of Schneider Electric.
- B. Panelboards: NEMA PB 1, power and feeder distribution type.
- C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
 - 1. For doors more than 36 inches high, provide two latches, keyed alike.
- D. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.
- E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D; a brand of Schneider Electric.
- B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- C. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- D. Doors: Concealed hinges; secured with flush latch with steel tumbler lock; keyed alike.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D; a brand of Schneider Electric.
- B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.
 - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 - 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
 - 3. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
 - 4. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
 - a. Standard frame sizes, trip ratings, and number of poles.
 - b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
 - c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
 - d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 - e. Shunt Trip: 24-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.
 - f. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage with field-adjustable 0.1- to 0.6-second time delay.

- g. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts and "b" contacts operate in reverse of circuit-breaker contacts.
- h. Multi-pole units enclosed in a single housing or factory assembled to operate as a single unit.
- i. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in the position indicated on the plans.

2.5 ACCESSORY COMPONENTS AND FEATURES

- A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Receive, inspect, handle, and store panelboards according to NECA 407 and/or NEMA PB 1.1.
- B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.
- C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install panelboards and accessories according to NECA 407 and/or NEMA PB 1.1.
- B. Mount such that the top-most switch or circuit breaker (in the panel) is not higher than 79 inches above finished floor or grade. Align adjacent panels for a neat appearance.
- C. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- D. Install overcurrent protective devices and controllers not already factory installed.
 - 1. Set field-adjustable, circuit-breaker trip ranges.
- E. Install filler plates in unused spaces.
- F. Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.
- G. Arrange conductors in gutters into groups and bundle and wrap with wire ties.
- H. Comply with NECA 1.

3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 26 05 53 "Electrical Identification."
- B. Create a directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 26 05 53 "Electrical Identification."

- D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Section 26 05 53 "Electrical Identification."

3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- C. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- D. Panelboards will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

- A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges as specified in Section 26 05 73 "Electrical Coordination Study".

3.6 PROTECTION

- A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION

SECTION 26 27 26 WIRING DEVICES

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:
 - 1. Receptacles, receptacles with integral GFCI, and associated device plates.
 - 2. Twist-locking receptacles.
 - 3. Receptacles with integral surge-suppression units.
 - 4. Tamper-resistant receptacles.
 - 5. Weather-resistant receptacles.
 - 6. Snap switches and wall-box dimmers.
 - 7. Wall-switch and exterior occupancy sensors.
 - 8. Communications outlets.
 - 9. Pendant cord-connector devices.
 - 10. Cord and plug sets.
 - 11. Floor service outlets, poke-through assemblies, service poles, and multi-outlet assemblies.

1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- D. RFI: Radio-frequency interference.
- E. TVSS: Transient voltage surge suppressor.
- F. UTP: Unshielded twisted pair.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Receptacles for Owner-Furnished Equipment: Match plug configurations.
 - 2. Cord and Plug Sets: Match equipment requirements.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.
- C. Samples: One for each type of device and wall plate specified, in each color specified.

1.6 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

1.8 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Service/Power Poles: One for every 10, but no fewer than one.
 - 2. Floor Service-Outlet Assemblies: One for every 10, but no fewer than one.
 - 3. Poke-Through, Fire-Rated Closure Plugs: One for every five floor service outlets installed, but no fewer than two.

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. Cooper Wiring Devices; Division of Cooper Industries, Inc. (Cooper).
 - 2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
 - 3. Leviton Mfg. Company Inc. (Leviton).
 - 4. Pass & Seymour/Legrand (Pass & Seymour).
- B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 GENERAL WIRING-DEVICE REQUIREMENTS

- A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.
- C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:
 - 1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
 - 2. Devices shall comply with the requirements in this Section.

2.3 STRAIGHT-BLADE RECEPTACLES

- A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 5351 (single), CR5362 (duplex).
 - b. Hubbell; HBL5351 (single), HBL5352 (duplex).
 - c. Leviton; 5891 (single), 5352 (duplex).
 - d. Pass & Seymour; 5361 (single), 5362 (duplex).

- B. Tamper-Resistant Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498 Supplement sd, and FS W-C-596.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; TR8300.
 - b. Hubbell; HBL8300SGA.
 - c. Leviton; 8300-SGG.
 - d. Pass & Seymour; TR63H.

2.4 GFCI RECEPTACLES

- A. General Description:

1. Straight blade, feed-through type.
2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

- B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; VGF20.
 - b. Hubbell; GFR5352L.
 - c. Pass & Seymour; 2095.
 - d. Leviton; 7590.

- C. Tamper-Resistant GFCI Convenience Receptacles, 125 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hubbell; GFTR20.
 - b. Pass & Seymour; 2095TR.

2.5 TWIST-LOCKING RECEPTACLES

- A. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration L5-20R, and UL 498.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; CWL520R.
 - b. Hubbell; HBL2310.
 - c. Leviton; 2310.
 - d. Pass & Seymour; L520-R.

2.6 CORD AND PLUG SETS

- A. Description:

1. Match voltage and current ratings and number of conductors to requirements of equipment being connected.
2. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and ampacity of at least 130 percent of the equipment rating.

3. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.7 TOGGLE SWITCHES

A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

B. Switches, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Single Pole:

- 1) Cooper; AH1221.
- 2) Hubbell; HBL1221.
- 3) Leviton; 1221-2.
- 4) Pass & Seymour; CSB20AC1.
- 5)

b. Two Pole:

- 1) Cooper; AH1222.
- 2) Hubbell; HBL1222.
- 3) Leviton; 1222-2.
- 4) Pass & Seymour; CSB20AC2.

c. Three Way:

- 1) Cooper; AH1223.
- 2) Hubbell; HBL1223.
- 3) Leviton; 1223-2.
- 4) Pass & Seymour; CSB20AC3.

d. Four Way:

- 1) Cooper; AH1224.
- 2) Hubbell; HBL1224.
- 3) Leviton; 1224-2.
- 4) Pass & Seymour; CSB20AC4.

C. Pilot-Light Switches, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

- a. Cooper; AH1221PL for 120 and 277 V.
- b. Hubbell; HBL1201PL for 120 and 277 V.
- c. Leviton; 1221-LH1.
- d. Pass & Seymour; PS20AC1RPL for 120 V, PS20AC1RPL7 for 277 V.

2. Description: Single pole, with neon-lighted handle, illuminated when switch is "off."

D. Key-Operated Switches, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

- a. Cooper; AH1221L.
- b. Hubbell; HBL1221L.
- c. Leviton; 1221-2L.
- d. Pass & Seymour; PS20AC1-L.

2. Description: Single pole, with factory-supplied key in lieu of switch handle.

E. Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches: 120/277 V, 20 A; for use with mechanically held lighting contactors.

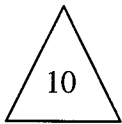
1. Products: Subject to compliance with requirements, provide one of the following:

- a. Cooper; 1995.
- b. Hubbell; HBL1557.

- c. Leviton; 1257.
 - d. Pass & Seymour; 1251.
- F. Key-Operated, Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches: 120/277 V, 20 A; for use with mechanically held lighting contactors, with factory-supplied key in lieu of switch handle.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 1995L.
 - b. Hubbell; HBL1557L.
 - c. Leviton; 1257L.
 - d. Pass & Seymour; 1251L.

2.8 WALL PLATES

- A. Single and combination types shall match corresponding wiring devices.
 - 1. Plate-Securing Screws: Metal with head color to match plate finish.
 - 2. Material for Finished Spaces: ~~Galvanized steel~~-Unbreakable Nylon.
 - 3. Material for Unfinished Spaces: Galvanized steel.
 - 4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.
- B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.



2.9 FLOOR SERVICE FITTINGS

- A. Type: Modular, flush-type activation or recess-type activation, as scheduled on the plans.
- B. Compartments: Barrier separates power from voice and data communication cabling.
- C. Service Plate: As called for on the Plans.
- D. Power Receptacle: NEMA WD 6 Configuration 5-20R, gray finish, unless otherwise indicated.
- E. Voice and Data Communication Outlet: Modular, keyed, color-coded, RJ-45 jacks (quantity as shown on plans) for UTP cable complying with requirements in Section 269000 "Structured Cabling System."

2.10 POKE-THROUGH ASSEMBLIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Hubbell Incorporated; Wiring Device-Kellems.
 - 2. Pass & Seymour/Legrand.
 - 3. Thomas & Betts Corporation.
 - 4. Wiremold/Legrand.
- B. Description:
 - 1. Factory-fabricated and -wired assembly of below-floor junction box with multichanneled, through-floor raceway/firestop unit and detachable matching floor service-outlet assembly.
 - 2. Comply with UL 514 scrub water exclusion requirements.

3. Service-Outlet Assembly: Flush type with receptacles and RJ-45 jacks as called for on the plans complying with requirements listed elsewhere in these specifications.
4. Fire Rating: Unit is listed and labeled for fire rating of floor-ceiling assembly.
5. Closure Plug: Arranged to close unused cored openings and reestablish fire rating of floor.
6. Wiring Raceways and Compartments: For a minimum of four No. 12 AWG conductors and a minimum of four, four-pair cables that comply with requirements in Section 16 90 00 - Structured Cabling."

2.11 SERVICE POLES

A. Description:

1. Factory-assembled and -wired units to extend power and voice and data communication from distribution wiring concealed in ceiling to devices or outlets in pole near floor.
2. Poles: Nominal 2.5-inch- (65-mm-) square cross section, with height adequate to extend from floor to at least 6 inches (150 mm) above ceiling, and with separate channels for power wiring and voice and data communication cabling.
3. Mounting: Ceiling trim flange with concealed bracing arranged for positive connection to ceiling supports; with pole foot and carpet pad attachment.
4. Finishes: Manufacturer's standard painted finish and trim combination.
5. Wiring: Sized for minimum of five No. 12 AWG power and ground conductors and a minimum of four, four-pair, Category 3 or Category 5 voice and data communication cables.
6. Power Receptacles: Two duplex, 20-A, straight-blade receptacles complying with requirements in this Section.
7. Voice and Data Communication Outlets: Four RJ-45 jacks complying with requirements in Section 26 90 00 "Structured Cabling System."

2.12 FINISHES

A. Device Color:

1. Wiring Devices Connected to Normal Power System: As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.
2. Wiring Devices Connected to Emergency Power System: Red.

B. Wall Plate Color: For plastic covers, match device color.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.
- B. Coordination with Other Trades:
 1. Protect installed devices and their boxes. 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 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 right 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. Pigtailling existing conductors is permitted, provided the outlet box is large enough.
- D. Device Installation:
1. Replace devices that have been in temporary use during construction and that 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 (152 mm) in length.
 5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
 6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
 7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
 8. Tighten unused terminal screws on the device.
 9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.
- E. Receptacle Orientation:
1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the left.
- F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
- G. Dimmers:
1. Install dimmers within terms of their listing.
 2. Verify that dimmers used for fan speed control are listed for that application.
 3. 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, multi-gang wall plates.
- I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 GFCI RECEPTACLES

- A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.3 IDENTIFICATION

- A. Comply with Section 26 05 53 "Identification for Electrical Systems."
- B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Test Instruments: Use instruments that comply with UL 1436.
 - 2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.
- B. Tests for Convenience Receptacles:
 - 1. Line Voltage: Acceptable range is 105 to 132 V.
 - 2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
 - 3. Ground Impedance: Values of up to 2 ohms are acceptable.
 - 4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
 - 5. Using the test plug, verify that the device and its outlet box are securely mounted.
 - 6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.
- C. Wiring device will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

END OF SECTION

SECTION 26 28 16 ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Fusible switches.
 - 2. Non-fusible switches.
 - 3. Shunt trip switches.
 - 4. Molded-case circuit breakers (MCCBs).
 - 5. Enclosures.

1.3 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
 - 1. Enclosure types and details for types other than NEMA 250, Type 1.
 - 2. Current and voltage ratings.
 - 3. Short-circuit current ratings (interrupting and withstand, as appropriate).
 - 4. Include evidence of NRTL listing for series rating of installed devices.
 - 5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
 - 6. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.
- B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Wiring Diagrams: For power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Field quality-control reports.
 - 1. Test procedures used.

2. Test results that comply with requirements.
 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- C. Manufacturer's field service report.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified elsewhere in these specifications "Operation and Maintenance Data," include the following:
1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
 2. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
 2. Fuse Pullers: Two for each size and type.

1.8 QUALITY ASSURANCE

- A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.
- B. Product Dimensions: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- C. 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.
- D. Comply with NFPA 70.

1.9 COORDINATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Provide mounting structure for safety switches independent of the equipment and install flexible connection from switch to equipment as required.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.

3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.
- B. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- C. Accessories:
 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
 4. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.2 NON-FUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 3. Siemens Energy & Automation, Inc.
 4. Square D; a brand of Schneider Electric.
- B. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- C. Accessories:
 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 2. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.3 SHUNT TRIP SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Cooper Bussmann, Inc.
 2. Ferraz Shawmut, Inc.
 3. Littelfuse, Inc.
- B. Switches: Three-pole, horsepower rated, with integral shunt trip mechanism and Class J fuse block; lockable handle with capability to accept three padlocks; interlocked with cover in closed position.
- C. Control Circuit: 120-V ac; obtained from integral control power transformer, with primary and secondary fuses, with a control power transformer of enough capacity to operate shunt trip, connected pilot, and indicating and control devices.
- D. Accessories:
 1. Oiltight key switch for key-to-test function.

2. Oiltight green ON pilot light.
3. Isolated neutral lug; 100 percent rating.
4. Mechanically interlocked auxiliary contacts that change state when switch is opened and closed.
5. Form C alarm contacts that change state when switch is tripped.
6. Three-pole, double-throw, fire-safety and alarm relay; 24-V dc coil voltage.
7. Three-pole, double-throw, fire-alarm voltage monitoring relay complying with NFPA 72.

2.4 MOLDED-CASE CIRCUIT BREAKERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 3. Siemens Energy & Automation, Inc.
 4. Square D; a brand of Schneider Electric.
- B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.
- C. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
- D. Features and Accessories:
 1. Standard frame sizes, trip ratings, and number of poles.
 2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
 3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.

2.5 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
 1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
 2. Outdoor Locations: NEMA 250, Type 3R.
 3. Kitchen and Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
 4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
 5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- C. Install fuses in fusible devices.
- D. Comply with NECA 1.

3.3 IDENTIFICATION

- A. Comply with requirements in Section 26 05 53 "Electrical Identification."
 - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 - 2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- C. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 - 3. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges as specified in Section 26 05 73 "Electrical Coordination Study."

END OF SECTION

SECTION 26 51 00 INTERIOR LIGHTING

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:
 - 1. Interior lighting fixtures, lamps, and ballasts.
 - 2. Emergency lighting units.
 - 3. Exit signs.
 - 4. Lighting fixture supports.
- B. Related Sections:
 - 1. Section 26 27 26 "Wiring Devices" for manual wall-box dimmers for incandescent lamps.
 - 2. Section 26 09 23 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multi-pole lighting relays and contactors.

1.3 DEFINITIONS

- A. BF: Ballast factor.
- B. CCT: Correlated color temperature.
- C. CRI: Color-rendering index.
- D. HID: High-intensity discharge.
- E. LER: Luminaire efficacy rating.
- F. Lumen: Measured output of lamp and luminaire, or both.
- G. Luminaire: Complete lighting fixture, including ballast housing if provided.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:
 - 1. Physical description of lighting fixture including dimensions.
 - 2. Emergency lighting units including battery and charger.
 - 3. Ballast, including BF.
 - 4. Energy-efficiency data.
 - 5. Sound Performance Data: For air-handling lighting fixtures. Indicate sound power level and sound transmission class in test reports certified according to standards specified elsewhere in these specifications - "Diffusers, Registers, and Grilles."
 - 6. Life, output (lumens, CCT, and CRI), and energy-efficiency data for lamps.
 - 7. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing & Calculation Guides, of each lighting fixture type.

The adjustment factors shall be for lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.

- a. **Manufacturer Certified Data:** Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
- B. **Shop Drawings:** For nonstandard or custom lighting fixtures. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 2. **Wiring Diagrams:** For power, signal, and control wiring.
- C. **Installation instructions.**

1.5 INFORMATIONAL SUBMITTALS

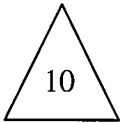
- A. **Coordination Drawings:** Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Lighting fixtures.
 - 2. Suspended ceiling components.
 - 3. Partitions and millwork that penetrate the ceiling or extends to within 12 inches of the plane of the luminaires.
 - 4. Ceiling-mounted projectors.
 - 5. Structural members to which suspension systems for lighting fixtures will be attached.
 - 6. Other items in finished ceiling including the following:
 - a. Air outlets and inlets.
 - b. Speakers.
 - c. Sprinklers.
 - d. Smoke and fire detectors.
 - e. Occupancy sensors.
 - f. Photo-sensors.
 - g. Access panels.
 - h. Ceiling projector mounts.
 - i. Ceiling mounted surveillance cameras.
 - 7. Perimeter moldings.
- B. **Qualification Data:** For qualified agencies providing photometric data for lighting fixtures.
- C. **Product Certificates:** For each type of ballast for bi-level and dimmer-controlled fixtures, from manufacturer.
- D. **Field quality-control reports.**
- E. **Warranty:** Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.
1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. ~~Lamps: 10 for every 100 of each type and rating installed. Furnish at least one of each type.~~
 2. ~~Plastic Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.~~
 3. ~~Fluorescent fixture-mounted, emergency battery pack: One for every 20 emergency lighting units.~~
 4. ~~Ballasts: One for every 100 of each type and rating installed. Furnish at least one of each type.~~
 5. ~~Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.~~



1.8 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, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NFPA 70.
- D. FM Global Compliance: Lighting fixtures for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.
1. Approved fixtures in mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- E. On-site coordination meetings: Provide three on-site coordination meetings between contractor and authorized lighting manufacturer's representative to review the following:
1. Pre-construction meeting, prior to rough in stage to review control wiring diagrams, control component placement, occupancy sensor location/placement, wiring types and interconnections, locations of racks/panels, and general overview of control system.
 2. Mock up review, after completion of mock-up areas to review operation of each area type for correct operation. At this meeting, the general settings, adjustments, and programming shall be documented and implemented.
 3. Final operational test shall take place at substantial completion to verify proper operation of entire building and site lighting control systems. Final settings and programming adjustments shall be made to the satisfaction of the engineer and architect and fully documented for future reference by the owner as required, and included/provided in the final closeout documentation.

1.9 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide product indicated on Drawings.

2.2 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

- A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.
- B. Sheet Metal Components:
 - 1. Formed from 22 gauge steel unless otherwise indicated.
 - 2. Form and support to prevent warping and sagging.
 - 3. Free of burrs and sharp corners and edges.
 - 4. Cleaned and powder-coated after fabrication
- C. LED fixtures: Comply with UL 1598. L80 Performance for 50,000 hours. Color temperature consistency shall be indistinguishable and the color shift over a five year period shall be less than 0.007 on the CIE 1976 (u',v') diagram, or a 7-step MacAdam ellipse.
- D. Metal Parts: Free of burrs and sharp corners and edges.
- E. Doors, Frames, and Other Internal Access:
 - 1. Spring loaded cam type latches.
 - 2. Gasketed lens frame – fixture to be free of light leakage under operating conditions.
 - 3. Designed to permit re-lamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during re-lamping and when secured in operating position.
- F. Diffusers 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: 0.125 inch MINIMUM unless otherwise indicated.
 - b. UV stabilized.
 - 2. Glass: Annealed crystal glass unless otherwise indicated.
- G. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and ballasts. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
 - 1. Label shall include the following lamp and ballast characteristics:
 - a. "USE ONLY" and include specific lamp type.
 - b. Lamp diameter code (T-4, T-5, T-8, T-12, etc.), tube configuration (twin, quad, triple, etc.), base type, and nominal wattage for fluorescent and compact fluorescent luminaires.
 - c. Lamp type, wattage, bulb type (ED17, BD56, etc.) and coating (clear or coated) for HID luminaires.

- d. Start type (preheat, rapid start, instant start, etc.) for fluorescent and compact fluorescent luminaires.
- e. ANSI ballast type (M98, M57, etc.) for HID luminaires.
- f. CCT and CRI for all luminaires.

2.3 LED DRIVERS

- A. LED drivers shall be fully accessible from below ceiling.
- B. Ambient temperature ratings shall be -40 deg F minimum, 130 deg F maximum
- C. Power factor: 0.94 or higher
- D. Total Harmonic distortion: <20%
- E. Minimum warranty on drivers 5 years
- F. NRTL certified (UL/CSA/FM)

2.4 EXIT SIGNS

- A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.
- B. Internally Lighted Signs:
 - 1. Lamps for AC Operation: Fluorescent, two for each fixture, 20,000 hours of rated lamp life.
 - 2. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.
 - 3. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
 - a. Battery: Sealed, maintenance-free, nickel-cadmium type.
 - b. Charger: Fully automatic, solid-state type with sealed transfer relay.
 - c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
 - d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 - f. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
 - g. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.5 EMERGENCY LIGHTING UNITS

- A. General Requirements for Emergency Lighting Units: Self-contained units complying with UL 924.
 - 1. Battery: Sealed, maintenance-free, lead-acid type.

2. Charger: Fully automatic, solid-state type with sealed transfer relay.
3. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
6. Wire Guard: Heavy-chrome-plated wire guard protects lamp heads or fixtures.
7. Integral Time-Delay Relay: Holds unit on for fixed interval of 15 minutes when power is restored after an outage.
8. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

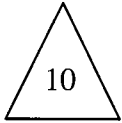
2.6 LIGHTING FIXTURE SUPPORT COMPONENTS

- A. Comply with Section 260529 "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. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage.
- E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage.
- F. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.
- G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Lighting fixtures:
 1. Set level, plumb, and square with ceilings and walls unless otherwise indicated.
 2. Install lamps in each luminaire.
- B. Temporary Lighting: If it is necessary, and approved by Architect, 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.
- C. Remote Mounting of Ballasts: Distance between the ballast and fixture shall not exceed that recommended by ballast manufacturer. Verify, with ballast manufacturers, maximum distance between ballast and luminaire.
- D. Lay-in Ceiling Lighting Fixtures Supports:



1. Install ceiling support system wires, independent of the ceiling suspension devices and grid, to all four ~~(4)~~ (2) corners of each fixture.
2. Support Clips: Fasten to lighting fixtures 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.

E. Suspended Lighting Fixture 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.

F. Air-Handling Lighting Fixtures: Install with dampers closed and ready for adjustment.

G. Connect wiring according to Section 26 05 19 "Low Voltage Electrical Power Conductors and Cables."

3.2 IDENTIFICATION

- A. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Section 260553 "Electrical Identification."

3.3 FIELD QUALITY CONTROL

- A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.
- 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.

3.4 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting aimable luminaires to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose. Some of this work may be required after dark.
1. Adjust aimable luminaires in the presence of Architect.

END OF SECTION

SECTION 26 65 20 – FIRE ALARM SYSTEM EXTENSION

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 APPLICABLE PUBLICATIONS^B

- 1. National Fire -National Electric Code (NEC)
- 2. No. 70-2013 -National Fire Alarm Code
- 3. No. 101 -Life Safety Code
- 4. Underwriters Laboratories Inc. (UL) - USA:
- 5. No. 464-Audible Signaling Appliances
- 6. No. 1971-Visual Signaling Appliances
- 7. No. 38-Manually Actuated Signaling Boxes
- 8. Local and State Building Codes.
- 9. All requirements of the Authority Having Jurisdiction (AHJ).

1.3 SUMMARY

- A. These specifications include the furnishing, installation, and connection of the fire alarm equipment required to form a complete extension of the existing system.
- B. The fire alarm system extension shall comply with requirements of NFPA Standard No. 72 for protected premises signaling systems except as modified and supplemented by this specification. The system shall be electrically supervised and monitor the integrity of all conductors.
- C. The fire alarm peripheral devices shall match existing system devices (verify at site prior to bidding).
- D. The system and its components shall be Underwriters Laboratories, Inc. listed under the appropriate UL testing standard as listed herein for fire alarm applications and shall be installed in compliance with the UL listing.
- E. The installing company shall employ NICET (minimum Level II Fire Alarm Technology) technicians on site to guide the final check-out and to ensure the systems integrity.
- F. Section Includes:

1. Manual fire-alarm boxes.
2. System smoke detectors.
3. Heat detectors.
4. Notification appliances.
5. Magnetic door holders.
6. Addressable interface device.

1.4 DEFINITIONS

- A. LED: Light-emitting diode.
- B. NICET: National Institute for Certification in Engineering Technologies.

1.5 SYSTEM DESCRIPTION

- A. Non-coded, UL-certified addressable system, with multiplexed signal transmission, dedicated to fire-alarm service only.
- B. All equipment and components shall be new, and the manufacturer's current model.
- C. All equipment and components shall be installed in strict compliance with manufacturers' recommendations.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For fire-alarm system. Include plans, elevations, sections, details, and attachments to other work.
 1. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.
 2. Include voltage drop calculations for notification appliance circuits.
 3. Include battery-size calculations.
 4. 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.
 5. 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.

6. Include voice/alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
7. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.

C. General Submittal Requirements:

1. 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.

D. Delegated-Design Submittal: For smoke and heat detectors indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Drawings showing the location of each smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the detector.
2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72.
3. Include manufacturer's name(s), model numbers, ratings, power requirements, equipment layout, device arrangement, and complete wiring point-to-point diagrams.
4. Together with the submittals, submit a certification from the major equipment manufacturer indicating that the proposed supervisor of installation is an authorized representative of the major equipment manufacturer.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Seismic Qualification Certificates: For fire-alarm control unit, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

4. Field quality-control reports.

1.8 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals. Include the following:
 1. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
 2. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.
 3. Record copy of site-specific software.
 4. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:
 - a. Frequency of testing of installed components.
 - b. Frequency of inspection of installed components.
 - c. Requirements and recommendations related to results of maintenance.
 - d. Manufacturer's user training manuals.
 5. Manufacturer's required maintenance related to system warranty requirements.
 6. Abbreviated operating instructions for mounting at fire-alarm control unit.
- B. Software and Firmware Operational Documentation:
 1. Software operating and upgrade manuals.
 2. Program Software Backup: On magnetic media or compact disk, complete with data files.
 3. Device address list.
 4. Printout of software application and graphic screens.

1.9 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. 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: Two (2) of each type installed.
7. Fuses: Two of each type installed in the system.

1.10 QUALITY ASSURANCE

- A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.
- B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level III technician.
- C. 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.
- D. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.

1.11 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:
 8. Notify Architect and/or Owner no fewer than ten (10) days in advance of proposed interruption of fire-alarm service.
 9. Do not proceed with interruption of fire-alarm service without Architect's and/or Owner's written permission.

1.12 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.

1.13 SOFTWARE SERVICE AGREEMENT

- A. Comply with UL 864.
- B. Technical Support: Beginning with Substantial Completion, provide with the product approval submittals an itemized cost proposal 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 and to allow Owner to upgrade computer equipment if necessary.

PART 2 - PRODUCTS

2.1 FIRE ALARM CONDUIT

- A. Conduit shall be in accordance with The National Electrical Code (NEC), local and state requirements.
- B. Conduit fill shall not exceed 40 percent of interior cross-sectional area where three or more cables are contained within a single conduit.
- C. Cable must be separated from any open conductors of Power, or Class 1 circuits, and shall not be placed in any conduit, junction box or raceway containing these conductors, as per NEC Article 760-29.
- D. Conduit shall be 3/4 inch (19.1 mm) minimum, RED in color.

2.2 MANUAL FIRE-ALARM BOXES

- A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
 - 1. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
 - 2. Station Reset: Key-operated switch – NO HEX WRENCH TYPES ALLOWED.

3. Weatherproof Protective Shield (where required): Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm.
4. An operated station shall automatically condition itself so as to be visually detected, as operated, at a minimum distance of 100 feet, front or side.
5. Manual stations shall be constructed of high impact Lexan, with operating instructions provided on the cover. The word FIRE shall appear on the manual station in letters one half inch in size or larger.

2.3 SYSTEM SMOKE DETECTORS

A. General Requirements for System Smoke Detectors:

1. Photoelectric smoke detectors shall be a 24 VDC, two wire, ceiling-mounted, light scattering type using an LED light source.
2. Each detector shall contain a remote LED output and a built-in test switch.
3. Detector shall be provided on a twist-lock base.
4. It shall be possible to perform a calibrated sensitivity and performance test on the detector without the need for the generation of smoke. The test method shall test all detector circuits.
5. A visual indication of an alarm shall be provided by dual latching Light Emitting Diodes (LEDs), on the detector, which may be seen from ground level over 360 degrees. These LEDs shall flash every 10 seconds, indicating that power is applied to the detector.
6. The detector shall not go into alarm when exposed to air velocities of up to 3000 feet per minute.
7. The detector screen and cover assembly shall be easily removable for field cleaning of the detector chamber.
8. All field wire connections shall be made to the base through the use of a clamping plate and screw.
9. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
10. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
11. Remote Control: Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.

- a. Rate-of-rise temperature characteristic shall be selectable at fire-alarm control unit for 15 or 20 deg F per minute.
- b. Fixed-temperature sensing shall be independent of rate-of-rise sensing and shall be settable at fire-alarm control unit to operate at 135 or 155 deg F.
- c. Provide multiple levels of detection sensitivity for each sensor.

B. Photoelectric Smoke Detectors:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status.
 - b. Device type.
 - c. Present average value.
 - d. Present sensitivity selected.
 - e. Sensor range (normal, dirty, etc.).

2.4 NOTIFICATION APPLIANCES

- A. General Requirements for Notification Appliances:** Connected to notification appliance signal circuits, zoned as indicated, equipped for mounting as indicated and with screw terminals for system connections.

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:**
 - a. 15/30/75/110 cd, selectable in the field.
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.

2.5 MAGNETIC DOOR HOLDERS

- A. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching doorplate.
 1. Electromagnet: Requires no more than 3 W to develop 25-lbf holding force.
 2. Wall-Mounted Units: Flush mounted unless otherwise indicated.
 3. Rating: 24-V ac or dc.
- B. Material and Finish: Match door hardware.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

- A. Comply with NFPA 72 for installation of fire-alarm equipment.
- B. Install wall-mounted equipment, with tops of cabinets not more than 72 inches above the finished floor.
- C. 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.
- D. Smoke- or Heat-Detector Spacing:
 1. Comply with NFPA 72, "Smoke-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for smoke-detector spacing.
 2. Comply with NFPA 72, "Heat-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for heat-detector spacing.

3. Smooth ceiling spacing shall not exceed 30 feet.
 4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Appendix A or Appendix B in NFPA 72.
 5. HVAC: Locate detectors not closer than 3 feet from air-supply diffuser or return-air opening.
 6. Lighting Fixtures: Locate detectors not closer than 12 inches from any part of a lighting fixture.
- E. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct.
- F. Heat Detectors in Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location.

3.2 CONNECTIONS

- A. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 3 feet from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.
1. Smoke dampers in air ducts of designated air-conditioning duct systems.
 2. Supervisory connections at valve supervisory switches.

3.3 IDENTIFICATION

- A. Paint all fire alarm junction boxes and covers RED. Indicate FIRE on box cover.

3.4 GROUNDING

- A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

3.5 FIELD QUALITY CONTROL

- A. Field tests shall be witnessed by Architect, the Engineer and the Authorities Having Jurisdiction.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- D. 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. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
 4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
 5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
 6. 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.
- E. Fire-alarm system will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.
- G. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.
- H. 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.

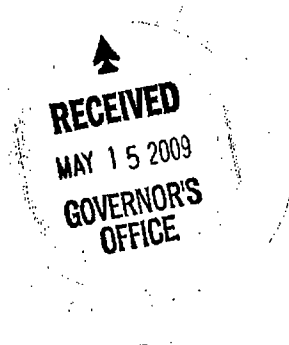
3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

END OF SECTION 26 65 20

ACT# 2009- 657

1 HB289
2 111990-4
3 By Representatives Hurst and Sanderford
4 RFD: Boards and Commissions
5 First Read: 03-FEB-09



1
2 ENROLLED, An Act,

3 Relating to fire alarm systems, to create a new
4 chapter in Title 34 of the Code of Alabama 1975, to regulate
5 and license persons who install a fire detection, fire alarm,
6 or fire communication system; to provide for administration by
7 the State Fire Marshal; to provide exceptions; to provide for
8 fees; to provide for criminal and civil penalties; and in
9 connection therewith would have as its purpose or effect the
10 requirement of a new or increased expenditure of local funds
11 within the meaning of Amendment 621 of the Constitution of
12 Alabama of 1901, now appearing as Section 111.05 of the
13 Official Recompilation of the Constitution of Alabama of 1901,
14 as amended.

15 BE IT ENACTED BY THE LEGISLATURE OF ALABAMA:

16 Section 1. Chapter 33A is added to Title 34 of the
17 Code of Alabama 1975, to read as follows:

18 §34-33A-1.

19 For purposes of this chapter, the following words
20 have the following meanings:

21 (1) CERTIFICATE HOLDER. An individual who is listed
22 on the State Fire Marshal's permit as the responsible managing
23 owner, partner, officer, or employee who is actively in charge
24 of the work of the certified fire alarm contractor meeting the
25 requirements established in Section 34-33A-4.

1 (2) CERTIFIED FIRE ALARM CONTRACTOR. A fire alarm
2 contractor who has qualified and received a permit from the
3 State Fire Marshal, with an NICET Level III on staff.

4 (3) FIRE ALARM CONTRACTOR. An individual,
5 partnership, corporation, association, or joint venture
6 engaged in the business of installation, repair, alteration,
7 addition, maintenance, or inspection of fire alarm systems.
8 The term does not include local building officials, fire
9 inspectors, or insurance inspectors when acting in their
10 official capacity.

11 (4) FIRE ALARM SYSTEM. A system or portion of a
12 combination system that consists of components and circuits
13 arranged to monitor and annunciate the status of fire alarm or
14 supervisory signal-initiating devices and to initiate the
15 appropriate response to those signals. ~~The~~ Any system
16 installed after the passage of this chapter shall follow the
17 installation standard set forth by the latest edition of the
18 National Fire Protection Association 72 National Fire Alarm
19 Code. The system shall meet the requirements of all locally
20 adopted codes and standards of the local municipality into
21 which the system is installed and shall be acceptable to the
22 local authority having jurisdiction.

23 (5) LICENSED ELECTRICAL CONTRACTOR. An individual,
24 partnership, corporation, association, or joint venture which
25 is licensed as an electrical contractor engaged in the

1 business of installation of conduit, wire, and fire alarm
2 associated equipment, but does not design, program, certify,
3 inspect, or test fire alarm systems. A licensed electrical
4 contractor is not a fire alarm contractor for the purpose of
5 this chapter.

6 (6) NICET. National Institute for Certification in
7 Engineering Technology.

8 (7) STATE FIRE MARSHAL'S PERMIT. The form issued by
9 the State Fire Marshal to a fire alarm contractor upon
10 application being approved and fee paid. The permit shall be
11 issued in the name of the fire alarm contractor, with the name
12 of the certificate holder noted thereon.

13 §34-33A-2.

14 The administration of this chapter is vested in the
15 State Fire Marshal who shall have the power to set or make
16 changes in the amount of the fee charged as necessary for the
17 administration and enforcement of this chapter.

18 §34-33A-3.

19 (a) It shall be unlawful for any individual,
20 partnership, corporation, association, or joint venture to
21 engage in the business of installation, repair, alteration,
22 addition, maintenance, or inspection of a fire alarm system in
23 this state except in conformity with this chapter.

24 (b) This chapter shall not apply to the following:

1 (1) The owner of a fire alarm system who employs
2 ~~registered professional fire protection engineers~~ and skilled
3 trained workers who regularly and routinely ~~design,~~ install,
4 repair, alter, add to, maintain, and inspect fire alarm
5 systems on and within the premises of the owner for the use of
6 the owner only.

7 ~~(2) A smoke detector installed in one or two family~~
8 ~~dwellings by a licensed electrical contractor.~~

9 (2) A smoke detector installed in a residential
10 dwelling.

11 (3) A residential combination burglary and fire
12 alarm system installed by a licensed burglary alarm contractor
13 in a residential occupancy as defined in the adopted building
14 code where located.

15 §34-33A-4.

16 (a) Every fire alarm system installed in this state
17 shall have a record of completion signed by a certified fire
18 alarm contractor, in accordance with the requirements of the
19 adopted building code and fire alarm code. The record of
20 completion and all supporting documents shall be available for
21 inspection by the State Fire Marshal or his or her designated
22 representative during normal business hours.

23 (b) Every fire alarm system in this state shall have
24 the name, address, phone number, and permit number, of the
25 responsible certified fire alarm contractor attached to the

1 main fire alarm control in a manner as prescribed by and
2 acceptable to the State Fire Marshal.

3 (c) Every fire alarm system in this state installed
4 after the passage of this chapter shall be maintained and
5 inspected by a certified fire alarm contractor in accordance
6 with the requirements of the most recently adopted version of
7 the National Fire Protection Association 72 National Fire
8 Alarm Code. Testing documentation shall be maintained by the
9 owner for inspection by the State Fire Marshal or his or her
10 designated representative during normal business hours.

11 §34-33A-5.

12 (a) Any individual, partnership, corporation,
13 association, or joint venture desiring to engage in the
14 business as a fire alarm contractor shall submit to the State
15 Fire Marshal on standard forms provided by the State Fire
16 Marshal a completed application. The applicant shall include a
17 fee of one hundred dollars (\$100) when making the application.
18 The applicant shall designate in the application the name of
19 the proposed certificate holder and provide written proof that
20 the individual has met all of the requirements and passed a
21 competency test administered by NICET as a Fire Alarm System
22 Technician - Level III or above. A copy of the current NICET
23 certificate shall be accepted as sufficient written proof as
24 required above. The State Fire Marshal, upon receipt of the
25 application and fee, shall issue a State Fire Marshal's permit

1 to a fire alarm contractor who has a current State Fire
2 Marshal's Permit, or who produces evidence of having a current
3 state permit from another state, if the state has entered into
4 an agreement of reciprocity with the State of Alabama.

5 (b) (1) Any individual desiring to engage in the
6 programming, maintenance, testing, inspection, certification,
7 or modification of fire alarm systems shall provide current
8 written proof that he or she has passed a competency test
9 administered by the NICET as a Fire Alarm System Technician -
10 Level II or any other acceptable nationally recognized fire
11 alarm technician certification requiring continuing education
12 that is deemed equivalent by the State Fire Marshal.

13 (2) Each individual, partnership, corporation,
14 association, or joint venture shall have 36 months after the
15 effective date of this chapter to be in full compliance with
16 the requirement of this subsection.

17 (3) A new employee who is hired by a certified fire
18 alarm contractor shall have 12 months from the date of hiring
19 to comply with the requirements of this chapter. A new
20 employee who is not in compliance with this chapter shall work
21 under the direct supervision of the certificate holder of the
22 certified fire alarm contractor.

23 §34-33A-6.

24 If the required fee has been paid, satisfactory
25 written proof from the NICET has been provided that the

1 requirements have been met and a competency test was passed
2 when required by this chapter, and the proposed certificate
3 holder is found to be a responsible, managing owner, partner,
4 officer, or employee of the fire alarm contractor, the State
5 Fire Marshal within 30 days shall issue a State Fire Marshal's
6 permit in the name of the fire alarm contractor with the name
7 of the certificate holder noted thereon.

8 §34-33A-7.

9 A certificate holder may not obtain a State Fire
10 Marshal's permit for more than one fire alarm contractor at
11 any time. A certificate holder may only hold a certificate for
12 the fire alarm contractor where he or she is currently
13 employed. If the certificate holder leaves the employment of
14 the fire alarm contractor, the certificate holder shall notify
15 the State Fire Marshal within 30 days. The certificate holder
16 may not obtain a State Fire Marshal's permit for more than one
17 other fire alarm contractor for a period of 12 months
18 thereafter. If the certificate holder leaves the employment of
19 the fire alarm contractor, or dies, the fire alarm contractor
20 shall have nine months to submit a new application proposing
21 designation of another individual as the certificate holder
22 for the applicant. If the application is not received and a
23 new permit issued within the allotted time, the State Fire
24 Marshal shall revoke the permit of the fire alarm contractor.

25 §34-33A-8.

1 A State Fire Marshal's permit shall expire annually
2 at midnight on September 30. At least 30 days prior to
3 expiration, a renewal application with a renewal fee shall be
4 submitted. A permit which is not renewed prior to expiration
5 shall be null and void on the expiration date, and it shall be
6 unlawful under this chapter for any individual, partnership,
7 corporation, association, or joint venture to engage in the
8 business of installing, repairing, altering, adding,
9 maintaining, or inspecting a fire alarm system without a
10 validly renewed State Fire Marshal's permit. The permit may be
11 reinstated by making application as before and payment of the
12 fee; however, until the time as a new permit is issued, it
13 shall be unlawful for the fire alarm contractor to engage in
14 installing, repairing, altering, adding, maintaining, or
15 inspecting fire alarm systems.

16 §34-33A-9.

17 If a certified fire alarm contractor desires to do
18 business in any part of the state, he or she shall deliver to
19 the local building official a copy of his or her State Fire
20 Marshal's permit. The local building official shall require a
21 copy of the State Fire Marshal's permit before issuing a
22 license or building permit. The certified fire alarm
23 contractor shall pay any fees normally imposed for local
24 licenses or permits. The local official may not impose other
25 requirements on the certified fire alarm contractor to prove

1 competency other than proper evidence of a valid State Fire
2 Marshal's permit.

3 §34-33A-10.

4 Nothing in this chapter limits the power of a
5 municipality, county, or the state to regulate the quality and
6 character of work performed by contractors, through a system
7 of permits, fees, and inspections which are designed to assure
8 compliance with, and aid in the implementation of, state and
9 local building laws or to enforce other local laws for the
10 protection of the public health and safety. Nothing in this
11 chapter limits the power of a municipality, county, or the
12 state to adopt any system of permits requiring submission to
13 and approval by the municipality, county, or the state, of
14 plans and specifications for work to be performed by
15 contractors before commencement of the work..If the plans for
16 a fire alarm system are required to be submitted to and
17 approved by any municipality, county, or the state, or any
18 departments or agencies thereof, the plans shall bear the seal
19 of a professional engineer licensed in the State of Alabama or
20 be submitted by a certified fire alarm contractor. The
21 official authorized to issue building or other related permits
22 shall ascertain that the fire alarm contractor is duly
23 certified by requiring evidence of a valid State Fire
24 Marshal's permit.

25 §34-33A-11.

1 (a) This chapter applies to any fire alarm
2 contractor performing work for any municipality, county, or
3 the state. Officials of any municipality, county, or the state
4 shall determine compliance with this chapter before awarding
5 any contract for the installation, repair, alteration,
6 addition, or inspection of a fire alarm system. Any bid for a
7 contract shall be accompanied by a copy of a valid State Fire
8 Marshal's permit.

9 (b) All architects and engineers preparing plans and
10 specifications for work involving fire alarm systems to be
11 contracted in the State of Alabama shall include in their
12 invitation to bidders and their specifications a copy of this
13 chapter or portions as are deemed necessary to convey to the
14 invited bidder that it will be necessary for the bidder to
15 show evidence of licensure before a bid is considered whether
16 the bidder is a resident or nonresident of this state and
17 whether a license has been issued to the bidder or not.

18 §34-33A-12.

19 All funds collected pursuant to this chapter shall
20 be deposited in the State Treasury to the credit of the State
21 Fire Marshal's Fund authorized in Section 24-5-10. The State
22 Fire Marshal may expend moneys from the State Fire Marshal's
23 Fund for the administration and enforcement of this chapter.
24 The State Fire Marshal may receive grants and donations from
25 associations, firms, or individuals who are interested in the

1 upgrading and quality of fire alarm systems in compliance with
2 Alabama state ethics laws.

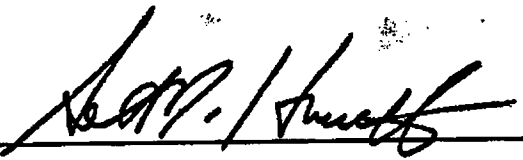
3 §34-33A-13.

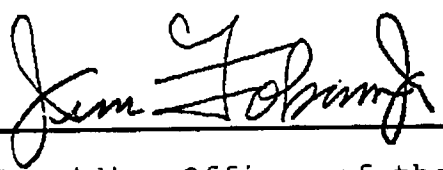
4 Whenever the State Fire Marshal has reason to
5 believe that any individual, partnership, corporation,
6 association, or joint venture is or has been violating any
7 provision of this chapter, the State Fire Marshal or his or
8 her deputy or assistant may issue and deliver to the
9 individual, partnership, corporation, association, or joint
10 venture an order to cease and desist the violation. Failure to
11 comply with any order under this section shall constitute a
12 Class B misdemeanor and shall be punishable as provided by
13 state law. In addition, the State Fire Marshal may impose a
14 civil penalty not to exceed two hundred fifty dollars (\$250)
15 for each day the violation exists. Violation of any provision
16 of this chapter or failure to comply with a cease and desist
17 order shall be cause for revocation of a State Fire Marshal's
18 permit.

19 Section 2. Although this bill would have as its
20 purpose or effect the requirement of a new or increased
21 expenditure of local funds, the bill is excluded from further
22 requirements and application under Amendment '621, now
23 appearing as Section 111.05 of the Official ReCompilation of
24 the Constitution of Alabama of 1901, as amended, because the

1 bill defines a new crime or amends the definition of an
2 existing crime.

3 Section 3. This act shall become effective on the
4 first day of the third month following its passage and
5 approval by the Governor, or its otherwise becoming law.


 Speaker of the House of Representatives

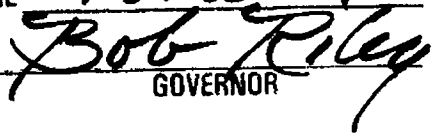

 President and Presiding Officer of the Senate

House of Representatives

I hereby certify that the within Act originated in
 and was passed by the House 06-MAY-09, as amended.

Greg Pappas
 Clerk

Senate	15-MAY-09	Amended and Passed
House	15-MAY-09	Concurred in Senate Amendment

APPROVED May 21, 2009
 TIME 9:07 a.m.

 GOVERNOR

Alabama Secretary Of State

Act Num....: 2009-657
 Bill Num....: H-289

Recv'd 05/21/09 02:51pm JJB

SECTION 26 90 00

STRUCTURED CABLING SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Section 26 01 01 "Basic Electrical Requirements".
- C. Section 26 05 26 "Grounding and Bonding for Electrical Systems".
- D. Section 26 05 29 "Hangers and Supports for Electrical Systems".
- E. Section 26 05 33 "Raceways and Boxes for Electrical Systems".
- F. Section 26 05 44 "Sleeves and Seals for Electrical Raceways and Cabling".

1.2 SUMMARY

- A. All work under this specification section to be performed by a qualified telecommunications contractor as defined in this section. This includes, but is not limited to, cabling installation, cabling termination, equipment installation, system component labeling, owner coordination, etc. All work performed by a contractor who does not meet the contractor qualifications as defined in this section will be replaced at no expense to the owner.
- B. This document describes the products and execution requirements relating to furnishing and installing Telecommunications Cabling at the building. Backbone and horizontal cabling comprised of copper and fiber cabling, and support systems are covered under this document.
- C. The Horizontal (workstation) Cabling System shall consist of 4-pair Unshielded Twisted Pair (UTP) Copper Cables to each work area outlet as shown on the plans. The cables shall be installed from the Work Area Outlet to the Telecommunications Room location as called for, and routed to the appropriate rack serving that area and terminated as specified in this document.
- D. All cables and related terminations, support and grounding hardware shall be furnished, installed, wired, tested, labeled, and documented by the Telecommunications contractor as detailed in this document or as required for a fully functional system as intended.
- E. Product specifications, general design considerations, and installation guidelines are provided in this document. Quantities of telecommunications outlets, typical installation details, cable routing and outlet types will be provided as an attachment to this document. If the bid documents are in conflict, this specification shall take precedence. Any/ all work called for in this document or the attachment shall be included in the bid price as if called for in both this document and any/ all attachments. The successful vendor shall meet or exceed all requirements for the cable system described in this document
- F. Section Includes:
 - 1. Patch cords.

2. Telecommunications outlet assemblies.
3. Horizontal (workstation) cabling and terminations.
4. Cable identification.
5. Cable connecting hardware.
6. Cross-connects.
7. Patch panels.
8. Telecommunications equipment racks, cabinets and enclosures.
9. Cable management system.
10. Optical fiber panels/ enclosures, patch panels and terminations.
11. Backbone cabling.
12. Telecommunications mounting elements.
13. Backboards.
14. Copper cable protection units.
15. Copper cable punch-down blocks.
16. Grounding.
17. Firestopping.

G. Related Requirements:

1. All work and materials shall conform in every detail to the rules and requirements of the National Fire Protection Association (latest edition of applicable sections), all local codes, requirements of authority having jurisdiction, and present manufacturing standards.
2. All materials shall be UL Listed and shall be marked as such. If UL has no published standards for a particular item, then other national independent testing standards shall apply and such items shall bear those labels. Where UL has an applicable system listing and label, the entire system shall be so labeled.
3. All modular jacks, patch cords, patch panels and CAT6 cable performance shall be verified (not just tested) by a third party to be category 6 component and channel compliant.
4. Regulatory References:
 - a. NFPA 70/ NEC (latest edition): National Electrical Code.
 - b. ANSI J-STD-607 (latest edition): Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.
 - c. TIA/EIA-606 (latest revision): Administration Standard for Telecommunications Infrastructure.
 - d. UL 969 (latest revision): Marking and Labeling Systems.
 - e. NECA 1 (latest edition): Standard Practice of Good Workmanship in Electrical Construction.
 - f. BICSI TDMM (latest edition): Telecommunications Distribution Methods Manual.
 - g. TIA/EIA-569 (latest edition): Commercial Building Standard for Telecommunications Pathways and Spaces.
 - h. TIA/EIA-568 (latest edition): Cabling Standard.
 - i. All other regulatory references noted in this document.
5. If this document and any of the documents listed above are in conflict, then the more stringent requirement shall apply. The Contractor has the responsibility to determine and adhere to the most recent release when developing the proposal for installation.
6. This document does not replace any code, either partially or wholly. The contractor must be aware of local codes that may impact this project.

1.3 WORK INCLUDED

- A. The work included under this specification consists of furnishing all labor, equipment, materials, and supplies and performing all operations and setup necessary to complete the installation of this structured cabling system in compliance with the specifications, drawings and applicable codes/ regulatory references. The Telecommunications contractor will provide and install all of the required material to form a complete system whether specifically addressed in the technical specifications or not.
- B. The work shall include, but not be limited to the following:
 - 1. Furnish and install a complete telecommunications wiring infrastructure.
 - 2. Furnish, install, and terminate ALL UTP and Optical Fiber cable and Coaxial cable.
 - 3. Furnish and install all work area patch cords, wall plates, jacks, patch panels, punch-down blocks and equipment room patch cords.
 - 4. Furnish and install all required cabinets and/or racks and/ or enclosures as required or as indicated.
 - 5. Perform link or channel testing (100% of horizontal and/or backbone links/ channels) and certification of all components.
 - 6. Furnish test results of all cabling to the owner in electronic (searchable PDF file) and paper format, listed by each closet, then by workstation ID with the close-out documents.
 - 7. Adhere and comply with all requirements of connectivity and cabling manufacturer Certification programs.
 - 8. Provide owner training and documentation.
 - 9. Coordinate with the owner and the engineer for the required telecom room and equipment identification, conduit routes and identifications, cable identification (at the rack and at the work area). Provide and install labeling for all cables using the owner approved labeling scheme.
 - 10. Furnish any other material required to form a complete system.

1.4 DEFINITIONS

- A. BICSI: Building Industry Consulting Service International.
- B. LAN: Local Area Network.
- C. CLAN: Campus Local Area Network.
- D. RCDD: Registered Communications Distribution Designer.
- E. EF: Entrance facility.
- F. ER: Equipment Room.
- G. CMDF: Campus Main Distribution Frame.
- H. CIDF: Campus Intermediate Distribution Frame.
- I. MDF: Facility Main Distribution Frame. May include the Entrance Facility equipment and/ or the Equipment Room equipment.
- J. IDF: Intermediate Distribution Frame.
- K. EMI: Electromagnetic Interference.

- L. Cross-connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.
- M. IDC: Insulation Displacement Connector.
- N. UTP: Unshielded Twisted Pair.
- O. Consolidation point: A location for interconnection between horizontal cables extending from building pathways and horizontal cables extending into furniture pathways.
- P. MUTOA: Multiuser telecommunications outlet assembly, a grouping in one location of several telecommunications outlet/ connectors.
- Q. Outlet/ connectors: A connecting device in the work area on which horizontal cable or outlet cable terminates.
- R. WAP: Wireless Access Point

1.5 HORIZONTAL CABLING DESCRIPTION

- A. Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/ connector and the horizontal cross-connect located in the communications equipment room. This cabling and its connecting hardware are called a "permanent link," a term that is used in the testing protocols.
 - 1. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications outlet/connector.
 - 2. Bridged taps and splices shall not be installed in the horizontal cabling.
 - 3. Splitters shall not be installed as part of the optical fiber or copper cabling system (excluding coaxial cable).
- B. A work area is approximately 100 sq. ft., and includes the components that extend from the telecommunications outlet/connectors to the station equipment.
- C. The maximum allowable horizontal cable length is 295 feet. This maximum allowable length does not include an allowance for the length of 16 feet of patch cord to the workstation equipment or in the horizontal cross-connect.

1.6 BACKBONE CABLING DESCRIPTION

- A. Backbone cabling system shall provide interconnections between communications equipment rooms, entrance facilities, MDF, IDF and CMDF (where applicable) in the telecommunications cabling system structure. Cabling system consists of backbone cables, intermediate and main cross-connections, mechanical terminations, and patch cords or jumpers used for backbone-to-backbone cross-connection.
- B. Backbone cabling cross-connections may be located in communications equipment rooms, entrance facilities or MDF. Bridged taps and splitters shall not be used as part of backbone cabling.
- C. Performance requirements
 - 1. General Performance: Backbone cabling system shall comply with transmission standards in TIA/EIA-568-B.1, when tested according to test procedures of this standard.

1.7 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate layout and installation of telecommunications cabling with Owner's telecommunications department and LAN equipment and service suppliers.
- B. Coordinate telecommunications outlet/ connector locations with location of power receptacles at each work area.
- C. Coordinate typical labeling configuration with owner in writing prior to implementing.
- D. Coordinate cable pathway routings with electrical contractor and all other trades.

1.8 SUBMITTALS

- A. Contractor shall provide 7 hard copies and a electronic copy (searchable PDF file) of all submittal data required including Product Data, Shop drawings, Informational submittals and samples. Submittals will not be reviewed until complete Structured Cabling submittal package is received.
- B. The Structured Cabling contractor shall check all suppliers' submittals regarding measurements, capacity, performance and details to satisfy him/ herself that they conform to the intent of the contract drawings and specifications. Submittals package shall bear the stamp of approval of the Structured Cabling contractor as evidence that the submittals have been checked by him/ her. Submittals will not be reviewed without the Structured Cabling contractor's stamp.
- C. See 26 01 01 for additional submittal requirements.
- D. Product Data: For each type of product including but not limited to: Patch cords, jacks, faceplates, cables, patch panels, racks/ cabinets
 - 1. Work shall NOT proceed without the engineer's approval of the submitted items.
 - 2. For all cable types used include:
 - a. Performance characteristics.
 - b. Nominal outside diameter.
 - c. Minimum bending radius.
 - d. Maximum pulling tension.
 - 3. For all racks/ cabinets and associated accessories include:
 - a. Construction details, material descriptions, dimensions of individual components and profiles, and finishes for equipment racks and cabinets.
 - b. Rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- E. Shop Drawings:
 - 1. Submit a typical outlet assembly and labeling configuration.
 - 2. System Labeling Schedules:
 - a. Systems Labeling Schedule method shall be approved by owner, in writing, prior to implementation.
 - b. Provide a typical Systems Labeling Schedule sampling with submittals.

3. Cabling administration drawings and printouts.
4. Wiring diagrams to show typical wiring schematics including the following:
 - a. Cross-connects.
 - b. Patch panels (copper and fiber)
 - c. Patch cords and jumpers.
 - d. Work area outlet.
 - e. Active network equipment.
5. Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.
6. Cable pathway layout, showing raceway route and type (cable tray, J-hooks, conduit, sleeves and pullboxes) to scale, with relationship between the pathway and adjacent structural, electrical, and mechanical elements. Include the following:
 - a. Vertical and horizontal offsets and transitions.
 - b. Clearances for access above and to side of cable trays and J-hook pathway.
 - c. Vertical elevation of pathway above the floor or bottom of ceiling structure.
 - d. Load calculations to show dead and live loads as not exceeding manufacturer's rating for tray/ J-hooks and support elements.
 - e. Load calculations to show dead and live loads as not exceeding manufacturer's rating for conduit support elements.
7. Detail equipment assemblies and indicate dimensions, weights, loads, recommended clearances, method of field assembly, components, and location and size of each field connection.
8. Equipment Racks and Cabinets: Include workspace requirements and access for cable connections.
9. Grounding: Submit a scale drawing of grounding bus bar and its mounting detail showing standoff insulators and wall mounting brackets.
10. Contractor shall include in the submittal package 1-1/2" scale equipment rack elevations (front) for all equipment racks/ cabinets. Elevations must include and identify (by manufacturer and model# where applicable) the following:
 - a. Individual equipment rack identification
 - b. All rack-mounted equipment
 - c. All rack-mounted cable management
 - d. All rack-mounted Power Distribution Units
 - e. All rack-mounted ground bars
 - f. All blank filler plates
 - g. All rack mounted Uninterruptable Power Supplies (UPS)
11. Contractor shall include in the submittal package 1/2" scale drawings of each telecom room. Drawings must include and identify (by manufacturer and model# where applicable) the following:
 - a. All equipment rack(s) and clearances.
 - b. All backboard(s).
 - c. All cable tray/ cable runway.
 - d. Wall mounted ground bar.
 - e. All raceway penetrations.
 - f. All riser conduits.
 - g. All punch-down blocks.
 - h. All floor or wall-mounted Uninterruptable Power Supplies (UPS).

- i. Receptacle locations.
 - j. All fire-stopping material/ fittings
 - k. All other equipment indicated on drawings or existing (where applicable).
12. Contractor shall include in the submittal package ½" scale interior elevations of all walls in each Comm room. Elevations must include and identify (by manufacturer and model# where applicable) the following:
- a. All backboards.
 - b. All wall mounted equipment.
 - c. All raceway penetrations.
 - d. All riser conduits.
 - e. All wall mounted cable management (D-rings).
 - f. All backbone cabling.
 - g. All receptacles.
 - h. All punch-down blocks.
 - i. Wall mounted ground bar(s).
 - j. All fire-stopping material/ fittings.

F. INFORMATIONAL SUBMITTALS

1. The following informational submittal information must be provided with the submittal package:
- a. Qualification Data: For all telecommunications contractor's personnel on site, qualified layout technicians, installation supervisor, Installers, telecommunications contractor's field quality inspector and RCDD. Personnel qualification data shall include all BICSI certifications as well as all current cabling/ connectivity manufacturer's certifications.
 - 1) Contractor shall submit names of all personnel to be performing work related to this project
 - 2) Contractor shall submit a copy of the current cabling/ connectivity manufacturer's certification documents for all contractor personnel to be involved with this project.
 - 3) Contractor shall submit a copy of all BICSI certification documents for all contractor personnel to be involved with this project.
 - b. Seismic Qualification Certificates: For equipment frames from manufacturer.
 - 1) Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2) Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions. Base certification on the maximum number of components capable of being mounted in each rack type. Identify components on which certification is based.
 - 3) Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
 - c. Contractor must submit the following information regarding the 3 projects of similar size and scope (see "Quality Assurance"):
 - 1) Project name.
 - 2) Project location.
 - 3) Project owner. Include contact information (name, address, telephone and e-mail) for owners IT department or responsible party as it relates to structured cabling.
 - 4) Approximate value of project structured cabling.
 - 5) Approximate drop count.

- 6) Contact information (including name, address, telephone and e-mail) of electrical or general contractor directly responsible for the structured cabling subcontractor.
 - d. Contractor must submit a sample of the labeling system for all outlets, cables and patch panels.
- G. Samples: jacks, jack assemblies, icons, cable (1 foot section), patch cable (3 foot length) and faceplate. Provide one of each type and size of each product submitted.

1.9 CLOSEOUT SUBMITTALS

- A. Maintenance data: For splices and connectors to include in maintenance manuals.
- B. Software and Firmware Operational Documentation:
 - 1. Software operating and upgrade manuals.
 - 2. Program Software Backup: On magnetic media or compact disk, complete with data files.
 - 3. Device address list.
 - 4. Printout of software application and graphic screens.
- C. System Labeling Schedules: Electronic copy of labeling schedules in searchable PDF file format.
- D. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.
- E. All testing records.
- F. All as-built drawings.
- G. All warranty materials.
- H. Other records as called for within this specification.

1.10 MAINTENANCE SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Patch cables: Ten of each length used.
 - 2. Jacks: Ten of each type used.
 - 3. Faceplates: Ten of each type/ port capacity used.
 - 4. 4 pair UTP Cable: One 500ft reel of each type used.
 - 5. Patch-Panel units: Two of each type used.
 - 6. Rack filler panels: Five of each type used.
 - 7. Power distribution units: Two of each type used.
 - 8. Punch-down blocks: Three of each type used.

1.11 QUALITY ASSURANCE

- A. Installer Qualifications: The successful telecommunications contractor shall be a company specializing in communication cabling installation and shall have been in business for a minimum of 5 years under the same name and with the same board of directors/ management.

Contractor must have successfully completed a minimum of 3 projects of similar size and scope within the last 5 years. At least 30 percent of the copper installation and termination crew must be certified by BICSI and the cable/connectivity manufacturer with a Technicians Level of Training. At least 10 percent of the optical fiber installation and termination crew must be certified by BICSI and the cable/connectivity manufacturer in optical fiber installation and termination practices. The contractor must have an RCDD on staff in responsible charge of the project. Provide all contact information for the RCDD as this will be the point of contact for the project.

1. Layout Responsibility: Preparation of Shop Drawings shall be under the direct supervision of an RCDD.
2. Installation Supervision: Installation shall be under the direct supervision of a BICSI certified Commercial Installer, Level 2, who shall be present at all times when work of this Section is performed at Project site.
3. Contractor's field quality inspector shall be the RCDD who is in responsible charge of the project or the on-site installation supervisor. Contractor's field quality inspector shall provide bi-weekly on-site inspection reports to the engineer documenting this discipline's project progress. These reports shall be submitted to adam@jrmengineering.com. Report shall include work that has been completed, work that is in progress, work remaining and estimated date of completion for each phase of work for the project. Report shall include photographs of completed work and work in progress. Report shall include telecommunications contractor's personnel on-site for the duration of time included in the report. The report shall also include work by other trades to be utilized for the completion of the work specified in this section.
4. Structured cabling contractor shall have, on site for final inspection, the RCDD who is in responsible charge of the project or the on-site installation supervisor. If one of the requested personnel is not present at the final inspection, the structured cabling contractor will be charged for time (\$125.00/ hour) and mileage (\$0.50/ mile) for the Jack R. Morgan Engineering, Inc. representative for the missed inspection. This charge must be paid prior to any subsequent visits to the site.
5. Testing supervisor shall be currently certified by BICSI as an RCDD and shall be on-site to supervise all testing.

- B. The cabling/ connectivity manufacturer shall extend a manufacturer's warranty for all products installed, this project, to the end user once the telecommunications contractor fulfills all requirements under this specification. See section 3 of this document for full warranty requirements.
- C. 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.
- D. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.
- E. Grounding: Comply with ANSI-J-STD-607-A.

1.12 DELIVERY, STORAGE, AND HANDLING

- A. Delivery and receipt of products shall be at the site.
- B. Cable shall be stored according to manufacturer's recommendations at a minimum. In addition, cable must be stored in a location protected from vandalism and weather. If cable is stored outside, it must be covered with opaque plastic or canvas with provision for ventilation to prevent condensation and for protection from weather. If air temperature at cable storage

location will be below 40 degrees F., the cable shall be moved to a heated (50 degrees F. minimum) location. If necessary, cable shall be stored off site at the contractor's expense.

- C. If the telecommunications contractor wishes to have a trailer on site for storage of materials, arrangements shall be made with the Owner.
- D. Test all cables upon receipt at Project site.
 - 1. Test optical fiber cable to determine the continuity of the strand end to end. Use optical loss test set.
 - 2. Test optical fiber cable while on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector, including the loss value of each. Retain test data and include the record in closeout submittals.
 - 3. Test each pair of UTP cable for open and short circuits.

1.13 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install ANY cables or connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.14 DRAWINGS

- A. It shall be understood that the electrical details and drawings provided with the specification package are diagrammatic. They are included to show the intent of the specifications and to aid the telecommunications contractor in bidding the job. The telecommunications contractor shall make allowance in the bid proposal to cover whatever work is required to comply with the intent of the plans and specifications and provide a fully functional system as intended.
- B. The telecommunications contractor shall verify all dimensions at the site and be responsible for their accuracy.
- C. Prior to submitting the bid, the telecommunications contractor shall call the attention of the Engineer to any materials or apparatus the telecommunications contractor believes to be inadequate and to any necessary items of work omitted.

PART 2 - PRODUCTS

2.1 PRODUCTS

- A. Due to the nature and type of communications all products, including but not limited to faceplates, jacks, patch panels, racks, punch-down blocks, and patch cords, for the purpose of this document, shall be manufactured by Leviton.
 - 1. Subject to compliance with plans and specifications, the following manufacturers shall be considered equal: Hubbell, Ortronics, Panduit
- B. Due to the nature and type of communications all products, including but not limited to all copper cables and fiber optic cables, for the purpose of this document, shall be manufactured by Berktek.
 - 1. Subject to compliance with plans and specifications, the following manufacturers shall be considered equal: Hitachi, Superior Essex, General Cable.

2.2 TELECOMMUNICATIONS OUTLET/CONNECTORS

- A. Work area cables shall each be terminated at their designated work area location in the connector types specified on drawings/ described in the subsections below. Included are modular telecommunication jacks. These connector assemblies shall snap into a faceplate.
- B. The Telecommunications Outlet Assembly shall accommodate a minimum of two (2) modular jacks plus any additional accommodations for specific locations as noted in the plans for optical fiber and/or additional copper cables as necessary
- C. A blank filler will be installed when extra ports are not used.
- D. A dust cap shall be provided on all modular jacks with the circuit number on the identifier strip.
- E. Multiple jacks that are identified in close proximity on the drawings (but not separated by a physical barrier) may be combined in a single assembly. The telecommunications contractor shall be responsible for determining the optimum compliant configuration based on the products proposed.
- F. The same orientation and positioning of jacks and connectors shall be utilized throughout the installation. Prior to installation, the telecommunications contractor shall submit the proposed configuration for each outlet assembly for review by the owner.
- G. The modular jack shall incorporate printed label strip on the dust cap module for identifying the outlet. Printed labels shall be permanent and compliant with ANSI/TIA/EIA-606-A standard specifications. Labels shall be printed using standard connectivity manufacturer's label program or using a printer such as a Brady hand held printer. Hand printed labels shall NOT be accepted.
- H. Workstation Outlets shall be as specified on drawings with connector and faceplate.
 - 1. Jacks shall:
 - a. Be 100-ohm, balanced, twisted-pair connector; four-pair, eight-position modular. Comply with TIA/EIA-568-B.1.
 - b. Meet category 6 performance as defined by the references in this document including ANSI/TIA/EIA-568-B.2-1. All pair combinations must be considered, with the worst-case measurement being the basis for compliance. Modular jack performance shall be third-party verified by a nationally recognized independent testing laboratory.
 - c. Use dual reactance modular contact array.
 - d. Have low emission IDC contacts.
 - e. Use standard termination practice using 110 impact tool.
 - f. Be backwards compatible to Category 3, 5, and 5e.
 - g. Be center tuned to category 6 test specifications.
 - h. Dust covers shall be used on each termination.
 - i. Be as specified on drawings. Jack and icon color to be selected by owner/ architect.
 - 2. Faceplate shall:
 - a. Be as manufactured by connectivity manufacturer.
 - b. Be UL listed and CSA certified.
 - c. Be available in single-gang or dual-gang.

- d. Shall provide easy access for adds, moves, and changes by front removal of jack modules.
- e. Possess recessed designation windows to facilitate labeling and identification.
- f. Shall include a clear plastic cover to protect labels in the designation window.
- g. Have mounting screws located under recessed designation windows.
- h. Comply with ANSI/TIA/EIA-606-A work area labeling standard.
- i. Allow for the UTP modules to be inverted in place for termination purposes.
- j. Be manufactured by an ISO 9001 registered company.
- k. Be compliant with the above requirements along with the following when incorporating optical fiber:
 - l. Be a low profile assembly,
- m. Incorporate a mechanism for storage of cable and fiber slack needed for termination,
- n. Position the fiber optic couplings to face downward or at a downward angle to prevent contamination.
- o. Incorporate a shroud that protects the fiber optical couplings from impact damage.
- p. Be Impact resistant nylon as specified on drawings and complying with requirements in section 26 27 26 "Wiring Devices". Color shall be selected by architect.
- q. For use with snap-in jacks accommodating any combination of UTP, optical fiber and coaxial work area cords.
- r. Flush mounting jacks.
- s. Shall have window for snap-in, clear-label covers and machine-printed paper inserts.

2.3

UTP CABLE



A.

Subject to compliance with requirements, provide product indicated on drawing. **Minimum compliant CAT6 cable is acceptable.**

B.

Performance:

- 1. General Performance: Horizontal cabling system shall comply with transmission standards in TIA/EIA-568-B.1 when tested according to test procedures of this standard.
- 2. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 50 or less.
- 3. 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.
- 4. Grounding: Comply with J-STD-607-A.

C. Description: 100-ohm, four-pair UTP, covered with a thermoplastic jacket shall:

- 1. Comply with ICEA S-90-661 for mechanical properties.
- 2. Comply with TIA/EIA-568-B.1 for performance specifications.
- 3. Comply with TIA/EIA-568-B.2, Category 6 and/ or Category 5e for cables as specified on drawings
- 4. Be listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:

- a. Communications, General Purpose: CMP or CMR.
 - b. Communications, Plenum Rated: Type CMP, complying with NFPA 262.
 - c. Communications, Riser Rated: Type CMR, complying with UL 1666.
5. Be plenum rated and meet applicable requirements of ANSI/ICEA S-80-576 in all locations where the cable path crosses any space rated as a return air plenum. All 4 pairs must be insulated with F.E.P. No constructions that use mixed insulation materials for a single cable pathway will be allowed.
 6. Consist of (4) 23 AWG twisted pairs.
 7. Be suitable for the environment in which they are to be installed.
 8. Have an overall diameter no larger than 0.250 inches.
 9. Have an ultimate breaking strength measured in accordance with ASTM D 4565 and shall be no less than 400 N minimum.
 10. Shall withstand a bend radius of 1 inch at -20 degrees Celsius without jacket or insulation cracking.
 11. Be third party verified to meet ANSI/TIA/EIA-568-B.2.
 12. Shall be color coded as required to meet owners color coding scheme.
 13. Be as specified on drawings.

2.4 UTP CABLE HARDWARE

- A. Subject to compliance with requirements, provide product indicated on drawing.
- B. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-B.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.
- C. Connecting Blocks: 110-style IDC for Category 5e and Category 6. Provide blocks for the number of cables terminated on the block, plus 10 percent spare. Integral with connector bodies, including plugs and jacks where indicated.
- D. Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between cables.
 1. Number of Terminals per Field: One for each conductor in assigned cables.
- E. Patch Panel shall:
 1. House multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.
 2. Have number of Jacks required to provide one for each four-pair UTP Data and Voice cable indicated plus 10 percent spare.
 3. Have Data, Voice and security related cables terminated on separate patch panels.
 4. meet category 6 component compliance and be verified by a third-party nationally recognized independent testing laboratory
 5. Use low emission IDC contacts
 6. Use dual reactance technology to enhance the signal-to-noise ratio
 7. Require standard termination practices using a 110 impact tool
 8. Use a single piece IDC housing designed to accept larger Category 6 conductors
 9. Support both T568B and T568A wiring
 10. Include easy to follow wiring labels
 11. Include label fields
 12. Allow for the use of icons
 13. Include full length metal rear cable management

14. Be available in standard or high density
15. Be backward compatible to category 3, 5 and 5e
16. Be center tuned to category 6 test specifications
17. Be accompanied by horizontal cable management in a ratio of one rack unit of wire management per 24 ports of patch panel.
18. Be as specified on drawings.

F. Copper Patch Cords:

1. Patch Cords shall:
 - a. Be factory-made, four-pair cables in standard lengths; terminated with eight-position modular plug at each end.
 - b. Have bend-relief-compliant boots and color-coded icons to ensure Category 6 performance. Patch cords shall have latch guards to protect against snagging.
 - c. Have color-coded boots for circuit identification.
 - d. Use 8 position connector with impedance matched contacts and designed using dual reactance.
 - e. Be constructed of 100 ohm, 4 pair, 24 AWG, stranded conductor, unshielded twisted pair copper per the requirements of the ANSI/TIA/EIA-568-B.2 and ANSI/TIA/EIA-568-B.2-1 standard.
 - f. Meet TIA category 6 component specifications in ANSI/TIA/EIA-568-B.2-1
 - g. Be 100% factory tested to meet category 6 performance
 - h. Have ETL or any other nationally recognized 3rd party verification
 - i. Be center tuned to category 6 performance specifications by using paired bi-level contact array
 - j. Be capable of universal T568A or T568B wiring schemes
 - k. Have a connector that maintains the paired construction of the cable to facilitate minimum untwisting of the wires.
 - l. Have a performance marking indelible label on the jacket (by the manufacturer).
 - m. Have the ability to accept color-coded labels and icons to comply with ANSI/TIA/EIA-606A labeling specifications.
 - n. Have "snag-less" protection for the locking tab to prevent snagging and to protect locking tab in tight locations and provide bend relief
 - o. Be available in three standard colors
 - p. Be backwards compatible to Category 3, 5, and 5e
 - q. Be manufactured by a ISO 9001 registered company.
 - r. Be color coded as directed by owner.
 - s. Be as manufactured by submitted cable or connectivity manufacturer.
2. Work Area Patch cords: Factory-made, four-pair, category 6 cables in 3 foot, 5 foot, 7 foot, 10 foot and 15 foot lengths; terminated with eight-position modular plug at each end.
 - a. Contractor shall provide one each patch cord for each Data and Voice cable terminated in a work area outlet. Patch cord shall be provided in the following lengths:
 - 1) 10% of patch cords provided shall be 3 foot in length.
 - 2) 20% of patch cords provided shall be 5 foot in length.
 - 3) 30% of patch cords provided shall be 7 foot in length.
 - 4) 30% of patch cords provided shall be 10 foot in length.
 - 5) 10% of patch cords provided shall be 15 foot in length.

3. Cross-connect copper Patch Cords: Factory-made, four-pair, category 6 cables in lengths as required; terminated with eight-position modular plug at each end.
 - a. Contractor shall provide one each patch cord for each Data and Voice cable terminated in telecom room. Cables shall be furnished in lengths as required to facilitate a neat and flexible installation.
4. Cross-connect fiber patch cords: factory made, single pair, multimode,, 50/125 micrometer, 62.5/125micrometer, in lengths as required, terminated with type ST, SC, LC, connectors as required. Verify connector type with owner prior to ordering.

2.5 COPPER CABLE PROTECTION UNITS

- A. All copper circuits shall be provided with protection between each building with an entrance cable protector panel. All building-to-building circuits shall be routed through this protector. The protector shall be connected with a #4 AWG copper bonding conductor between the protector ground lug and the structured cabling ground point. Protector modules shall be housed in connector with cover and splice chamber and shall contain punch-down blocks of same style as specified elsewhere. Enclosure shall be consistent with the environment in which it is installed.
 1. Copper cable protection modules for Digital voice, Data and Security cabling shall be Circa# 4B1FS-240 or equal.
 2. Copper cable protection modules for P.O.T.S, Fire Alarm System and paging cabling shall be Circa# 4B1E or equal.

2.6 OPTICAL FIBER CABLE

- A. Subject to compliance with requirements, provide product indicated on drawing.
- B. Optical fiber cable characteristics
 1. OSP fiber cable shall be suitable for use in both outdoor and indoor applications without the use of a transition at the building entrance.
 2. Shall be suitable for use in environment where it is being installed (risers, plenums and horizontal applications).
 3. OSP fiber shall be loose tube with dry water blocking elements.
 4. Premise fiber shall be tight buffered.
 5. Shall be available with a fiber strand count range from 6 to 72.
 6. Shall have a 3.0 mm sub-unit diameter.
 7. Shall have and be marked with an UL-OFNP or UL-OFNR Flame Rating as required for environment where it is installed.
 8. Shall be independently verified to comply with Bellcore GR-409 and GR20
 9. Shall be independently verified to comply with ICEA S-83-596 & ANSI/ICEA S-87-640
 10. Strength members shall be FGE/Aramid yarn.
 11. Suitable for underground or aboveground conduits.
 12. Fibers shall be color coded in accordance with EIA / TIA 598 with an overall aqua jacket for indoor multimode cable, yellow jacket for singlemode cable and black for OSB fiber cable.
 13. Shall have a ripcord for overall jacket.
 14. Suitable for operation between -40° to +75° C
 15. OSP fiber cable shall be UV resistant
 16. Shall be constructed with dielectric yarns, dielectric central strength member or dielectric outer strength members
 17. Shall be protected by interlocking armor where specified
 18. All fiber routed in conduit or above ceiling spaces shall be protected by Maxcell, 2", 3-cell, Teflon innerduct

C. Multimode optical fiber cable shall:

1. Comply with ICEA S-83-596 for mechanical properties of indoor cables.
2. Comply with ICEA S-87-640 for mechanical properties of OSP cables.
3. Comply with TIA/EIA-568-B.3 for performance specifications.
4. Comply with TIA-492AAAB for detailed specifications for 50/125-micrometer cable.
5. Comply with TIA-492AAAA-A for detailed specifications for 62.5/125-micrometer cable.
6. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:
 - a. General Purpose, Nonconductive: OFNR, OFNP.
 - b. Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262.
 - c. Riser Rated, Nonconductive: Type OFNR, complying with UL 1666.
 - d. Plenum Rated, Conductive: Type OFNP, complying with NFPA 262.
 - e. Riser Rated, Conductive: Type OFNR, complying with UL 1666.
7. cable shall be steel armored type.
8. Minimum Bandwidth overfilled launch: 220 MHz-km at 850 nm; 600 MHz-km at 1300 nm.
9. Minimum Laser effective Modal Bandwidth: 2,000 MHz-km at 850 nm; 500 MHz-km at 1300 nm.
10. Attenuation shall be measured in accordance with ANSI/EIA/TIA-455-46, 53 or 61.
11. Information transmission capacity shall be measured in accordance with ANSI/EIA/TIA-455-51 or 30.
12. The measurements shall be performed at 23 degrees C +/- 5 degrees.
13. Shall have a maximum attenuation of 3.5 dB/km at 850nm and 1.5 dB/km at 1300nm
14. 50/125 micrometer, multimode optical fiber cable shall be laser optimized and guarantee Gigabit Ethernet distances of 1000m/600m at 850nm and 1300nm respectively.
15. 50/125 micrometer, multimode optical fiber cable Shall support 10G Ethernet distances of 300m/300m at 850nm and 1300nm respectively.

D. Jacket:

1. Jacket Color: Aqua for 50/125-micrometer cable, Orange for 62.5/125-micrometer cable.
2. Cable cordage jacket, fiber, unit, and group color shall be according to TIA-598-C.
3. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches.

E. Singlemode optical fiber cable shall:

1. comply with ANSI/TIA 568-C.3, TIA 492CAAB, UL444 sunlight resistant, and listed OFNP (NFPA 262)
2. have a maximum attenuation of 0.7dB/km at 1310nm and 1550nm
3. support Gigabit Ethernet up to 10km at 1310nm and 70km at 1550nm
4. support 10G Ethernet up to 25km at 1310 and 40km at 1550km

2.7 OPTICAL FIBER CABLE HARDWARE

A. Subject to compliance with requirements, provide product indicated on drawing.

B. Optical Fiber Cabinets/ Enclosures.

1. Rack Mount Optical Fiber Enclosure shall:

- a. Be equipped with either a swing out mechanism or a sliding drawer to access fibers.
 - b. Be capable of terminating tight-buffered or loose tube optical fiber cable.
 - c. Provide for bend radius control throughout the panel as well as storage space for slack cabling.
 - d. Meet or exceed the performance criteria per ANSI/TIA-568-C.3.
 - e. Be equipped with optical fiber adapter panels.
 - 1) The optical fiber adapter panels shall accommodate either multi-mode or single-mode terminated optical fiber.
 - 2) The optical fiber adapter panels shall be compatible with ST, SC and LC connectors.
2. Wall Mount Optical Fiber Cabinet shall:
 - a. Have a hinged door for access, with locking cover.
 - b. Be capable of terminating tight-buffered or loose tube optical fiber cables and all popular connector types.
 - c. Provide for bend radius control throughout the panel as well as storage space for slack cabling.
 - d. Meet or exceed the performance criteria per ANSI/TIA-568-C.3.
 - e. Be equipped with optical fiber adapter panels.
 - 1) The optical fiber adapter panels shall accommodate either multi-mode or single-mode terminated optical fiber.
 - 2) The optical fiber adapter panels shall be compatible with ST, SC and LC connectors.
- C. Laser optimized adaptors and connectors shall be Aqua for 50/125-micrometer cable, Orange for 62.5/125-micrometer cable in color and equipped with zirconia ceramic sleeves.
- D. Cross-Connects and Patch Panels: Modular panels housing multiple-numbered, duplex cable connectors.
- E. Number of Connectors per Field: One for each fiber of cable or cables assigned to field, plus spares and blank positions adequate to suit specified expansion criteria.
- F. Patch Cords: Factory-made, dual-fiber cables in various lengths as defined elsewhere in these specifications.
- G. Cable Connecting Hardware:
 1. Comply with Optical Fiber Connector Intermateability Standards (FOCIS) specifications of TIA-604-2-B, TIA-604-3-B, and TIA/EIA-604-12. Comply with TIA/EIA-568-B.3.
 2. Quick-connect, simplex and duplex, Type SC, Type ST, Type LC connectors. Insertion loss not more than 0.75 dB. Verify connector type with owner prior to ordering
 3. Type SFF connectors may be used in termination racks, panels, and equipment packages if coordinated with owner prior to installation.

2.8 COAXIAL CABLE

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Superior Essex.
 2. Belden Inc.
 3. CommScope, Inc.
- B. Cable Characteristics: Broadband type, recommended by cable manufacturer specifically for broadband data transmission applications. Coaxial cable and accessories shall have 75-ohm nominal impedance with a return loss of 20 dB maximum from 7 to 806 MHz.
- C. RG-11/U: NFPA 70, Type CATV.
1. No. 14 AWG, solid, copper-covered steel conductor.
 2. Gas-injected, foam-PE insulation.
 3. Quad shielded with 100 percent aluminum polyester tape and minimum 60 percent aluminum braid.
 4. Jacketed with sunlight-resistant, black PVC or PE.
 5. Suitable for outdoor installations in ambient temperatures ranging from minus 40 to plus 85 deg C.
- D. RG-6/U: NFPA 70, Type CATV or CM.
1. No. 16 AWG, solid, copper-covered steel conductor; gas-injected, foam-PE insulation.
 2. Quad shielded with 100 percent aluminum-foil shield and minimum 60 percent aluminum braid.
 3. Jacketed with black PVC or PE.
 4. Suitable for indoor installations.
- E. NFPA and UL compliance, listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1655 and with NFPA 70 "Radio and Television Equipment" and "Community Antenna Television and Radio Distribution" Articles. Types are as follows:
1. CATV Cable: Type CATV, or CATVP or CATVR.
 2. CATV Plenum Rated: Type CATVP, complying with NFPA 262.
 3. CATV Riser Rated: Type CATVR; or CATVP, CATVR, or CATV, complying with UL 1666.
 4. CATV Limited Rating: Type CATVX.

2.9 COAXIAL CABLE HARDWARE

- A. Subject to compliance with requirements, provide product indicated on drawing.
- B. Coaxial-Cable Connectors: Type BNC, 75 ohms; Type F, 75 ohms.

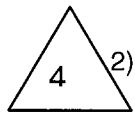
2.10 PATHWAYS

- A. General Requirements: Comply with TIA/EIA-569-A.
- B. Cable Support: 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.
- C. Cable Trays:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cablofil Inc.
 - b. Cooper B-Line, Inc.
 - c. WBT

2. Cable Tray Material: Metal, suitable for indoors, and protected against corrosion by electroplated zinc galvanizing, complying with ASTM B 633, Type 1, not less than 0.000472 inches thick.

- a. Where cable tray is indicated on plans, the following types shall be utilized in these specific areas:



- 1) Basket Cable Trays: 12 inches wide and 4 inches deep. Wire mesh spacing shall not exceed 2 by 4 inches. Tray shall be powder-coated black and shall include tray liner.
 - 2) In telecom rooms, **provide** ladder Cable Trays: Nominally 24 inches wide, and a rung spacing of 8 inches.

- D. Conduit and Boxes: Comply with requirements in 26 05 33 "Raceways and Boxes for Electrical Systems."

1. Outlet boxes shall be no smaller than 4 inches wide, 4 inches high, and 2-1/2 inches deep.

2.11 BACKBOARDS

- A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches sheets to cover area indicated on drawings.

2.12 EQUIPMENT FRAMES

- A. Subject to compliance with requirements, provide product indicated on drawing.

- B. General Frame Requirements:

1. Equipment racks/ cabinets shall provide vertical cable management and support for the patch cords at the front of the rack and wire management, support, and protection for the horizontal cables inside the legs of the rack. Waterfall cable management shall be provided at the top of the rack for patch cords and for horizontal cables entering the rack channels for protection and to maintain proper bend radius and cable support. Horizontal Wire management shall also be mounted above and below each patch panel and/or piece of equipment on the rack at a ratio of 1 rack unit of horizontal cable management per each rack unit of patching or equipment or 1 rack unit of horizontal cable management per 24 ports of patching or active network equipment (whichever is greater). The rack shall include mounting brackets for cable tray ladder rack/ cable runway to mount to the top of the rack. Velcro cable ties shall be provided inside the rack channels to support the horizontal cable. Rack shall be black in color to match the patch panels and cable management. Contractor shall provide complete dimensioned rack assembly details showing all components including part numbers as called for in as built drawings submittals section of this document.
2. Distribution Frames: Freestanding and wall-mounting, modular-steel units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.
3. Module Dimension: Width compatible with EIA 310-D standard, 19-inch panel mounting.

4. Finish: Manufacturer's standard, baked-polyester powder coat.

C. Floor-Mounted Racks shall:

1. Be modular type steel construction. vertical and horizontal cable management channels, top and bottom cable troughs, grounding lug and PDU.
2. Have Baked-polyester powder coat finish.
3. Provide the necessary strain relief, bend radius and cable routing for proper installation of high performance cross connect products, meeting all specifications of ANSI/TIA/EIA-568-B.
4. Have top cable trough with waterfall and built in patch/ horizontal cable distribution separator.
5. Have EIA hole pattern on front and rear.
6. Provide floor and ceiling access for cable management and distribution.
7. Provide pre-drilled base for floor attachment of rack.
8. Be available in standard color of black.
9. Be manufactured by an ISO 9001 registered company.
10. Be furnished with manufacturer's grounding kit.
11. Use blank panels where required

D. Modular Freestanding Cabinets shall:

1. Have removable and lockable side panels.
2. Have hinged and lockable front and rear doors.
3. Have adjustable feet for leveling.
4. Have screened ventilation openings in the roof and rear door.
5. Provide cable access provisions in the roof and base.
6. Have grounding bus bar.
7. Have integral, 550-cfm fan with filter.
8. Provide the necessary strain relief, bend radius and cable routing for proper installation of high performance cross connect products, meeting all specifications of ANSI/TIA/EIA-568-B.
9. Have top cable trough with waterfall and built in patch/ horizontal cable distribution separator.
10. Have EIA hole pattern on front and rear.
11. Provide floor and ceiling access for cable management and distribution.
12. Provide pre-drilled base for floor attachment of rack.
13. Be available in standard color of black.
14. Be manufactured by an ISO 9001 registered company.
15. Be furnished with manufacturer's grounding kit.
16. Use blank panels where required
17. Baked-polyester powder coat finish.
18. All cabinets keyed alike.

E. Modular Wall Cabinets shall:

1. Be steel construction.
2. Be treated to resist corrosion.
3. Have lockable front door.
4. Have louvered side panels.
5. Provide cable access provisions top and bottom.
6. Have grounding lug.
7. Have power strip.
8. All cabinets keyed alike.

9. Where 30" of clearance from front and rear of rack is not possible the use of wall mount racks will be allowed.
10. Provide the necessary strain relief, bend radius and cable routing for proper installation of high performance cross connect products, meeting all specifications of ANSI/TIA/EIA-568-B.
11. Have top cable trough to route patch and distribution cables between racks.
12. Have EIA hole pattern on front and rear.
13. Be available with hook and loop straps for securing cables inside the vertical U-channels.
14. Be available with vertical cable management rings for cord routing organization and strain relief.
15. Be available with vertical U-channels to protect and conceal distribution cables.
16. Provide floor and ceiling access for cable management and distribution.
17. Have wall mount braces with locator posts for easy wall mounting.
18. Have side access points that allow for access to manage/ install distribution cables in the vertical channels.
19. Be available in standard color of black.
20. Be manufactured by an ISO 9001 registered company.
21. Use blank panels where required.

F. Modular Ceiling Enclosures:

1. Be steel construction.
2. Be treated to resist corrosion.
3. Have lockable front door.
4. Have louvered side panels.
5. Provide cable access provisions top and bottom.
6. Have grounding lug.
7. Have integral quad receptacle.
8. All cabinets/ enclosures keyed alike.
9. Where 295ft cable length is exceeded, the use of ceiling enclosures may be allowed.
10. Provide the necessary strain relief, bend radius and cable routing for proper installation of high performance cross connect products, meeting all specifications of ANSI/TIA/EIA-568-B.
11. Have EIA hole pattern on front and rear.
12. Be available with hook and loop straps for securing cables inside the vertical U-channels.
13. Be manufactured by an ISO 9001 registered company.
14. Use blank panels where required

G. Cable Management for Equipment Frames:

1. Metal, with integral wire retaining fingers.
2. Baked-polyester powder coat finish.
3. Vertical cable management panels shall have front and rear channels, with covers.
4. Provide horizontal crossover cable manager at the top of each relay rack, with a minimum height of two rack units each.

2.13 POWER DISTRIBUTION UNITS

A. Power Distribution Units shall:

1. Comply with UL 1363.
2. Be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
3. Be rack mounted.

4. LED indicator lights for power and protection status.
5. LED indicator lights for reverse polarity and open outlet ground.
6. Be provided in each rack/ cabinet as required to provide one 5-20R outlet for each 24 cables terminated at the rack.
7. Shall NOT have on/ off switch.
8. Have integral amp/ current meter.
9. Have integral surge suppression with a minimum rating of 26 kA.
10. Surge suppression protection modes shall be line to neutral, line to ground, and neutral to ground. UL 1449 clamping voltage for all three modes shall be not more than 330 V.

B. Horizontal Power Distribution Unit

1. The horizontal power distribution unit shall be equipped with a minimum of ten (10) 3-prong, NEMA 5-20R, 120 VAC outlets, and 7' cord.
2. The horizontal power distribution unit shall be equipped with surge protection with a 20 Amp current limit.
3. The horizontal power distribution unit shall be equipped with a bracket that enables it to be mounted on a 19" rack, cabinet or wall mount bracket without modification.

C. Vertical Power Distribution Unit

1. The vertical power distribution unit shall be equipped with a minimum of ten (10) 3-prong, NEMA 5-20R, 120 VAC outlets, 10' cord.
2. The vertical power distribution unit shall be equipped with surge protection with a 20 Amp current limit.
3. The vertical power distribution unit shall be equipped with a bracket that enables it to be mounted on a 19" rack, cabinet or wall mount bracket without modification.

2.14 GROUNDING

- A. The facility shall be equipped with a Telecommunications Bonding Backbone (TBB) furnished and installed by the electrical contractor. This backbone shall be used to ground all telecommunications cable shields (where applicable), equipment, racks, cabinets, raceways, and other associated hardware that has the potential to act as a current carrying conductor.
- B. Each distribution frame location (backboard location) shall be equipped with a telecommunications ground bus bar (TGB). Each TGB shall be connected to the building electrical entrance grounding facility with #3 AWG in 1" C. The intent of this system is to provide a grounding system that is equal in potential to the building electrical ground system. Therefore, ground loop current potential is minimized between telecommunications equipment and the electrical system to which it is attached.
- C. All racks, cabinets, enclosures, cable sheaths, metallic strength members, splice cases, cable trays, sleeves, conduits, etc. entering or residing in the EF, ER, MDF or IDF shall be grounded to the respective TGB using conductors as shown on the plans or called for elsewhere in the specifications. Telecommunications grounding conductors shall be a minimum of #6 AWG.
- D. All cable tray sections shall be connected to building ground.
- E. All metallic components of fire-stop fittings and conduits shall be connected to system ground.
- F. All wires used for telecommunications grounding purposes shall be identified with a green insulation. Non-insulated wires shall be identified at each termination point with a wrap of green

tape. All cables and bus bars shall be identified and labeled in accordance with the System Documentation Section of this specification.

- G. Comply with requirements in 26 05 26 "Grounding and Bonding for Electrical Systems" for grounding conductors and connectors.
- H. Telecommunications Main Bus Bar:
 - 1. Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.
 - 2. Ground Bus Bar: Copper, minimum 1/4 inch thick by 4 inches wide with 9/32-inch holes spaced 1-1/8 inches apart.
 - 3. Stand-Off Insulators: Comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.
- I. Comply with J-STD-607-A.

2.15 FIRE-STOP

- A. Fire-stop system is comprised of the item or items penetrating the fire rated structure, the opening in the structure and the materials and assembly of the materials used to seal the penetrated structure. Fire-stop systems comprise an effective block for fire, smoke, heat, vapor and pressurized water stream.
- B. All penetrations through fire-rated building structures (walls and floors) shall be sealed with an appropriate fire-stop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure). Any penetrating item i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall be properly fire-stopped.
- C. All through penetrations shall be fire-stopped with Wiremold flamestopper (or equal) adjustable fire-stop fitting with integrated intumescent barrier.
- D. Fire-stop systems shall be UL Classified to ASTM E814 (UL 1479) and shall be approved by a qualified Professional Engineer (PE), licensed (actual or reciprocal) in the state where the work is to be performed. A drawing showing the proposed fire-stop system, stamped/embossed by the PE shall be provided to the Owner's Technical Representative prior to installing the fire-stop system(s).

2.16 IDENTIFICATION PRODUCTS

- A. Comply with TIA/EIA-606-A and UL 969 for labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
- B. Comply with requirements in Section 26 05 53 "Identification for Electrical Systems."

2.17 LABELING

- A. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

2.18 SOURCE QUALITY CONTROL

- A. Testing Agency: Contractor shall engage a qualified, third party testing agency to evaluate all cables.
- B. Factory test UTP and optical fiber cables on reels according to TIA/EIA-568-B.1.
- C. Factory test UTP cables according to TIA/EIA-568-B.2.
- D. Factory test multimode optical fiber cables according to TIA-526-14-A and TIA/EIA-568-B.3.
- E. Factory-sweep test coaxial cables at frequencies from 5 MHz to 1 GHz. Sweep test shall test the frequency response, or attenuation over frequency, of a cable by generating a voltage whose frequency is varied through the specified frequency range and graphing the results.
- F. Cable will be considered defective if it does not pass tests and inspections.
- G. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 WORK AREA OUTLETS

- A. Cables shall be coiled in the in-wall or surface-mount boxes if adequate space is present to house the cable coil without exceeding the manufacturer's bend radius. In hollow wall installations where box-eliminators are used, excess wire can be stored in the wall. No more than 12" of UTP and 36" of fiber slack shall be stored in an in-wall box, modular furniture raceway, or insulated walls. Excess slack shall be loosely coiled and stored in the ceiling above each drop location when there is not enough space present in the outlet box to store slack cable.
- B. Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA/EIA-568-B.1 document, manufacturer's recommendations and best industry practices.
- C. Pair untwist at the termination shall not exceed one-half inch.
- D. Bend radius of the horizontal cable shall not be less than 4 times the outside diameter of the cable
- E. The cable jacket shall be maintained to within one inch of the termination point.
- F. Data jacks; unless otherwise noted in drawings, shall be located in the bottom position(s) of each faceplate. Data jacks in horizontally oriented faceplates shall occupy the right-most position(s).
- G. Voice jacks shall occupy the top position(s) on the faceplate. Voice jacks in horizontally oriented faceplates shall occupy the left-most position(s).

3.2 ENTRANCE FACILITIES

- A. Coordinate backbone cabling with the protectors and demarcation point provided by communications service provider.

- B. Contact telecommunications service provider and arrange for installation of demarcation point, protected entrance terminals, and a housing when so directed by service provider. Coordinate with owner for the provision of any/ all telecommunications utility service connections where owner request/ approval is required by the serving utility. Contractor shall notify owner in writing of any/ all required telecommunications utility service that requires owner coordination a minimum of five (5) weeks prior to scheduled project completion date. Contractor shall endeavor to assist owner with telecommunications utility coordination as required to expedite the provision of said utility service prior to the project completion date.

3.3 INSTALLATION OF EQUIPMENT ROOM FITTINGS

- A. Comply with NECA 1.
- B. Comply with BICSI TDMM for layout and installation of communications equipment rooms.
- C. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.
- D. Coordinate layout and installation of communications equipment with Owner's telecommunications and LAN equipment and service suppliers. Coordinate service entrance arrangement with local exchange carrier.
 - 1. Meet jointly with telecommunications and LAN equipment suppliers, local exchange carrier representatives, and Owner to exchange information and agree on details of equipment arrangements and installation interfaces.
 - 2. Record agreements reached in meetings and distribute them to other participants.
 - 3. Adjust arrangements and locations of distribution frames, cross-connects, and patch panels in equipment rooms to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment as directed by owner's IT department.
 - 4. Adjust arrangements and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in the equipment room. Contractor shall coordinate with owner's IT, Security, ETV and maintenance departments and facilitate inter-department coordination for acceptable configuration of shared space in telecom rooms.
- E. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.
- F. Racks/ cabinets shall be securely attached to the concrete floor using a minimum 3/8" hardware or as required by local codes.
- G. Racks/ cabinets shall be placed with a minimum of 36 inch clearance from the walls or other equipment on all sides of the rack. When mounted in a row, maintain a minimum of 36 inches from the wall or equipment behind and in front of the row of racks and from the wall or equipment at each end of the row.
- H. All racks/ cabinets shall be grounded to the telecommunications ground bus bar in accordance with other sections of this document.
- I. Rack mount screws not used for installing patch panels and other hardware shall be bagged and left with the rack upon completion of the installation.

- J. The contractor shall install 24" ladder cable tray from wall to each rack/ cabinet.

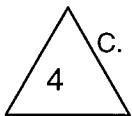
3.4 INSTALLATION OF PATHWAYS

- A. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A.
- B. Comply with requirements for demarcation point, pathways, cabinets, and racks specified elsewhere in this document. Drawings indicate general arrangement of pathways and fittings.
- C. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.
- D. Comply with requirements in Section 26 05 33 "Raceways and Boxes for Electrical Systems" for installation of conduits and wireways.
- E. Install manufactured conduit sweeps and long-radius elbows whenever possible.
- F. Pathway Installation in Communications 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 a minimum of 6 inches above finished floor.
 5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.
- G. Backboards: Install backboards with 96-inch dimension vertical. Butt adjacent sheets tightly, and form smooth gap-free corners and joints.

3.5 WIRING METHODS

- A. Wiring Method: Install cables in raceways, cable trays and J-hooks except within consoles, cabinets, desks, and counters. Conceal raceway and cables except in unfinished spaces.
1. Install plenum cable in environmental air spaces, including plenum ceilings.
 2. Comply with requirements for raceways and boxes specified in Section 26 05 33 "Raceways and Boxes for Electrical Systems."

- B. Conceal conductors and cables in accessible ceilings, walls and floor



- C. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible. ***All low voltage cables routed above accessible ceiling, for this specification section, may be supported with j-hooks or cable tray.***

- D. Wiring within Enclosures:

1. Bundle, lace, and train cables within enclosures.
2. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.
3. Provide and use lacing bars and distribution spools.
4. Install conductors parallel with or at right angles to sides and back of enclosure.

3.6 INSTALLATION OF CABLES

- A. Comply with NECA 1.
- B. No cables shall be painted either intentionally or inadvertently. Cables must be protected during painting to avoid accidental painting or overspray. Any cable that are painted shall be replaced at no cost to the owner. Paint can degrade the cable insulation and may void the warranty.
- C. General Requirements for Cabling installation:
 - 1. Comply with TIA/EIA-568-B.1.
 - 2. Cable shall be installed in accordance with manufacturer's recommendations, best industry practices and these specifications.
 - 3. A pull cord (nylon; 1/8" minimum) shall be co-installed with all cable installed in any conduit.
 - 4. Cable raceways shall not be filled greater than the ANSI/TIA/EIA-569-A maximum fill for the particular raceway type or 40% (whichever is less).
 - 5. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
 - 6. Install 110-style IDC termination hardware as required for copper cables unless otherwise indicated.
 - 7. Terminate all conductors; no cable shall contain un-terminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
 - 8. 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.
 - 9. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
 - 10. 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. Use lacing bars and distribution spools.
 - 11. 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. Any cabling found to be damaged during installation shall be removed and replaced at no cost to owner.
 - 12. Cold-Weather Installation: Bring cable to room temperature before de-reeling. Heat lamps shall not be used for heating.
 - 13. In the communications equipment room, install a 10-foot long service loop on each end of cable.
 - 14. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.
 - 15. MUTOA shall not be used as a cross-connect point.
 - 16. Consolidation points may be used only for making a direct connection to telecommunications outlet/ connectors and may only be used where specifically called for in the contract documents.
 - a. Do not use consolidation point as a cross-connect point, as a patch connection, or for direct connection to work station equipment.
 - b. Locate consolidation points for UTP at least 49 feet from communications equipment room.
 - 17. Cables shall be installed in continuous lengths from origin to destination (no splices) except for transition points, or consolidation points.
 - 18. Where transition points or consolidation points are allowed, they shall be located in accessible locations and housed in an enclosure intended and suitable for the purpose.

19. The cable's minimum bend radius and maximum pulling tension shall not be exceeded.
20. If a J-hook or trapeze system is used to support cable bundles all horizontal cables shall be supported at a maximum of 36 inch intervals. At NO point shall cable(s) rest on acoustic ceiling grids, ceiling panels, electrical conduits, fire alarm system conduits, structural elements, mechanical piping or ductwork.
21. Horizontal distribution cables shall be bundled in groups of no more than 50 cables. Cable bundle quantities in excess of 50 cables may cause deformation of the bottom cables within the bundle and degrade cable performance
22. Cable shall be installed above fire-sprinkler systems and shall not be attached to the system or any ancillary equipment or hardware. The cable system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices.
23. Cables shall not be attached to ceiling grid or lighting fixture wires. Where support for horizontal cable is required, the contractor shall install appropriate carriers to support the cabling. See the plans for approximate support locations and requirements.
24. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the contractor prior to final acceptance at no cost to the Owner.
25. Cables shall be identified by a self-adhesive label in accordance with the System Documentation Section of this specification and ANSI/TIA/EIA-606-A. The cable label shall be applied to the cable behind the faceplate on a section of cable that can be accessed by removing the cover plate.
26. Unshielded twisted pair cable shall be installed so that there are no bends smaller than four times the cable outside diameter at any point in the run and at the termination field.
27. Pulling tension on 4-pair UTP cables shall not exceed 25-lbf for a four-pair UTP cable.
28. Backbone cabling
 - a. Backbone cables shall be installed separately from horizontal distribution cables.
 - b. Where cables are housed in conduits, the backbone and horizontal cables shall be installed in separate conduits.
 - c. Where backbone cables are installed in an air return plenum, riser rated cable shall be installed in metallic conduit.
 - d. Where backbone cables and distribution cables are installed in a cable tray or wireway, backbone cables shall be installed first and bundled separately from the horizontal distribution cables.
 - e. All backbone cables shall be securely fastened to the sidewall of the telecom room.
 - f. Backbone cables spanning more than two floors shall be securely attached at the top of the cable run with a wire mesh grip and on alternating floors or as required by local codes.
 - g. Vertical runs of cable shall be supported to messenger strand, cable ladder, or other method to provide proper support for the weight of the cable.
 - h. Large bundles of cables and/or heavy cables shall be attached using metal clamps and/or metal banding to support the cables.

D. UTP Cable Installation:

1. Comply with TIA/EIA-568-B.2.
2. Do not untwist UTP cables more than 1/2 inch from the point of termination to maintain cable geometry.

E. Optical Fiber Cable Installation:

1. Comply with TIA/EIA-568-B.3.
2. Cable may be terminated on connecting hardware that is rack or cabinet mounted.

3. Verify termination type with owner prior to ordering.

F. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend UTP cable not in a wireway or pathway, a minimum of 8 inches above ceilings by cable supports not more than 36 inches apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

G. 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 6 feet long not less than 12 inches in diameter below each feed point.

H. Outdoor Coaxial Cable Installation:

1. Install outdoor connections in enclosures complying with NEMA 250, Type 4X. Install corrosion-resistant connectors with properly designed O-rings to keep out moisture.
2. Attach antenna lead-in cable to support structure at intervals not exceeding 36 inches.

I. UTP cable hardware installation

1. Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA/EIA-568-B standard, manufacturer's recommendations and best industry practices.
2. Pair untwist at the termination shall not exceed one-half inch.
3. Bend radius of the cable in the termination area shall not exceed 4 times the outside diameter of the cable.
4. Cables shall be neatly bundled and dressed to their respective panels or blocks. Each panel or block shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.
5. The cable jacket shall be maintained as close as possible to the termination point.
 - a. Each cable shall be clearly labeled on the cable jacket behind the patch panel at a location that can be viewed without removing the bundle support ties. Cables labeled within the bundle, where the label is obscured from view shall not be acceptable

J. Optical Fiber hardware installation

1. Adapter Plates/ fiber patch panels:

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 Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.
- 6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.7 GROUNDING

- A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. Comply with ANSI-J-STD-607-A.
- C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.
- D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.
 - 1. Bond the shield of shielded cable to the grounding bus bar in communications rooms and spaces. This includes the shield for coaxial cable.

3.8 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."
 - 1. Color-code cross-connect fields and apply colors to voice and data service backboards, connections, covers, and labels.
- B. Paint and label colors for equipment identification shall comply with TIA/EIA-606-A.
- C. Cable Schedule: Install in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

- D. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.
- E. Cable and Wire Identification:
 - 1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
 - 2. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 50 feet and at every cable pathway transition.
 - 3. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
 - a. Individually number wiring conductors connected to terminal strips and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device with name and number of particular device as shown.
 - b. Label each unit and field within distribution racks and frames.
 - 4. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
 - 5. Uniquely identify and label work area cables extending from the MUTOA to the work area. These cables may not exceed the length stated on the MUTOA label.
- F. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA 606-A, for the following:
 - 1. Cables use flexible vinyl or polyester that flexes as cables are bent.

3.9 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform the following tests and inspections under the direction of RCDD:
 - 1. Visually inspect UTP and optical fiber cable jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA/EIA-568-B.1.
 - 2. Visually confirm Category 5e, Category 6, marking of outlets, cover plates, outlet/connectors, and patch panels.
 - 3. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
 - 4. Test UTP backbone copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.

- a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
5. Optical Fiber Cable Tests:
 - a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.1. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
 - b. Link End-to-End Attenuation Tests:
 - 1) Horizontal and multimode backbone link measurements: Test at 850 or 1300 nm in 1 direction according to TIA-526-14-A, Method B, One Reference Jumper.
 - 2) Attenuation test results for backbone links shall be less than 2.0 dB. Attenuation test results shall be less than that calculated according to equation in TIA/EIA-568-B.1.
6. UTP Performance Tests:
 - a. Test for each outlet and MUTOA. Perform the following tests according to TIA/EIA-568-B.1 and TIA/EIA-568-B.2:
 - 1) Wire map.
 - 2) Length (physical vs. electrical, and length requirements).
 - 3) Insertion loss.
 - 4) Near-end crosstalk (NEXT) loss.
 - 5) Power sum near-end crosstalk (PSNEXT) loss.
 - 6) Equal-level far-end crosstalk (ELFEXT).
 - 7) Power sum equal-level far-end crosstalk (PSELFEXT).
 - 8) Return loss.
 - 9) Propagation delay.
 - 10) Delay skew.
7. Optical Fiber Cable Performance Tests: Perform optical fiber end-to-end link tests according to TIA/EIA-568-B.1 and TIA/EIA-568-B.3.
8. Final Verification Tests: Perform verification tests for UTP and optical fiber systems after the complete communications cabling and workstation outlet/connectors are installed.
 - a. Voice Tests: These tests assume that dial tone service has been installed. Connect to the network interface device at the demarcation point. Go off-hook and listen and receive a dial tone. If a test number is available, make and receive a local, long distance, and digital subscription line telephone call.
 - b. Data Tests: These tests assume the Information Technology Staff has a network installed and is available to assist with testing. Connect to the network interface device at the demarcation point. Log onto the network to ensure proper connection to the network.
- D. Document data for each measurement. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.

- E. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.
- G. Perform tests and inspections.
- H. Tests and Inspections:
 - 1. Visually inspect UTP and optical fiber jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA/EIA-568-B.1.
 - 2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
 - 3. Test UTP copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.
 - a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
 - 4. Optical Fiber Cable Tests:
 - a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.1. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
 - b. Link End-to-End Attenuation Tests:
 - 1) Horizontal and multimode backbone link measurements: Test at 850 or 1300 nm in 1 direction according to TIA/EIA-526-14-A, Method B, one Reference Jumper.
 - 2) Attenuation test results for backbone links shall be less than 2.0 dB. Attenuation test results shall be less than that calculated according to equation in TIA/EIA-568-B.1.
- I. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.
- J. Remove and replace cabling where test results indicate that they do not comply with specified requirements.
- K. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- L. Prepare test and inspection reports. All testing shall be performed by equipment that has been maintained and calibrated as directed by testing equipment manufacturer. Include calibration history with test and inspection reports.

3.10 SLEEVE AND SLEEVE SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 26 05 44 "Sleeves and Sleeve Seals for Electrical Systems."

3.11 FIRESTOPPING

- A. All fire-stop systems shall be installed in accordance with the manufacturer's recommendations and shall be completely installed and available for inspection by the local inspection authorities prior to cable system acceptance
- B. Comply with TIA-569-B, Annex A, "Firestopping."
- C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.12 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements in Section 26 05 53 "Identification for Electrical Systems."
- B. The contractor shall develop and submit for approval a labeling system for the cable installation. The Owner will negotiate an appropriate labeling scheme with the successful contractor. At a minimum, the labeling system shall clearly identify all components of the system: racks, cables, panels and outlets. The labeling system shall designate the cables origin and destination and a unique identifier for the cable within the system. Racks and patch panels shall be labeled to identify the location within the cable system infrastructure. All labeling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme. Labeling shall follow the guidelines of ANSI/TIA/EIA-606-A.
- C. All label printing will be machine generated by connectivity/ cabling manufacturer software using indelible ink ribbons or cartridges. Self-laminating labels will be used on cable jackets, appropriately sized to the OD of the cable, and placed within view at the termination point on each end. Outlet, patch panel and wiring block labels shall be installed on, or in, the space provided on the device.
- D. Paint and label colors for equipment identification shall comply with TIA/EIA-606-A.
- E. Labels shall be preprinted or computer-printed type.

3.13 DEMONSTRATION

- A. Train Owner's maintenance personnel in cable-plant management operations, including changing signal pathways for different workstations, rerouting signals in failed cables, and keeping records of cabling assignments and revisions when extending wiring to establish new workstation outlets.

3.14 TESTING AND ACCEPTANCE

- A. All cables and termination hardware shall be 100% tested for defects in installation and to verify cabling system performance under installed conditions according to the requirements of ANSI/TIA/EIA-568-B. All pairs of each installed cable shall be verified prior to system acceptance. Any defect in the cabling system installation including but not limited to cable, connectors, feed through couplers, patch panels, and connector blocks shall be repaired or replaced in order to ensure 100% useable conductors in all cables installed.

- B. All cables shall be tested in accordance with this document, the ANSI/TIA/EIA standards, the connectivity/ cabling manufacturer Certification Program Information Manual and best industry practice. If any of these are in conflict, the Contractor shall bring any discrepancies to the attention of the project team for clarification and resolution.
- C. Copper Channel Testing.
1. All twisted-pair copper cable links shall be tested for continuity, pair reversals, shorts, opens and performance as indicated below. Additional testing is required to verify Category performance. Horizontal cabling shall be tested using a Level III test unit for category 6 performance compliance as specified in ANSI/TIA/EIA-568-B.2-1.
 2. Continuity – Each pair of each installed cable shall be tested using a test unit that shows opens, shorts, polarity and pair-reversals, crossed pairs and split pairs. Shielded/screened cables shall be tested with a device that verifies shield continuity in addition to the above stated tests. The test shall be recorded as pass/fail as indicated by the test unit in accordance with the manufacturers' recommended procedures, and referenced to the appropriate cable identification number and circuit or pair number. Any faults in the wiring shall be corrected and the cable re-tested prior to final acceptance.
 3. Length - Each installed cable link shall be tested for installed length using a TDR type device. The cables shall be tested from patch panel to patch panel, block to block, patch panel to outlet or block to outlet as appropriate. The cable length shall conform to the maximum distances set forth in the ANSI/TIA/EIA-568-B Standard. Cable lengths shall be recorded, referencing the cable identification number and circuit or pair number. For multi-pair cables, the shortest pair length shall be recorded as the length for the cable.
 4. Category 6 Performance
 - a. Follow the Standards requirements established in ANSI/TIA/EIA-568-B .1, B.2-1
 - b. A Level III test unit is required to verify category 6 performance.
 - c. The basic tests required are:
 - 1) Wire Map
 - 2) Length
 - 3) Attenuation
 - 4) NEXT (Near end crosstalk)
 - 5) Return Loss
 - 6) ELFEXT Loss
 - 7) Propagation Delay
 - 8) Delay skew
 - 9) PSNEXT (Power sum near-end crosstalk loss)
 - 10) PSELFEXT (Power sum equal level far-end crosstalk loss)
- D. Fiber Testing
1. All fiber testing shall be performed on all fibers in the completed end to end system. There shall be no splices unless clearly defined in an RFP. Testing shall consist of an end to end power meter test performed per EIA/TIA-455-53A. The system loss measurements shall be provided at 850 and/or 1300 nanometers for multimode fibers and 1310 and/or 1550 nanometers for single mode fibers. These tests also include continuity checking of each fiber.
 2. Backbone multimode fiber cabling shall be tested at both 850 nm and 1300 nm (or 1310 and 1550 nm for singlemode) in both directions.
 3. Test set-up and performance shall be conducted in accordance with ANSI/EIA/TIA-526-14 Standard, Method B.

4. Where links are combined to complete a circuit between devices, the Contractor shall test each link from end to end to ensure the performance of the system. **ONLY LINK TEST IS REQUIRED.** The contractor can optionally install patch cords to complete the circuit and then test the entire channel. The test method shall be the same used for the test described above. The values for calculating loss shall be those defined in the ANSI/TIA/EIA Standard.
5. Attenuation testing shall be performed with an approved hand held tester from an industry recognized test equipment manufacturer.

E. System Documentation

1. Upon completion of the installation, the telecommunications contractor shall provide three (3) full documentation sets and one (1) searchable PDF document to the Engineer for approval. Documentation shall include the items detailed in the sub-sections below.
2. Documentation shall be submitted within ten (10) working days of the completion of each testing phase (e.g. subsystem, cable type, area, floor, etc.). This is inclusive of all test result and draft as-built drawings. Draft drawings may include annotations done by hand. Machine generated (final) copies of all drawings shall be submitted within 30 working days of the completion of each testing phase. At the request of the Engineer, the telecommunications contractor shall provide copies of the original test results.
3. The Engineer may request that a 10% random field re-test be conducted on the cable system, at no additional cost, to verify documented findings. Tests shall be a repeat of those defined above. If findings contradict the documentation submitted by the telecommunications contractor, additional testing can be requested to the extent determined necessary by the Engineer, including a 100% re-test. This re-test shall be at no additional cost to the Owner.

F. Test Results

1. Test documentation shall be provided (in searchable PDF format) on disk within three weeks after the completion of the project. The disk shall be clearly marked on the outside front cover with the words "Project Test Documentation", the project name, and the date of completion (month and year). The results shall include a record of test frequencies, cable type, conductor pair and cable (or outlet) I.D., measurement direction, reference setup, and crew member name(s). The test equipment name, manufacturer, model number, serial number, software version and last calibration date will also be provided at the end of the document. Unless the manufacturer specifies a more frequent calibration cycle, an annual calibration cycle is anticipated on all test equipment used for this installation. The test document shall detail the test method used and the specific settings of the equipment during the test as well as the software version being used in the field test equipment.
2. The field test equipment shall meet the requirements of ANSI/TIA/EIA-568-B including applicable TSB's and amendments. The appropriate Level III tester shall be used to verify Category 6 cabling systems.
3. Printouts generated for each cable by the wire (or fiber) test instrument shall be submitted as part of the documentation package. The telecommunications contractor must furnish this information in electronic form (flash drive or CD-ROM).
4. When repairs and re-tests are performed, the problem found and corrective action taken shall be noted, and both the failed and passed test data shall be documented.

3.15 AS-BUILT DRAWINGS

- A. The drawings are to include cable routes and outlet locations. Outlet locations shall be identified by their sequential number as defined elsewhere in this document. Numbering, icons,

and drawing conventions used shall be consistent throughout all documentation provided. Construction documents will be modified accordingly by the telecommunications contractor to denote as-built information as defined above and returned to the Owner.

- B. The Contractors shall annotate the base drawings and return a hard copy (same plot size as originals) and electronic (PDF format) form.

3.16 WARRANTY

- A. Supplier will honor claims on this warranty for Life (which is defined as the usable life of the building and is referred to as the "Warranty Period" and shall be no less than 30 years).
- B. This warranty covers the copper and fiber optic permanent links of the network (as defined by ANSI/TIA/EIA-568-C.2 for CAT 5e, CAT.6, CAT 6A, ANSI/TIA/EIA-568-C.3 for Optical Fiber Cabling and Components): which includes the cable and connecting hardware.
- C. This warranty will be extended to include the entire channel.
- D. The network cabling infrastructure must be installed in accordance with TIA 568 Series Standards, and installed by Leviton Certified installers.
- E. Each permanent link or channel in the network must be field tested in accordance with the TIA 568 series industry standard in force at the time of purchase AND the installed permanent links and channels must have passed all applicable TIA and manufacturer performance requirements.
- F. Appropriate Warranty Application form must be properly completed and submitted to Supplier prior to initiating the installation. The Warranty Submittal Form must be submitted within 10 days of installation completion.
- G. Copies of all certification test reports must be submitted as part of the Warranty Submittal Form, and be kept on file by the registrant to be re-submitted when requested by Supplier. Data must be saved in raw data and summary formats. Submitting the data via online upload, e-mail or on disc are the preferred methods for providing test data.
- H. The Campus Warranty provides that at the time of delivery, Premises Voice-Grade Cable and Outside Plant Cable products, when installed as part of a campus network along with copper and/or fiber cables from specified manufacturer for 100% of the premises LAN installation, will be free from defects in design, material, and manufacture and conform to manufacturer specifications in force at the time of purchase for a period of no less than thirty (30) years from the delivery date (the "Campus Warranty").
- I. Transfer manufacturer's warranties to the owner in addition to the General System Guarantee. Submit these warranties on each item in list form with shop drawings. Detail specific parts within equipment that are subject to separate conditional warranty. Warranty proprietary equipment and systems involved in this contract during the guarantee period. Final payment shall not relieve you of these obligations.
- J. An Extended Product Warranty shall be provided which warrants functionality of all components used in the system for no less than thirty (30) years from the date of registration. The Extended Product Warranty shall warrant the installed horizontal and/or backbone copper, and both the horizontal and the backbone optical fiber portions of the cabling system.
- K. The manufacturer and contractor shall provide a warranty on the physical installation.

- L. All materials furnished shall meet the requirements of the connectivity/ cabling manufacturer or solution partnership manufacturer's as required to provide the specified warranty period.
- M. All materials shall be installed per the connectivity/ cabling manufacturer or solution partnership manufacturer's recommendations as required to provide the specified warranty period.

3.17 CONTINUING MAINTENANCE

- A. The contractor shall furnish an hourly rate with the proposal submittal, which shall be valid for a period of one year from the date of acceptance. This rate will be used when cabling support is required to affect moves, adds, and changes to the system (MACs). MACs shall be performed by contractor that meets the qualifications outlined elsewhere in these Specifications.

3.18 FINAL ACCEPTANCE AND SYSTEM CERTIFICATION

- A. The contractor shall furnish an hourly rate with the proposal submittal, which shall be valid for a period of one year from the date of acceptance. This rate will be used when cabling support is required to affect moves, adds, and changes to the system (MACs). MACs shall be performed by an connectivity/ cabling manufacturer certified Integrator and shall be added to the warranty when registered with manufacturer. Completion of the installation, in-progress and final inspections, receipt of the test and as-built documentation and successful performance of the cabling system for a two week period will constitute acceptance of the system. Upon successful completion of the installation and subsequent inspection, the end user shall be provided with a numbered certificate, from connectivity/ cabling manufacturer, registering the installation.

END OF SECTION